Tennessee Department of Health

Communicable and Environmental Disease Services

2006 Annual Report

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

Vital to the success of CEDS are the services of the Tennessee Department of Health State Laboratory. The Microbiology Division, in particular, is at the epicenter of the various CEDS programs, performing serotyping to characterize pathogens from across Tennessee. Henrietta Hardin (above) is the Microbiology Supervisor.

Source: Donna Jones Bailey, Vanderbilt Medical Art Group

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: Breast & Cervical Cancer, Community Services, General Environmental Health, HIV/AIDS/STD, Maternal & Child Health, Child Wellness & Nutrition, Nutrition Services, TennCare & TENNderCare, Women's Health & Genetics, Health Services Medical, Fiscal Services and Personnel. 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 1997 through 2006 and builds upon the 1999, 2000, 2001, 2002, 2003 and 2004-2005 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 2004. 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 daily basis.

Form PH-1600 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 daily 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 reportable disease cases 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,[1] 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.

[1]McMillian M, Jones TF, Banerjee A et al. The burden of diarrheal illness in FoodNet, 2002-2003. Poster presented at the International Conference on Emerging Infectious Diseases, Feb 29-March 3, 2004, Atlanta, GA.

D. 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
  - Foodborne
  - Wound
- Diphtheria
- Disease Outbreaks
  - Foodborne
  - Waterborne
  - All Other
- Encephalitis, Arboviral
  - California/LaCrosse serogroup
  - Eastern Equine
  - St. Louis
  - Western Equine
- Group A Strep Invasive Disease
- Group B Strep 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
  - Creutzfeldt-Jakob Disease
  - variant Creutzfeldt-Jakob Disease
- Rabies – Human
- Rubella & Congenital Rubella Syndrome
- Severe Acute Respiratory Syndrome (SARS)
- Staphylococcus aureus Vancomycin nonsensitive – all forms
- Typhoid Fever
- West Nile Infections
  - West Nile Encephalitis
  - West Nile Fever

Possible Bioterrorism Indicators
Anthrax
Plague
Venezuelan Equine Encephalitis
Smallpox
Botulism
Q Fever
Staphylococcus 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 0157:H7
- Giardiasis (acute)
- Gonorrhea (Gen, Oral, Rectal, PID, Opht)
- Guillain-Barre Syndrome
- Hemolytic Uremic Syndrome
- Hepatitis, Viral
  - Type B acute
    - HBsAg positive pregnant female
    - HBsAg positive infant
  - Type C acute
- Influenza – weekly casecount
- Legionellosis
- Leprosy (Hansen Disease)
- Lyme Disease
- Malaria
- Psittacosis
- Rabies – Animal
- Rocky Mountain Spotted Fever
- Salmonellosis – other than *S. Typhi*
- Shiga-like Toxin positive stool
- Shigellosis
- Staphylococcus aureus Methicillin Resistant – Invasive
- Strep pneumoniae Invasive Disease
  - Penicillin resistant
  - Penicillin sensitive
- Syphilis
- Tetanus
- Toxic Shock Syndrome
  - Staphylococcal
  - Streptococcal
- Trichinosis
- Tuberculosis – all forms
- Vancomycin Resistant Enterococci – Invasive
- 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

E. 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.

F. 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
Francisella species
Yersinia pestis
Escherichia coli O157:H7
Clostridium botulinum
*Haemophlius 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, cerebral spinal fluid (CSF), pleural fluid, peritoneal fluid, joint fluid, sinus surgical aspirates or bone. Group A Streptococcus will be considered in isolates from intraoperative cultures and tissues obtained during surgery.

Information for Sending Cultures

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

For UPS and Federal Express Items

Tennessee Department of Health
Laboratory Services
630 Hart Lane
Nashville Tennessee 37216-2006
Phone 615-262-6300

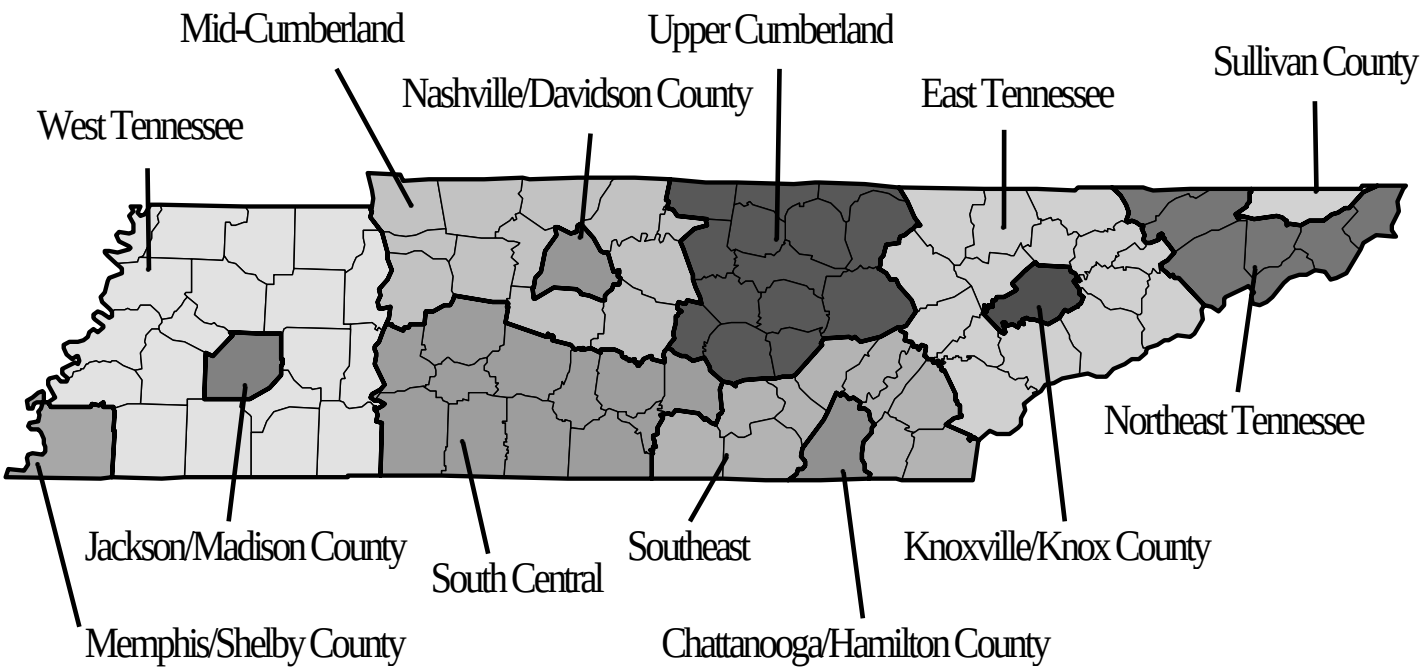
For U.S. Mail

Tennessee Department of Health
Laboratory Services
PO Box 305130
Nashville Tennessee 37230-5130

G. Tennessee Department of Health Regions

The state of Tennessee is divided up into 13 health regions. Over one-half of the state's population is within the borders of six metropolitan regions. Those metropolitan regions include six counties: Davidson, Hamilton, Knox, Madison, Shelby and Sullivan. The non-metropolitan regions are comprised of the seven clusters of counties shown in the map.

Tennessee's Department of Health Regions



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

Tennessee Department of Health	Address	City	Zip Code	Phone
Communicable and Environmental Disease Services	425 5th Avenue North, 1st Fl. CHB	Nashville	37243	615-741-7247
State Laboratory	630 Hart Lane	Nashville	37243	615-262-6300
Tennessee Department of Health Regions/Metros	**Address**	**City**	**Zip Code**	**Phone**
Chattanooga/Hamilton County (CHR)	921 East Third Street	Chattanooga	37403	423-209-8180
East Tennessee Region (ETR)	1522 Cherokee Trail	Knoxville	37920	865-546-9221
Jackson/Madison County (JMR)	804 North Parkway	Jackson	38305	731-423-3020
Knoxville/Knox County (KKR)	140 Dameron Avenue	Knoxville	37917-6413	865-215-5090
Memphis/Shelby County (MSR)	814 Jefferson Avenue	Memphis	38105-5099	901-544-7715
Mid-Cumberland Region (MCR)	710 Hart Lane	Nashville	37247-0801	615-650-7000
Nashville/Davidson County (NDR)	311 23rd Avenue North	Nashville	37203	615-340-5632
Northeast Region (NER)	1233 Southwest Avenue Extension	Johnson City	37604-6519	423-979-3200
South-Central Region (SCR)	1216 Trotwood Avenue	Columbia	38401-4809	931-380-2527
Southeast Region (SER)	540 McCallie Avenue, Suite 450	Chattanooga	37402	423-634-5798
Sullivan County (SUL)	PO Box 630, 154 Blountville Bypass	Blountville	37617	423-279-2638
Upper Cumberland Region (UCR)	200 West 10th Street	Cookeville	38501-6076	931-823-6260
West Tennessee Region (WTR)	295 Summar Street	Jackson	38301	731-421-6758

State Contact's Name	Title	E-mail
Allen S. Craig, MD	State Epidemiologist	allen.craig@state.tn.us
Tim F. Jones, MD	Deputy State Epidemiologist	tim.f.jones@state.tn.us
David Smalley, PhD, MSS, BCLD	Laboratory Services Director	david.smalley@state.tn.us

Contacts	Health Officers		Directors of Communicable Disease Control	
Region	Name	E-mail	Name	E-mail
CHR	Valerie Boaz, MD	vboaz@mail.hamiltontn.gov	Marie Stoudemire, RN	mstoudemire@mail.hamiltontn.gov
ETR	Paul Erwin, MD	paul.erwin@state.tn.us	Gail Baird, RN	gail.baird@state.tn.us
JMR	Tony Emison, MD	tony.emison@state.tn.us	Connie Robinson, RN	connie.robinson@state.tn.us
KKR	Martha Buchanan, MD	martha.buchanan @knoxcounty.org	Janice Johnson, RN	janice.johnson@knoxcounty.org
MSR	Helen Morrow, MD	hmorrow@the-med.org	Anthony Otuka, MD, PhD	anthony.otuka@co.shelby.tn.us
MCR	Barton Warner, MD	bart.warner@state.tn.us	Beth Collier, RN	beth.collier@state.tn.us
NDR	William S. Paul, MD	william.paul@nashville.gov	SwanLin Baker, RN	swanlin.baker@nashville.gov
NER	Lawrence Moffett, MD	lawrence.moffatt@state.tn.us	Jamie Swift, RN	jamie.swift@state.tn.us
SCR	Langdon Smith, MD	lang.smith@state.tn.us	Donna Gibbs, PHR	donna.j.gibbs@state.tn.us
SER	Jan Beville, MD	jan.beville@state.tn.us	Gayle Cross, RN	gayle.cross@state.tn.us
SUL	Stephen May, MD	asmay@sullivanhealth.org	Jennifer Williams, RN	jwilliams@sullivanhealth.org
UCR	Donald Tansil, MD	don.tansil@state.tn.us	Debbie Hoy, RN	debbie.hoy@state.tn.us
WTR	Shavetta Conner, MD	shavetta.conner@state.tn.us	Susan Porter, RN	susan.porter@state.tn.us

I. 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 eleven sites: California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, Tennessee and Texas.

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

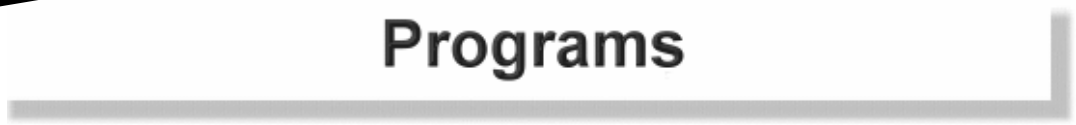
The core activity of the EIP is active surveillance of laboratory-confirmed cases of reportable pathogens. Laboratory directors and staff, physicians, nurses, infection control practitioners, and medical records personnel are key participants in EIP. Components of the EIP in Tennessee investigate foodborne 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 influenza surveillance and vaccine effectiveness.

J. 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 web site, go to http://tennessee.gov/health. Click Programs, and then click on Communicable and Environmental Disease Services.

Step 1:
Type in the web address
http://tennessee.gov/health

Step 2:
Click on Programs



Step 3:
Click on Communicable and Environmental Disease Services

- Bioterrorism
- Breast and Cervical Cancer Screening Program
- Chemical Terrorism
- Communicable and Environmental Disease Services
- Immunizations
- Infant Mortality
- Laboratory Services
- Lead Poisoning Prevention
- Local Health Departments
- Maternal and Child Health

K. Tennessee Population Estimates, 2006

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 sections, K and M.

SEX	POPULATION	AGE GROUP (years)	POPULATION	AGE GROUP (years)	POPULATION
Male	2,932,548	<1	80,141	45-49	451,789
Female	3,072,176	1-4	316,788	50-54	419,453
RACE /SEX	**POPULATION**	5-9	398,871	55-59	369,707
White Male	2,400,130	10-14	414,829	60-64	293,067
White Female	2,479,820	15-19	414,947	65-69	229,078
Black Male	479,267	20-24	406,704	70-74	180,992
Black Female	537,394	25-29	399,392	75-79	144,566
Other Male	53,151	30-34	413,609	80-84	105,750
Other Female	54,962	35-39	419,512	85+	94,887
TOTAL	**6,004,724**	40-44	450,642		

L. Tennessee's Department of Health Regions: Counties and Population, 2006

East (Population 703,340)

County	Population	County	Population
Anderson	72,033	Loudon	42,026
Blount	113,274	Monroe	42,178
Campbell	41,017	Morgan	20,637
Claiborne	31,160	Roane	53,534
Cocke	35,309	Scott	22,548
Grainger	22,022	Sevier	78,724
Hamblen	60,707	Union	19,714
Jefferson	48,457		

Mid-Cumberland (Population 937,015)

County	Population	County	Population
Cheatham	39,237	Rutherford	208,017
Dickson	46,312	Stewart	13,460
Houston	8,236	Sumner	142,619
Humphreys	18,554	Trousdale	7,716
Montgomery	146,487	Williamson	147,382
Robertson	60,446	Wilson	98,549

Northeast (Population 334,983)

County	Population	County	Population
Carter	57,582	Johnson	18,308
Greene	65,176	Unicoi	17,917
Hancock	6,858	Washington	112,908
Hawkins	56,234		

South Central (Population 368,427)

County	Population	County	Population
Bedford	41,641	Lincoln	32,717
Coffee	50,875	Marshall	28,709
Giles	30,267	Maury	74,841
Hickman	24,550	Moore	6,011
Lawrence	41,586	Perry	7,742
Lewis	11,972	Wayne	17,516

Southeast (Population 312,811)

County	Population	County	Population
Bledsoe	12,940	McMinn	51,614
Bradley	93,538	Meigs	11,816
Franklin	40,977	Polk	16,517
Grundy	14,814	Rhea	29,803
Marion	28,440	Sequatchie	12,352

Upper Cumberland (Population 323,531)

County	Population	County	Population
Cannon	13,555	Overton	20,765
Clay	8,120	Pickett	5,157
Cumberland	50,681	Putnam	66,880
DeKalb	18,502	Smith	19,039
Fentress	17,399	Van Buren	5,665
Jackson	11,524	Warren	40,308
Macon	21,799	White	24,137

West (Population 531,803)

County	Population	County	Population
Benton	16,869	Haywood	19,920
Carroll	30,176	Henderson	26,767
Chester	16,562	Henry	31,872
Crockett	15,183	Lake	7,952
Decatur	11,851	Lauderdale	28,709
Dyer	38,290	McNairy	25,249
Fayette	31,720	Obion	33,004
Gibson	48,715	Tipton	56,699
Hardeman	29,907	Weakley	35,723
Hardin	26,635		

Metropolitan Regions (Population 2,492,814)

County	Population	County	Population
Davidson	595,832	Madison	96,205
Hamilton	313,194	Shelby	933,955
Knox	399,254	Sullivan	154,374

M. 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, 2005, MMWR 2007; 54, No.53. The 2006 Summary of Notifiable Diseases has not been released.

Section II.

Tennessee Reported Cases, 1997-2006

Our partners at clinical laboratories and hospitals across the state are a vital asset to the Tennessee Department of Health. Without these partners striving to provide high quality data, surveillance of notifiable diseases would not be the same. Emily Bishop (left), Medical Technologist, and Rosemary Verrall (right), Supervisor are a part of the Clinical Microbiology Laboratory at Vanderbilt Medical Center.

Source: Donna Jones Bailey, Vanderbilt Medical Art Group

Reported Cases, by Year of Diagnosis, Tennessee, 1997-2006

DISEASE	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AIDS	749	790	650	674	606	663	600	694	809	284
Botulism, Foodborne	0	0	2	0	0	0	0	0	0	0
Botulism, Infant	0	1	2	1	4	3	1	1	0	1
Brucellosis	1	1	0	0	1	0	0	1	0	1
California/LaCrosse Encephalitis	8	9	6	19	17	15	14	13	2	7
Campylobacteriosis	299	285	251	272	364	298	448	438	403	443
Chlamydia	12,501	13,717	14,216	15,073	15,556	16,042	21,034	22,513	23,041	25,303
Cryptosporidiosis	17	11	12	12	25	60	41	55	44	47
E. coli 0157:H7	46	55	53	59	50	51	35	48	45	88
Ehrlichiosis	5	6	19	46	20	26	31	20	24	35
Giardiasis	175	207	159	184	190	188	187	251	225	246
Gonorrhea	11,018	11,840	11,366	11,877	10,144	9,348	8,717	8,475	8,619	9,687
Group A *Streptococcus*	87	42	50	83	87	89	167	144	152	160
Group B *Streptococcus*	*	*	*	87	157	164	264	245	368	379
Haemophilus influenzae	31	33	36	26	48	37	58	53	93	72
Hepatitis B Surface Antigen Positive, Pregnant	*	2	3	36	104	103	109	115	104	121
Hepatitis A	407	224	190	154	187	122	202	96	149	69
Hepatitis B, Acute	437	266	228	213	272	128	212	221	153	173
Hepatitis C, Acute	232	166	96	97	64	26	23	35	28	28
Hemolytic Uremic Syndrome	1	1	8	12	10	7	14	16	10	24
HIV	966	840	803	1,127	805	833	549	586	665	697
Legionellosis	32	23	23	14	30	20	37	44	40	50
Listeriosis	14	13	7	13	9	12	9	16	12	14
Lyme Disease	47	45	39	28	30	27	19	25	18	30
Malaria	12	16	7	13	14	4	7	13	14	9
Measles (indigenous)	0	1	0	0	0	0	0	0	1	0
Meningicoccal Disease	81	69	61	56	63	38	30	23	27	25
Meningitis, Other Bacterial	41	36	44	52	54	39	28	28	16	4
Methicillin-Resistant *Staphylococcus aureus*	*	*	*	*	*	*	*	946	1,972	2,005
Mumps	9	2	0	2	1	2	5	4	3	11
Penicillin-Resistant *Streptococcus pneumoniae*	82	192	291	266	226	125	133	153	163	154
Penicillin-Sensitive *Streptococcus pneumoniae*	*	*	*	353	500	471	493	534	807	837
Pertussis	42	41	40	41	72	119	82	179	213	179
Rocky Mountain Spotted Fever	38	31	55	57	87	81	74	99	139	260
Rubella	0	2	0	1	0	1	0	0	0	0
Salmonellosis, Non-Typhoidal	439	587	548	693	724	853	736	776	820	841
Shigellosis	285	884	622	344	124	175	396	570	507	198
Syphilis, Congenital	38	13	11	18	24	11	2	9	19	8
Syphilis, Early Latent	984	659	649	627	553	390	227	206	205	233
Syphilis, Late Latent	595	499	426	511	570	424	461	400	359	434
Syphilis, Neurological	9	15	12	14	10	17	6	7	8	0
Syphilis, Primary	235	143	223	162	89	40	43	24	62	80
Syphilis, Secondary	512	424	418	370	242	128	93	106	155	169
Tetanus	2	1	0	0	1	1	0	2	0	1
Toxic Shock *Staphylococcus*	2	4	3	3	1	2	1	2	1	4
Toxic Shock *Streptococcus*	*	6	5	1	0	0	1	0	0	0
Trichinosis	1	4	0	0	0	1	2	0	1	0
Tuberculosis	467	439	382	383	313	308	285	277	299	277
Tularemia	0	0	0	1	6	4	3	2	7	0
Typhoid	1	2	1	2	1	1	3	4	3	1
Vancomycin Resistant *Enterococci*	46	322	447	524	711	649	802	406	278	388
Yersiniosis	*	*	*	7	14	19	24	26	18	29

Number of Reported Cases of Selected Notifiable Diseases with Rates per 100,000 Persons, by Age Group, Tennessee, 2006

DISEASE		<1Y	1-4	5-14	15-24	25-44	45-64	≥65
	Total population	80,141	316,788	813,700	821,651	1,683,155	1,534,016	755,273
AIDS Cases	Number	0	*	0	13	187	79	4
	Rate	0.0	~	0.0	1.6	11.1	5.1	0.5
Campylobacteriosis	Number	28	82	37	45	99	108	48
	Rate	34.9	25.9	4.5	5.5	5.9	7.0	6.4
Chlamydia	Number	48	*	443	18,210	6,268	325	8
	Rate	59.9	~	54.4	2,216.3	372.4	21.2	1.1
Gonorrhea	Number	8	*	158	5,825	3,218	456	19
	Rate	10.0	~	19.4	708.9	191.2	29.7	2.5
Group A Streptococcus	Number	3	8	6	8	36	43	57
	Rate	3.7	2.5	0.7	1.0	2.1	2.8	7.5
Hepatitis A	Number	0	5	7	7	20	18	12
	Rate	0.0	1.6	0.9	0.9	1.2	1.2	1.6
HIV Cases	Number	0	0	0	146	397	143	11
	Rate	0.0	0.0	0.0	17.8	23.6	9.3	1.5
Meningococcal Disease	Number	5	2	0	6	8	2	2
	Rate	6.2	0.6	0.0	0.7	0.5	0.1	0.3
Pertussis	Number	33	10	24	13	49	41	10
	Rate	41.2	3.2	2.9	1.6	2.9	2.7	1.3
Rocky Mountain Spotted Fever	Number	1	7	30	20	73	78	49
	Rate	1.2	2.2	3.7	2.4	4.3	5.1	6.5
Salmonellosis, Non-Typhoid	Number	88	129	131	79	166	150	112
	Rate	109.8	40.7	16.1	9.6	9.9	9.8	14.8
Shigellosis	Number	7	88	55	12	23	7	8
	Rate	8.7	27.8	6.8	1.5	1.4	0.5	1.1
Syphilis, Early Latent	Number	0	0	0	51	134	47	*
	Rate	0.0	0.0	0.0	6.2	8.0	3.1	~
Syphilis, Late Latent	Number	0	0	0	41	220	135	38
	Rate	0.0	0.0	0.0	49.9	130.7	88.0	50.3
Syphilis, Neurological	Number	0	0	0	0	0	0	0
	Rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syphilis, Primary	Number	0	0	0	10	50	20	0
	Rate	0.0	0.0	0.0	1.2	3.0	1.3	0.0
Syphilis, Secondary	Number	*	0	*	28	109	29	*
	Rate	~	0.0	~	3.4	6.5	1.9	~

SECTION III.

Disease Summaries

A. Foodborne Disease

Peter Sullivan of Nashville is one in a million. Make that one in about 6 million. But he didn't win the lottery. His distinction? Sullivan was Tennessee's only reported case of *E. coli* O157 infection linked to the "spinach" outbreak in the fall of 2006.

Source: Donna Jones Bailey, Vanderbilt Medical Art Group

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 laboratory surveillance for foodborne diseases and related 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, New Mexico in 2004). The total population of the current catchment is 44.9 million or 15% 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. The FoodNet objectives are:

- To determine the frequency and severity of foodborne diseases
- To monitor trends in foodborne diseases over time
- To determine the association of common foodborne diseases with eating specific foods
- To develop and assess interventions to reduce the burden of foodborne illness

Why is FoodNet important to public health?

Foodborne diseases are common; an estimated 76 million cases occur each year in the United States. 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 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 occur 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 604 clinical laboratories that test stool samples in the ten participating states. In Tennessee, 136 laboratories are visited regu-

larly 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) is conducted. The result is a comprehensive and timely database of foodborne illness in a well-defined population.

Survey of clinical laboratories: In 2003, a laboratory survey was carried out to ascertain the use of culture- and non-culture methods of testing for non-0157:H7 Shiga-toxin producing *Escherichia coli*'s (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.

In January 2005, a FoodNet survey of clinical laboratory practices for the isolation and identification of *Campylobacter* began. The laboratory survey assessed the routine practices used to isolate *Campylobacter* from stool specimens, including use of transport media, enrichment or filtration, choice of selective agar, and incubation duration and temperature, any of which could affect isolation rates for *Campylobacter* and therefore affect laboratory-confirmed incidence.

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. The fifth population survey, which began in mid-2006, is currently underway.

Epidemiologic Studies: In 2002, three case-control studies were initiated in FoodNet, to study 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 these diseases. In 2004, data analysis began on a study to measure susceptibility to fluoroquinolones on the outcome of *Salmonella* Typhi infections. In 2006, three new studies were initiated in FoodNet.Two case-control studies are investigating risk factors for unusual and emerging *Salmonella* serotypes, and the effect of antimicrobial resistance on clinical outcomes of *Salmonella* infection. Another study is assessing risk factors for HUS among patients with *E. coli* O157 infections.

Environmental Health Specialist Network (EHS-Net)

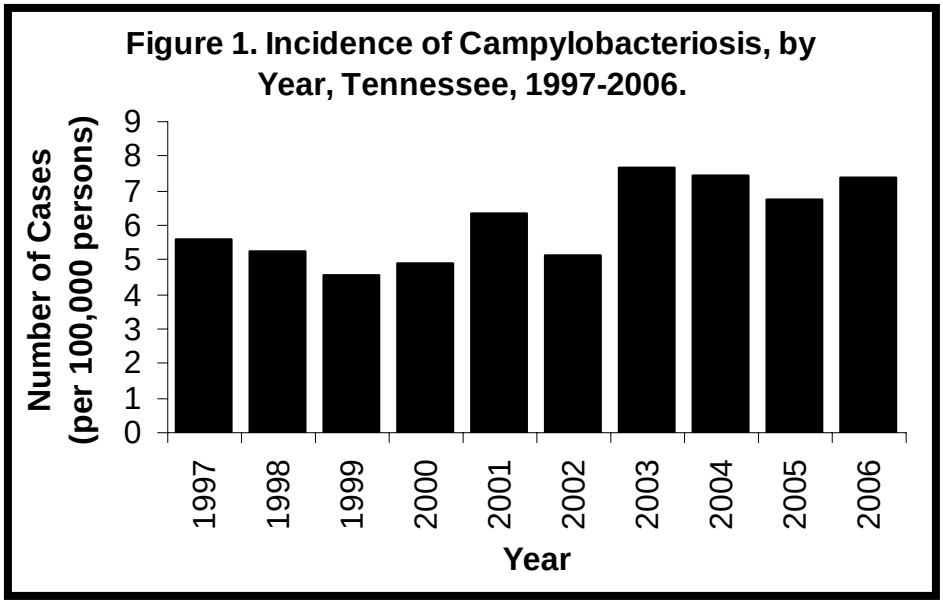
The Environmental Health Specialist Network (EHS-Net) is a network of environmental health specialists and epidemiologists collaborating and exchanging ideas with laboratories, state food protection programs, the Environmental Health Branch of the National Center of Environmental Health at CDC, the Food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

Data continues to be collected for the retail meat study; 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 hand hygiene study focusing mainly on handwashing procedures was completed in 2004. A study characterizing restaurants that have been associated with foodborne outbreaks is being completed, and a study of tomato handling practices in restaurants in the planning stages. Finally, a new waterborne component of EHS-Net was added in October of 2006.

Campylobacteriosis

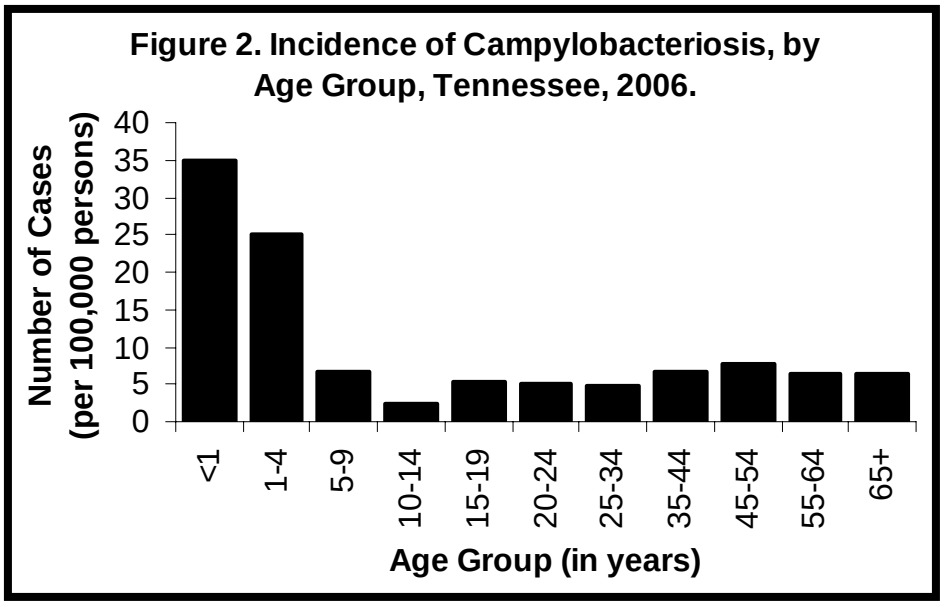
Campylobacteriosis is one of the most commonly reported gastrointestinal illnesses, not only in the United States, but in Tennessee as well. The causative agent is primarily *Campylobacter jejuni*. Most persons infected with the bacterium usually develop diarrhea, cramping, abdominal pain and fever within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

For the past four years rates of campylobacteriosis have been fairly steady at approximately 7.3 cases per 100,000 persons (**Figure 1**).



Active laboratory surveillance for *Campylobacter* is carried out statewide under the auspices of the FoodNet program. Unlike other foodborne pathogens, *Campylobacter* isolates are not required by state law to be sent in to the state laboratory.

Figure 2 illustrates that those at greatest risk of developing infection are those under the age of five years. In 2006, the rate of disease in this population was 21.9 cases per 100,000 persons. The risk for those under the age of one is even greater (34.9 cases per 100,000 persons).



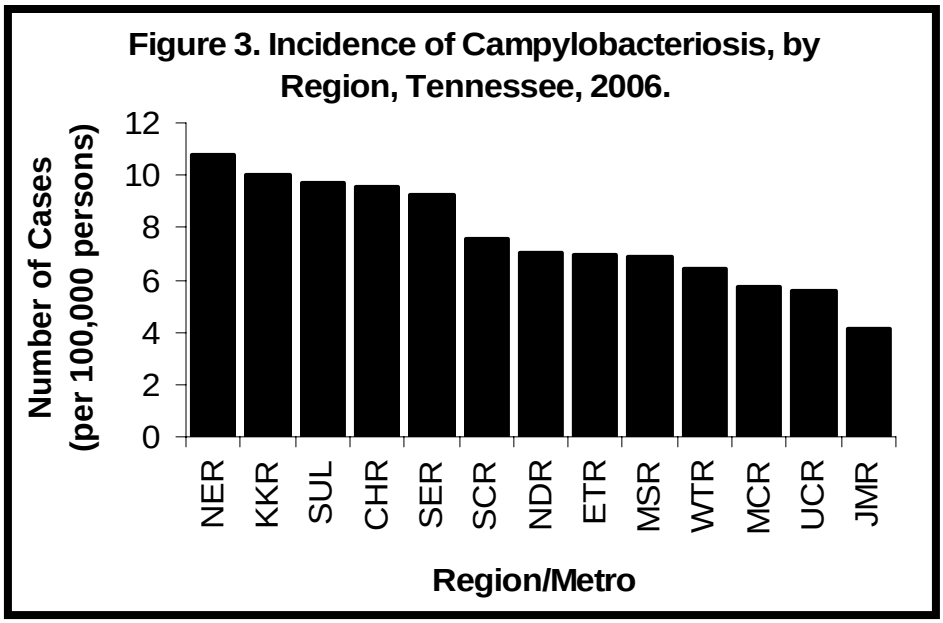
As shown in **Figure 3**, campylobacteriosis is a disease that affects more people in the eastern portion of Tennessee than in the western portion. This phenomenon is consistent year after year. In 2006, the rate of disease varied region to region across the state, with the highest rate in the Northeast Region with 10.7 cases per 100,000 persons, whereas the lowest rates in the state were found in the Jackson/Madison County metropolitan area with 4.2 cases per 100,000 persons.

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 2006 preliminary FoodNet data, Georgia reported the lowest rate of disease, with 6.3 cases per 100,000 persons, while California reported a rate quadruple that (26.8 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 partici-

pating sites in FoodNet has been proposed. One hypothesis is that the consumption of previously frozen chicken (which may decrease the burden of *Campylobacter* contamination) may vary by region.

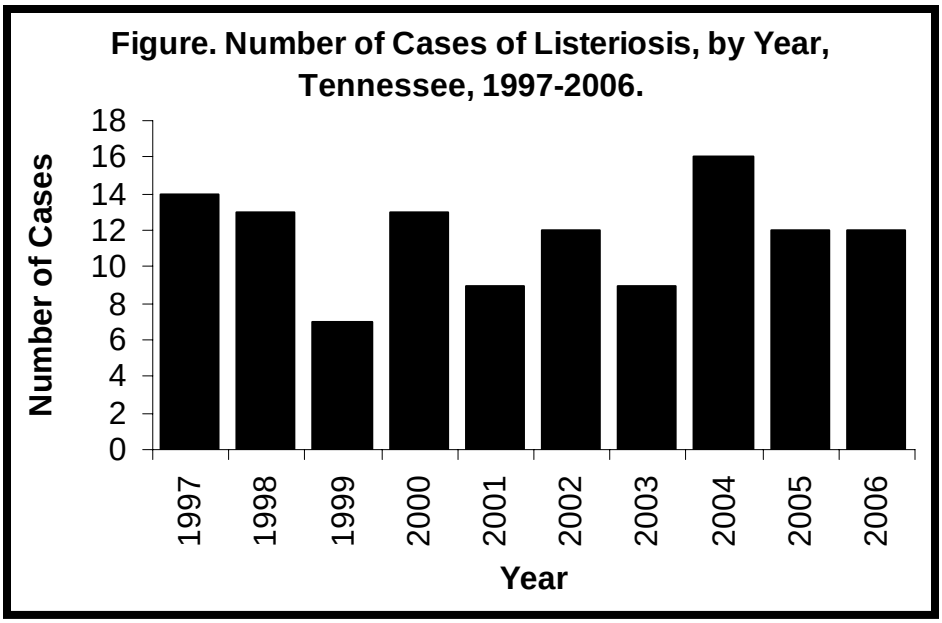
To help identify the risk factors for infants with campylobacteriosis and salmonellosis, a case-control study was conducted from 2002-2004. Several unique protective and risk factors were identified among infants, and these risk factors vary by age, suggesting that prevention measures be targeted accordingly. Riding in a shopping cart next to meat or poultry, drinking well water, visiting or living on a farm, having a pet with diarrhea in the home, eating fruits or vegetables prepared in the home and travelling outside the United States were some of the more interesting risk factors identified. Breast-feeding was protective for the youngest infants and should continue to be encouraged. For more details regarding the results of this study, a paper has been accepted and is to be published in the Pediatic Infectious Diseases Journal in January 2007. The results of 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.



Listeriosis

The bacterium *Listeria monocytogenes* causes listeriosis, a rare but serious foodborne disease. It results in only about 2,500 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 can 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 re-

sulted 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.

Among FoodNet sites in 2005, the overall rate in FoodNet sites was 0.30 cases per 100,000 persons. In Tennessee, the rate was 0.20 cases per 100,000 persons. In 2005, Tennessee reported 12 cases, and in 2006, Tennessee again reported 12 cases **(Figure)**.

Salmonellosis

Salmonellosis is an infection with a bacterium called *Salmonella*. Approximately 40,000 cases of salmonellosis are reported in the United States each year. As many milder cases go undiagnosed, the actual number of infections may be thirty or more times greater. Most persons infected with *Salmonella* develop diarrhea, fever, and abdominal cramps 12 to 72 hours after exposure. The illness usually lasts 4 to 7 days, and most persons recover without treatment. However, in some patients, the *Salmonella* infection may spread to the blood stream, and then to other body sites and can cause death unless the person is treated promptly with antibiotics. The elderly, infants, and those with impaired immune systems are more likely to have a severe illness with subsequent hospitalization.

The annual incidence rate of salmonellosis in Tennessee in 2000 through 2006 was higher than the rates in prior years **(Figure 1)**. A total of 851 cases were reported to the health department in 2006, representing a 4% increase from 820 cases in 2005. The overall rate in 2006 was 14.0 cases per 100,000 persons, as compared to the 1997 rate of 8.2 cases per 100,000 persons in Tennessee. The National Health Objective 2010 for incidence of salmonellosis is 6.8 per 100,000 persons.

Figure 1. Incidence of Salmonellosis, Tennessee, 1997-2006.

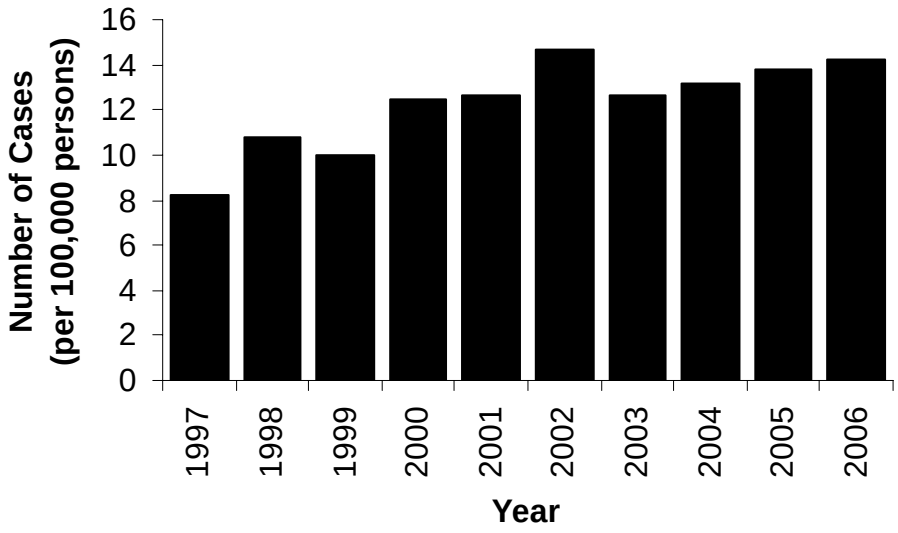
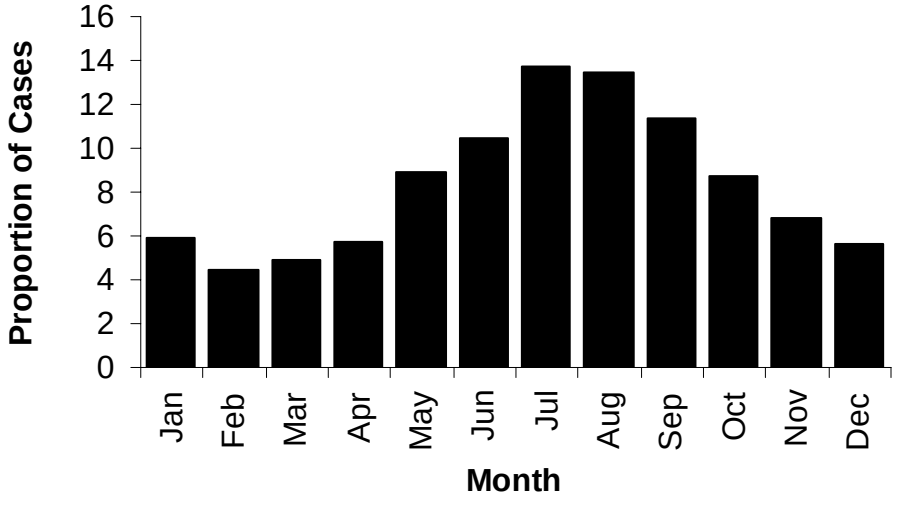


Figure 2. Proportion of Salmonellosis cases, by Month, Tennessee, 1995-2006.



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

In 2006, the rates of infection also varied by region. Jackson/Madison County and Knoxville/Knox County reported the highest rates of *Salmonella* infections, 25.0 and 20.0 cases per 100,000 persons, respectively, compared with 11.0 cases per 100,000 persons each in Nashville/Davidson County, Northeast Region, Southeast Region, and South-Central Region. Five foodborne outbreaks of *Salmonella* were reported in Tennessee in 2006. The largest was an outbreak of *Salmonella* Anatum associated with a restaurant with 44 ill persons.

From 1995 to 2006, 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 time period, 67% of cases were reported during the months of May through October. In 2006, salmonellosis peaked in July with 120 (14%) cases.

As shown in **Figure 3**, from 1995 to 2006, *Salmonella* was isolated most frequently from children under 5 years of age, who accounted for 33% of all salmonellosis cases. In 2006, the incidence rates of salmonellosis were 133 cases per 100,000 infants under the age of one and 40 cases per 100,000 children 1-4 years of age. The distribution of isolates between the sexes was similar from 1995 through 2006.

The five most common serotypes of *Salmonella* (S. Typhimurium, S. Enteritidis, S. Javiana, S. Newport, and S. Heidelberg) accounted for 41% of all *Salmonella* isolates sent to Tennessee Department of Health State Laboratory in 2006. Only one case of S. Typhi, with travel history to Indonesia prior to the illness, was reported in 2006.

Figure 3. Incidence of Salmonellosis, by Age Group, Tennessee, 1995-2006.

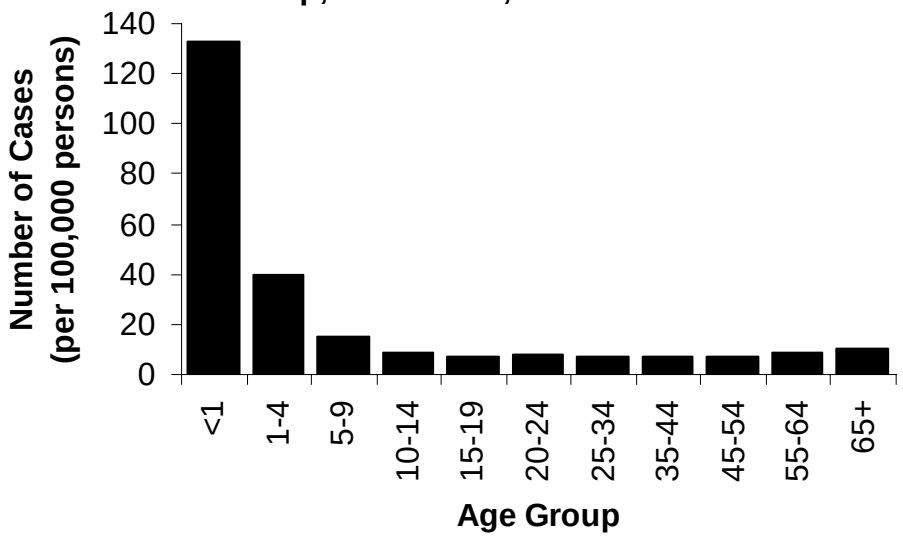
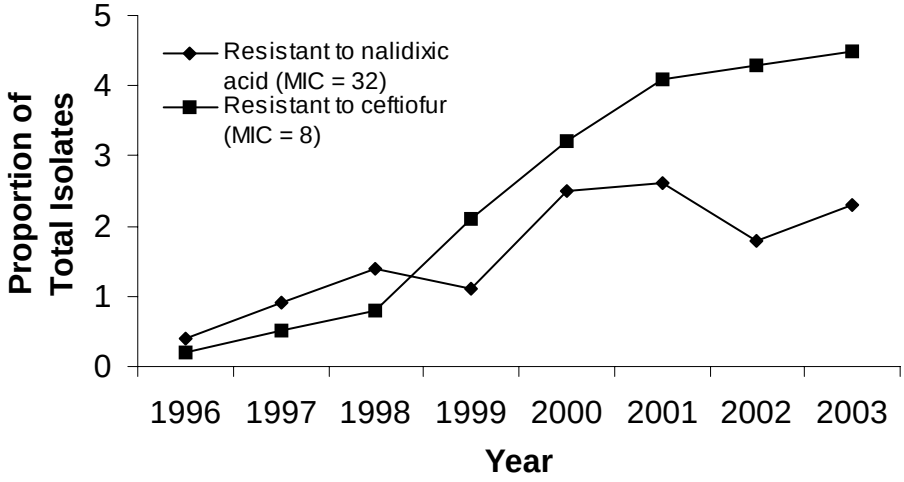


Figure 4. Proportion of non-Typhi *Salmonella* resistant to nalidixic acid or ceftiofur, United States, 1996-2003.



Nationwide, antimicrobial resistance among non-Typhi *Salmonella* to a number of clinically important antimicrobial agents like ampicillin and trimethoprim/sulfamethxazole has increased. In recent years, resistance to third-generation cephalosporines (e.g. ceftiofur) and quinolones (e.g. nalidixic acid) has also increased (**Figure 4**). A cohort study of clinical outcomes associated with resistance levels is currently underway in FoodNet sites. Outcomes of interest include, but are not limited to, potential treatment failure, increased duration of illness, and increased length of hospitalization.

A new case-control study of selected

Salmonella serotypes will be launched in January 2007 as an attempt to identify modifiable risk factors to prevent illness caused by three emerging serotypes of interest within FoodNet sites: *S.* Javiana, *S.* Infantis, and *S.* I 4, [5],12:i:- (a monophasic variant of *S.* Typhimurium).

Shiga-toxin Producing *E. coli* and Hemolytic Uremic Syndrome

Escherichia coli is a ubiquitous Gram-negative bacteria commonly encountered in clinical practice. Most *E. coli* are non-pathogenic residents of the colon. "Extraintestinal pathogenic *E. coli*", or ExPEC, is the most common cause of urinary tract infections, and can cause a plethora of other extraintestinal infections.

E. coli is a common cause of diarrhea worldwide. Several *E. coli* strains cause diarrhea via different mechanisms, and the various acronyms by which they are referred can be quite confusing (Table). Many of these pathogens are of particular importance in developing countries. Except for Shiga-toxin producing *E. coli*, routine culture methods do not identify these organisms.

Shiga-toxin producing *E. coli*, also referred to as "STEC" (of which enterohemorrhagic *E. coli* [EHEC] is a subset) are an important cause of sporadic and outbreak-associated diarrhea in the U.S. By definition, STEC strains produce Shiga-toxins (also called verotoxins), one of which is essentially identical to a toxin produced by *Shigella dysenteriae* (hence the unfortunate, confusion-inducing nomenclature). STEC strains can cause watery or bloody diarrhea and hemorrhagic colitis. Nausea, vomiting and fever are relatively uncommon. Of those infected, 5-10% may develop hemolytic uremic syndrome (HUS), which disproportionately affects young children and the elderly and can have a mortality rate of up to 5%.

STEC infection can be difficult to differentiate clinically from infection with many other common pathogens. Several studies have suggested that the risk of HUS is increased after treatment of STEC with antibiotics. If antimicrobial therapy is being considered for an enteric infection, obtaining a stool culture is important in guiding appropriate treatment.

By far the most commonly reported STEC strain in the U.S. is *E. coli* O157:H7. An important reason for this is that *E. coli* O157 is the only STEC which can be detected by culturing in most laboratories. Over 200 other serotypes of *E. coli* also produce Shiga-toxins. Up to half of STEC-associated diarrhea in the U.S. may be due to non-O157 serotypes, though most of these likely go unreported due to limitations in laboratory testing. The most common non-O157 STEC serotypes in the U.S. include O26:H11, O111, O103, O121, and O145. In some parts of the world non-O157 STECs are a more common cause of diarrhea than O157.

The natural reservoir for *E. coli* O157 is infected ruminants; it can be found

Table. Common *E. coli* pathotypes that cause diarrhea.

Acronym	Pathotype	Epidemiology
ETEC	Enterotoxigenic *E. coli*	Leading cause of "traveler's diarrhea", common cause of childhood diarrhea worldwide. Contaminated food/water.
EHEC / STEC*	Enterhemorrhagic *E. coli,* aka Shiga-toxin producing *E. coli*	Includes *E. coli O157.* Contaminated food/water, person-to-person. Animal reservoirs. Associated with Hemolytic Uremic Syndrome.
EPEC	Enteropathogenic *E. coli*	Common cause of infant diarrhea in developing countries. Person-to-person spread.
EIEC	Enteroinvasive *E. coli*	Contaminated food/water. Endemic in developing countries.
EAEC	Enteroaggregative *E. coli*	Transmission unknown. Chronic diarrhea in developing countries, especially children.

* Only STECs are reportable in Tennessee, and STEC are the only pathogenic *E. coli* readily identifiable on stool culture.

in up to half of cattle herds and 10% of cattle intended for human consumption. Not surprisingly, outbreaks have been associated with contaminated water, multiple different foods, and person-to-person spread.

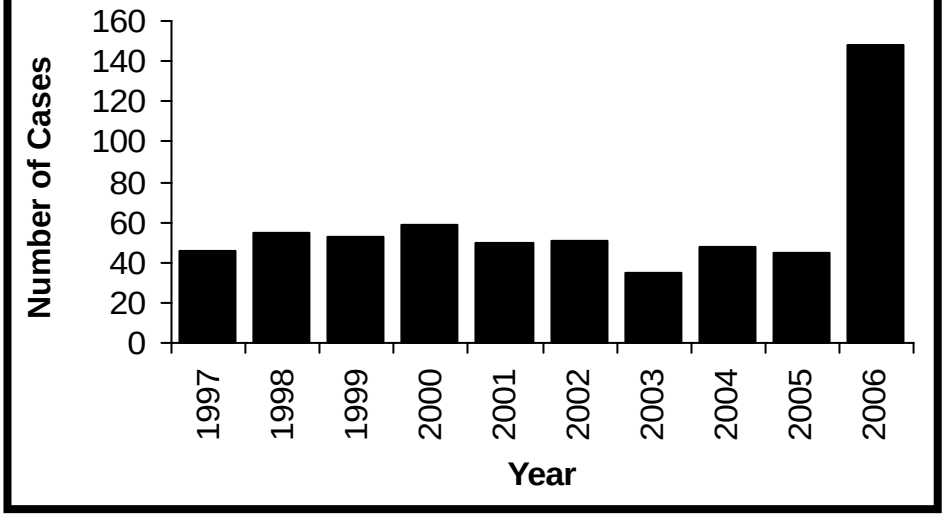
Laboratory Diagnosis

Most clinical laboratories have the capacity to identify *E. coli* O157 by culture, isolating sorbitol-negative *E. coli* on SMAC agar. Many laboratories, however, do not regularly test for *E. coli* O157 as part of a routine stool culture. Some laboratories will test for *E. coli* O157 only on bloody stools, on request, or according to other internal protocols. It is important for clinicians to understand the testing protocols of their laboratories, in order to ensure appropriate testing and interpret results correctly.

Recently, several enzyme immunoassays for Shiga-toxin testing directly on stool specimens have become available. These tests have the advantage of being able to detect STEC serotypes in addition to just O157. Unfortunately, however, these tests do not result in isolation of the pathogen. Therefore, positive Shiga-toxin tests should be followed up with culturing and isolation of the organism, which can then be available for serotyping, DNA fingerprinting, or other confirmatory testing. By law, all laboratories must send *E. coli* O157 isolates or Shiga-toxin-positive specimens to the state laboratory for additional testing, which is provided free of charge. Pulsed-field gel electrophoresis (PFGE), a form of DNA fingerprinting, is routinely performed on all STEC specimens submitted to the Tennessee Department of Health State Laboratory. Resulting fingerprint patterns can help to identify cases with potential epidemiologic links to other sporadic cases, recognized outbreaks, or contaminated foods.

Advances in laboratory testing methods have the potential to increase recognition and reporting of STEC substantially. It is important that clinicians and laboratorians communicate about testing procedures and the interpretation of results, and ensure that specimens are forwarded to the state laboratory to ensure appropriate public health follow-up.

Figure. Reported Cases of STEC, Tennessee, 1997-2006.



In 2006, 148 cases of STEC were reported to the Tennessee Department of Health. Of these, 88 were culture-confirmed *E. coli* 0157, 10 were culture-confirmed non-O157 STEC, and 5 were culture-confirmed STEC with O antigen undetermined.

In 2006, 26 cases of HUS were reported in persons under 18 years of age. Of these, laboratory evidence of a preceding STEC infection was obtained in 24 (92%).

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 statewide for *Shigella* under the auspices of the FoodNet program.

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 7.1 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 2004 (9.7 cases per 100,000), shigellosis rates currently fluctuate cyclically every 5-6 years in Tennessee (**Figure 1**).

In 2006, there were 198 cases of shigellosis reported in Tennessee (3.3 cases per 100,000 persons). This represents a significant decrease in incidence, more than two-fold, from the previous year and the lowest rate since 2002. The majority of those cases were concentrated in the Memphis/Shelby County metropolitan area (64.1%), which was experiencing a 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 198 cases reported in 2006, close to 67% were under the age of ten (for a rate of 16.7 cases per 100,000 persons in that age group). The rate of disease is even greater for those children between the ages of one and four – 27.5 cases per 100,000 persons (**Figure 2**).

Figure 1. Incidence of Shigellosis, by Year, Tennessee, 1990-2006.

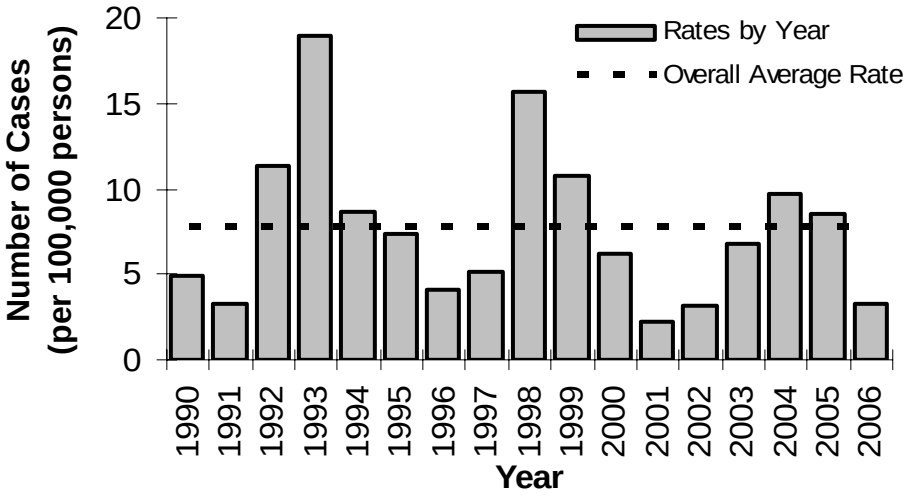
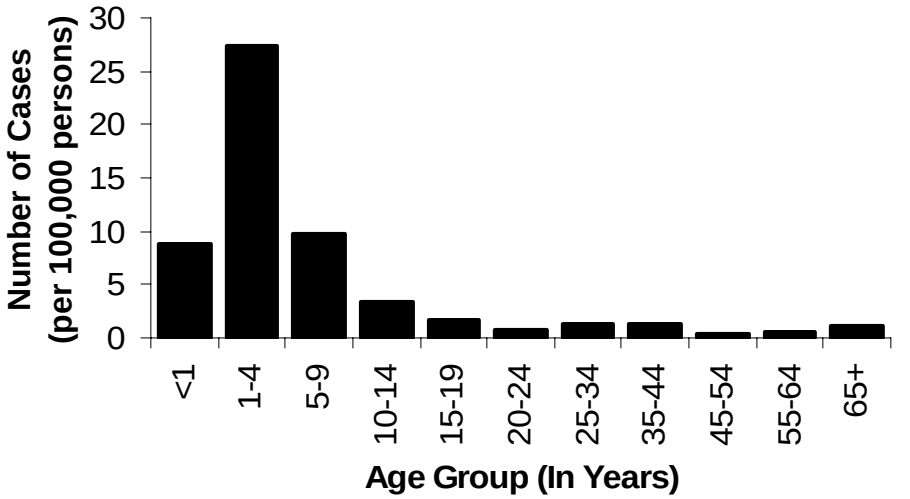


Figure 2. Incidence of Shigellosis, by Age Group, Tennessee, 2006.



The spread of *Shigella* from an infected person to other persons can be prevented by frequent and careful hand washing. 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

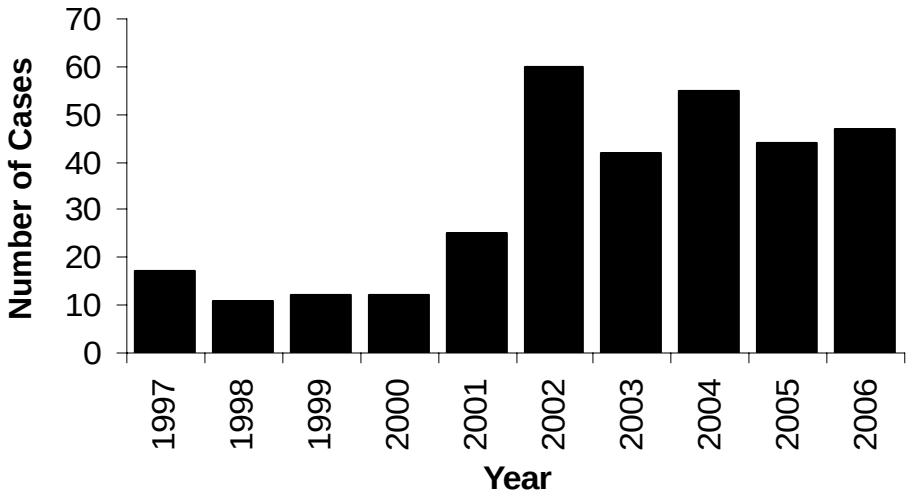
Parasites can cause diseases that range from the mildly annoying to the severe and even fatal. Many parasitic diseases have traditionally been considered exotic, and therefore, frequently have not been included in the differential diagnoses of patients with diarrhea in Tennessee. Nevertheless, these 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.

Figure. Number of Cases of Cryptosporidiosis, by Year, Tennessee, 1997-2006.



The reported number of cases of cryptosporidiosis in Tennessee has increased in recent years. In 1995 one case was reported. The highest yearly count occurred in 2002 when 60 cases were reported. Recent data in 2005 (45 cases) and 2006 (47 cases) reveal that the number of cases appears to have stabilized (**Figure**). A standard screen for a request for testing for ova and parasites is now frequently done with a kit that tests for both *Giardia* and *Cryptosporidia*. That testing, along with heightened awareness may account for the increase in numbers since 1995.

The incidence of cryptosporidiosis varied considerably among FoodNet sites in 2005. In Tennessee, the rate was 0.75 cases per 100,000 persons The overall incidence in the nine FoodNet sites was 2.95 cases per 100,000 persons.

Cyclosporiasis

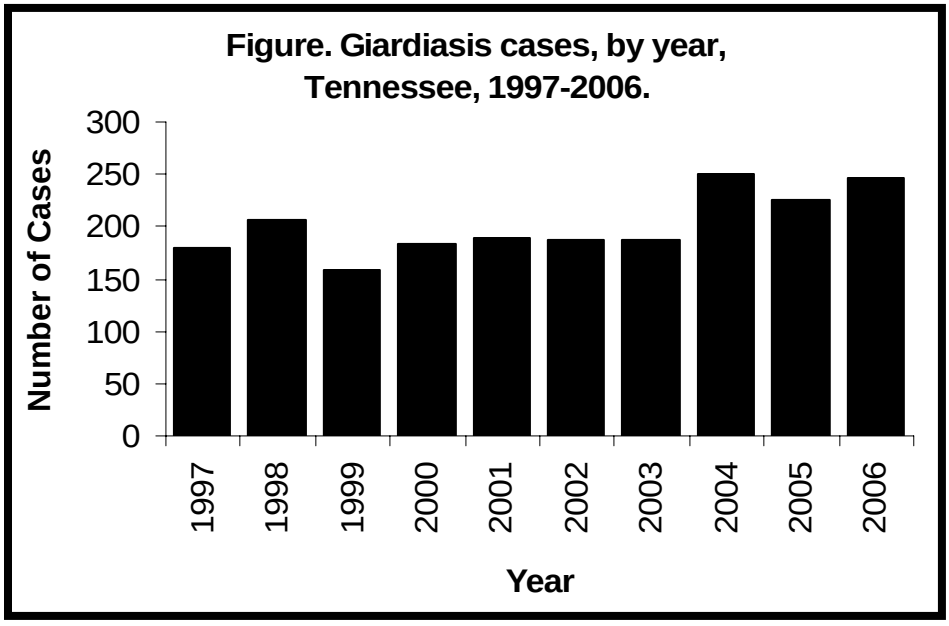
Cyclosporiasis was first described in humans in New Guinea in 1977; however, the causative organism eluded taxonomic classification until 1993. Oocysts of this organisim are quite stable in the environment, surviving freezing, formalin and chlorination. Oocysts can contaminate food and water, but direct 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. In April 2005, another large outbreak in Florida was attributed fresh basil. Over 300 individuals were sickened in 32 Florida counties.

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 and none in 2003 and 2004. In 2005, three cases were reported in Tennessee. Among all FoodNet sites for 2005, 65 cases were reported with an overall incidence rate of 0.14 per 100,000 persons. The number of cases in 2006 was the same as in 2005: three cases.

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 2006.



Acquisition of the parasite requires oral ingestion of *Giardia* cysts. This can occur in one of three ways: through the ingestion of contaminated water (the most frequent), via person-to-person transmission and with the intake of contaminated food. Many waterborne outbreaks have involved the use of untreated surface water or water that has been inadequately treated. Person-to-person transmission 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 2006; the numbers have remained fairly constant ranging from a low of 146 in 1995 to a high of 251, 225, and 246 in 2004, 2005, and 2006 respectively. For the period of 1995-2006, giardiasis reports followed a typical seasonal trend with mostly two thirds (62%) of cases occurring during the summer and fall.

Foodborne Disease Outbreaks

A foodborne disease outbreak is defined as the occurrence of two or more cases of a similar illness resulting from the ingestion of a food in common. All suspected outbreaks and unusual patterns of diarrheal illness should be reported promptly to the local health department.

Since 1997, the number of outbreaks reported to the health department has increased (**Figure 1**). In 2006, there were 33 foodborne disease outbreaks reported in Tennessee (**Table**).

The increasing use of pulsed-field gel electrophoresis (PFGE) to determine relatedness of bacterial isolates has improved the recognition and investigation of suspected outbreaks. In addition, the availability of polymerase chain reaction (PCR) testing has markedly improved our ability to confirm norovirus as the most common etiol-

Figure 1. Reported Foodborne Disease Outbreaks, Tennessee, 1997-2006.

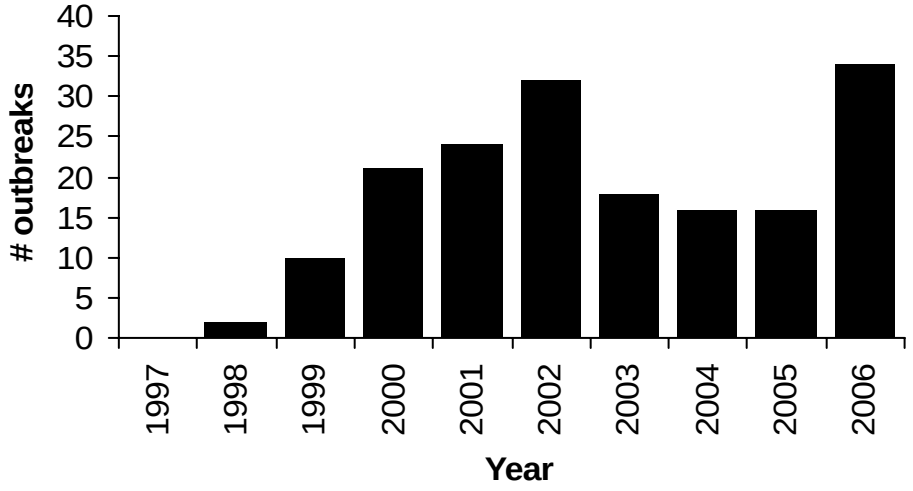
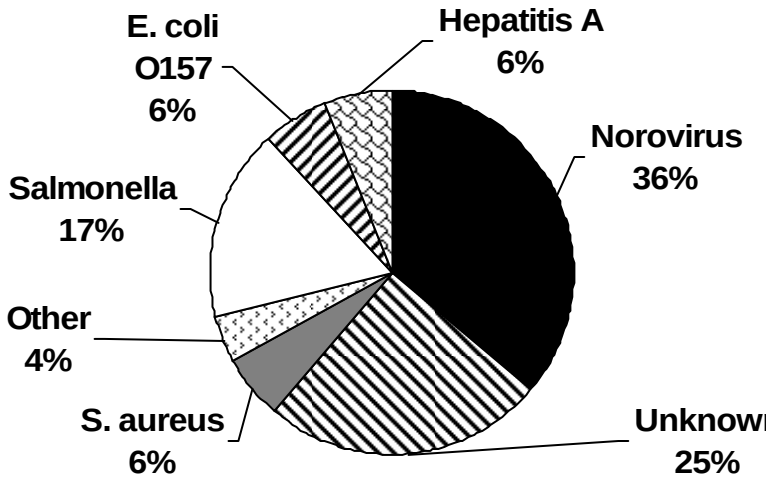


Table. Reported Foodborne Disease Outbreaks, Tennessee, 2006.

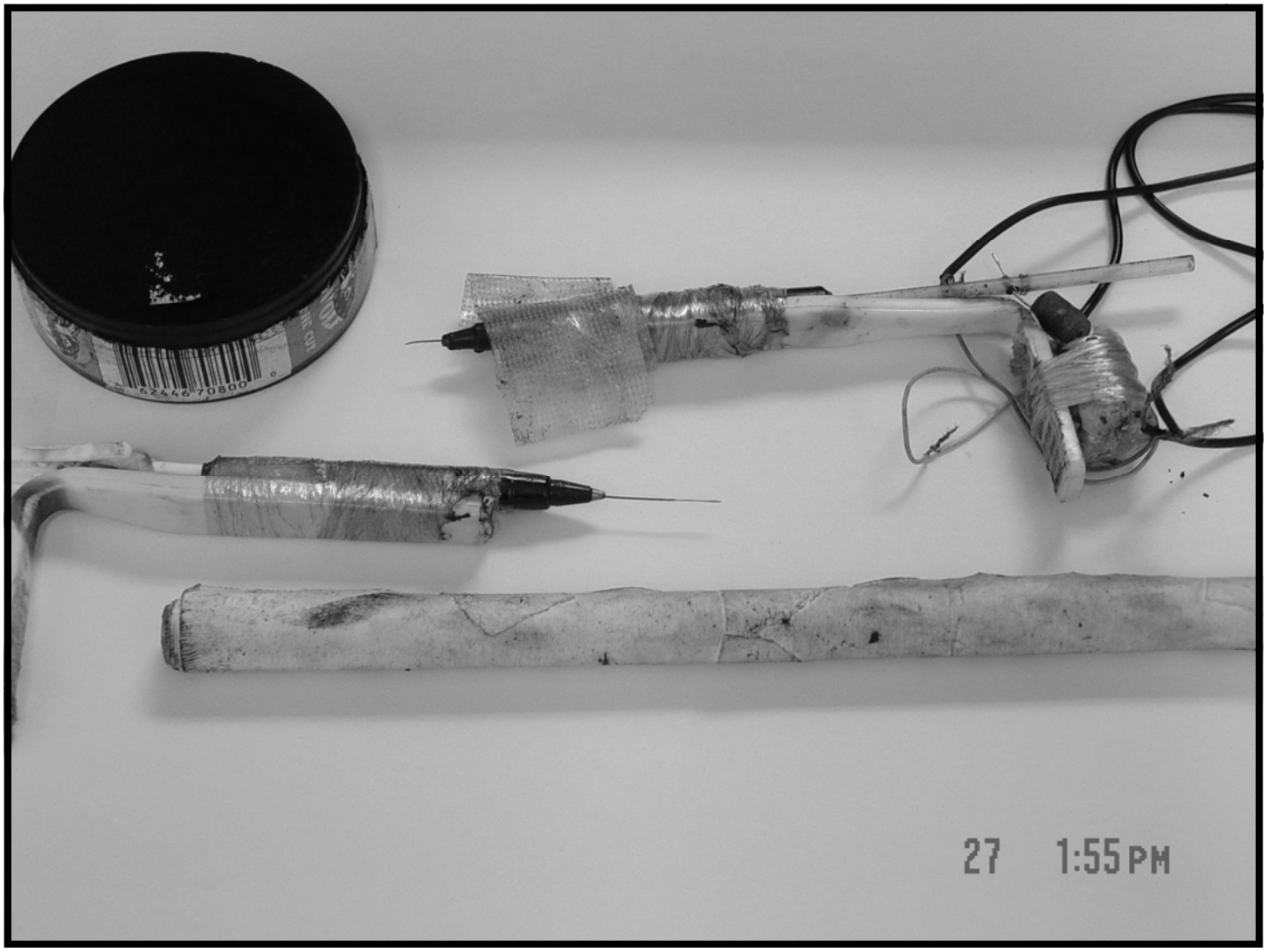
ONSET	COUNTY	# ILL	ETIOLOGY	SITE	SUSPECTED VEHICLE
1/13/2006	Shelby	8	S. Hadar	Shelter	Unknown
1/24/2006	Maury	8	Unknown	Restaurant	Unknown
1/24/2006	Hamilton	11	Unknown	Restaurant	Unknown
2/11/2006	Hamilton	8	Unknown	Restaurant	Unknown
2/19/2006	McNairy	6	Norovirus GII	Restaurant	Unknown
3/11/2006	Davidson	2	Unknown	Restaurant	Unknown
3/17/2006	Sullivan	2	Unknown	Restaurant	Unknown
3/18/2006	Knox	58	Norovirus GII	Restaurant	Unknown
3/25/2006	Dickson	25	Norovirus GII	Camp	Unknown
4/17/2006	Shelby	18	Norovirus GII	Community	Unknown
4/27/2006	Putnam	3	Norovirus GII	Church	Unknown
4/30/2006	Washington	10	Norovirus GII	Catered event	Unknown
5/8/2006	Washington	5	S. Tallahassee	Restaurant	Tomatoes
5/20/2006	Williamson	15	Norovirus GII	Office setting	Turkey roll
7/9/2006	Madison	44	S. Anatum	Restaurant	Unknown
7/10/2006	Hamilton	9	E. coli O157:H7	Restaurant	Unknown
7/22/2006	Hamilton	4	Unknown	Restaurant	Unknown
8/1/2006	Knox	3	Norovirus GII	Restaurant	Unknown
8/2/2006	Hamilton	3	Unknown	Restaurant	Unknown
9/6/2006	Gibson	3	Staph aureus	Restaurant	Tomatoes
9/9/2006	Davidson	2	E. coli O157:H7	Commercial	Spinach
9/18/2006	Multiple	15	S. Typhimurium	Commercial	Tomatoes
10/16/2006	Multiple	24	S. Tennessee	Multiple	Peanut butter
10/21/2006	Shelby	15	Unknown	Catered event	Unknown
11/11/2006	Sumner	9	S. Javiana	Restaurant	Iceberg lettuce
11/13/2006	Hamilton	12	Bacillus cereus	Restaurant	Unknown
11/25/2006	Davidson	5	Scombroid toxin	Restaurant	Tuna
11/30/2006	Hamilton	3	Unknown	Restaurant	Unknown
11/30/2006	Unicoi	11	Norovirus GII	Catered event	Chicken salad sandwich
12/1/2006	Hamilton	3	Norovirus	Restaurant	Unknown
12/10/2006	Lincoln	8	Unknown	Restaurant	Unknown
12/16/2006	Knox	30	Norovirus GII	Restaurant	Unknown
12/29/2006	Sullivan	10	Norovirus Gll	Restaurant	Unknown

ogy in foodborne disease outbreaks. In 2006, 75% of reported foodborne disease outbreaks had a laboratory-confirmed etiology (**Figure 2**).

Figure 2. Etiology of Reported Foodborne Disease Outbreaks, Tennessee, 2006.



B. Hepatitis



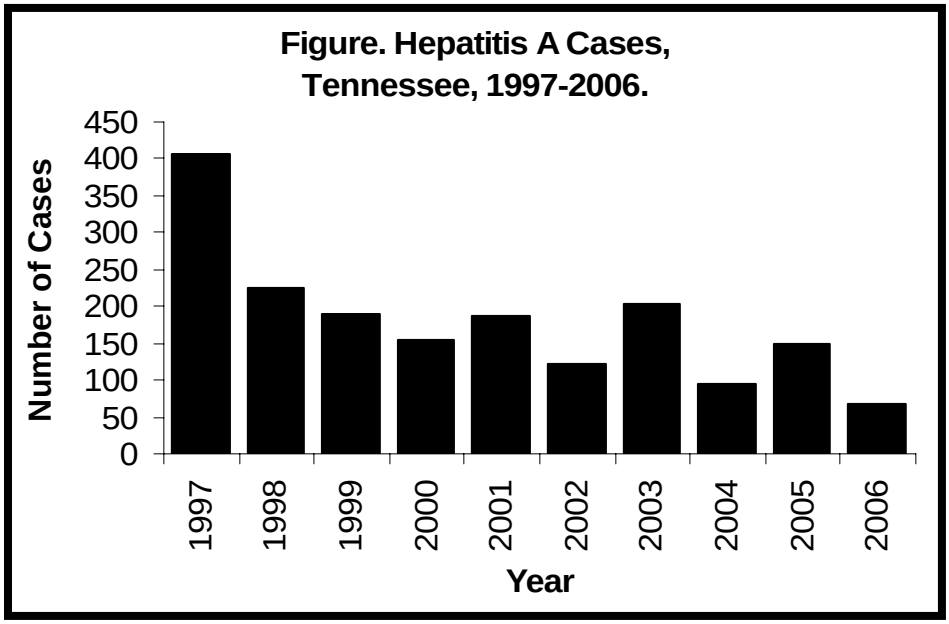
Homemade tattooing apparatus confiscated from a jail during an outbreak investigation. Illicit needle sharing is a substantial risk factor for bloodborne pathogens including hepatitis B and C.

Source: Tennessee Department of Health

Hepatitis A

Hepatitis A virus (HAV) infection characteristically is an acute, self-limited illness associated with fever, malaise, jaundice, anorexia, and nausea. Symptomatic hepatitis A infection occurs in approximately 30 % of infected children younger than 6 years of age; few of these children will have jaundice. Among older children and adults, infection is usually symptomatic and typically lasts several weeks, with jaundice occurring in approximately 70%. Prolonged or relapsing disease lasting as long as 6 months can occur. Fulminant hepatitis is rare but is more common in people with underlying liver disease. Chronic HAV infection does not occur. Once you have hepatitis A you cannot get it again. One-third of Americans have evidence of past infection (immunity). About 15% of people infected with HAV will have prolonged or relapsing symptoms over a 6-9 month period.

Hepatitis A virus 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 (ie, the fecal-oral route). HAV is usually spread from person to person by putting something in the mouth (even though it may look clean) that has been contaminated with the stool of a person with hepatitis A. 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 occurred among children 5 to 14 years old, and the lowest rates occurred among adults older than 40 years of age. In the late 1990s, hepatitis A vaccine was more widely used and the number of cases reached historic lows. In Tennessee, an epidemic of hepatitis A occurred in 1995 in Shelby County where almost 1600 cases occurred. Since that time, the number of cases has steadily declined. There were only 69 cases reported in 2006 in Tennessee (1.1 cases per 100,000 persons), the fewest number reported in the last decade (**Figure**).

In the Fall of 2003, approximately 80 cases were attributed to a hepatitis A outbreak from ingestion of contaminated food from a restaurant located in East Tennessee. Tennessee has not experienced a large outbreak of hepatitis A since 2003.

Among cases of hepatitis A infection reported to the CDC, the identified sources of infection include close personal contact with a person infected with hepatitis A virus, household or personal contact with a child care center, international travel to endemic areas, a recognized foodborne or waterborne outbreak of hepatitis A, men having sex with men, and injecting and non-injecting drug users. In child care centers, recognized symptomatic (icteric) illness occurs primarily among adult contacts of children. Most infected children in child care 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, when patients are most likely to transmit HAV, occur during the 1 to 2 weeks before the onset of illness. 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

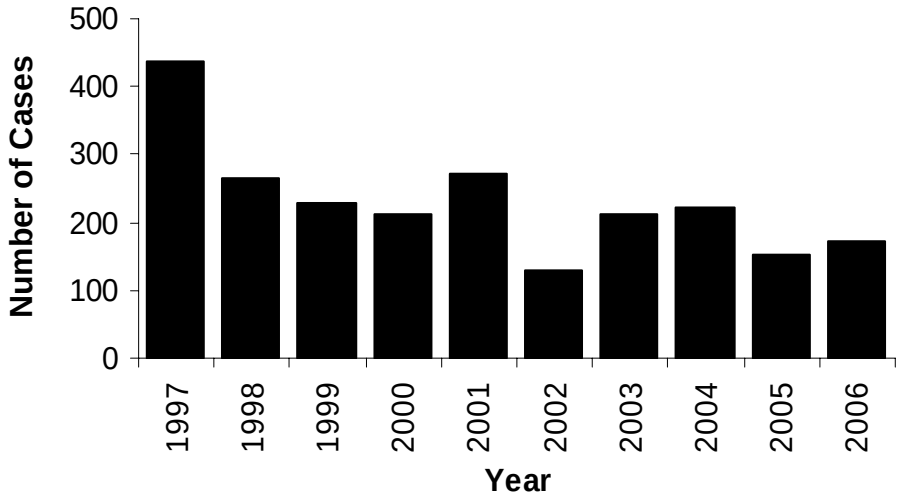
days, with an average of 25 to 30 days.

Immune globulin when given within 2 weeks after exposure to HAV, is greater than 85% effective in preventing symptomatic infection. Prevention is possible from always washing your hands with soap and water after using the bathroom, changing a diaper, and before preparing and eating food. Hepatitis A vaccine is the best protection, and there are two inactivated hepatitis A vaccines, Havrix and Vaqta. 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 > 18 years of age.

Hepatitis B

People with hepatitis B virus (HBV) infection may present with a variety of signs and symptoms, including subacute illness with nonspecific symptoms (eg, anorexia, nausea, or malaise), clinical hepatitis with jaundice, and fulminant fatal hepatitis. About 30% of persons have no signs or symptoms which are less common in children than adults. These signs include jaundice, fatigue, abdominal pain, loss of appetite, nausea and/or vomiting, and joint pain. Acute hepatitis B can not be distinguished from other forms of acute viral hepatitis on the basis of clinical signs and symptoms or nonspecific laboratory findings. 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.

Figure. Acute Hepatitis B Cases, Tennessee, 1997-2006.



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, household contacts of chronically infected persons, infants born to infected mothers, infants/children of immigrants from areas with high rates of HBV infection, health care and public safety workers, and hemodialysis patients. Persons at risk for HBV infection might also be at risk for infection with hepatitis C virus (HCV) or HIV. Drinking alcohol can make your liver disease worse.

Hepatitis B case reports for 2006 (Number of cases: 173, Incidence Rate: 2.9 cases per 100,000 persons) in Tennessee are at about the same level as experienced in 2005 (Number of cases: 153, Incidence Rate: 2.6 cases per 100,000 persons) as shown in the **figure**. The prevalence of HBV infection among adolescents and adults is 3 to 4 times greater for black individuals than for white individuals. Hepatitis B virus infection in adolescents and adults is associated with other sexually transmitted diseases, including syphilis and infection with human immunodeficiency virus (HIV). In the United States, HBV infection occurs primarily in adults and adolescents where 5% to 8% of the total population has been infected, and 0.2% to 0.9% of the population has chronic infection. HBV infection is highly endemic in 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% to 90% of the adult population has been infected, and 8% to 15% of the population has chronic infection. The incubation period for

acute infection is 45 to 160 days, with an average of 90 days.

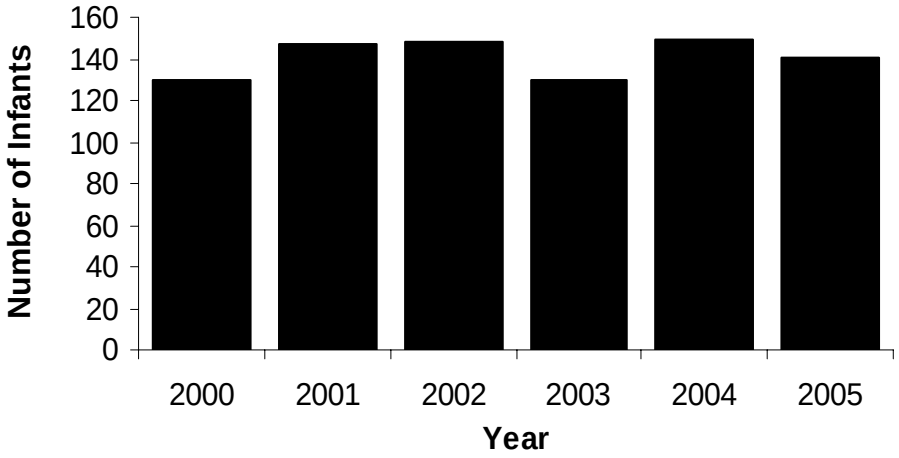
Hepatitis B vaccine, which has been available since 1982, is the best protection against HBV infection. Routine vaccination of 0-18 year olds and vaccination of risk groups of all ages is recommended. The number of new infections per year in the United States has declined from an average of 260,000 in the 1980s to about 60,000 in 2004. 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 which 20–30% acquired their infection during childhood.

Perinatal Hepatitis B

Children born to hepatitis B surface antigen (HBsAg) positive women are at high risk of becoming chronic carriers of hepatitis B virus. 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).

Figure. Reported Number of Infants Born to Hepatitis B Surface Antigen Positive Women, Tennessee, 2000-2005.



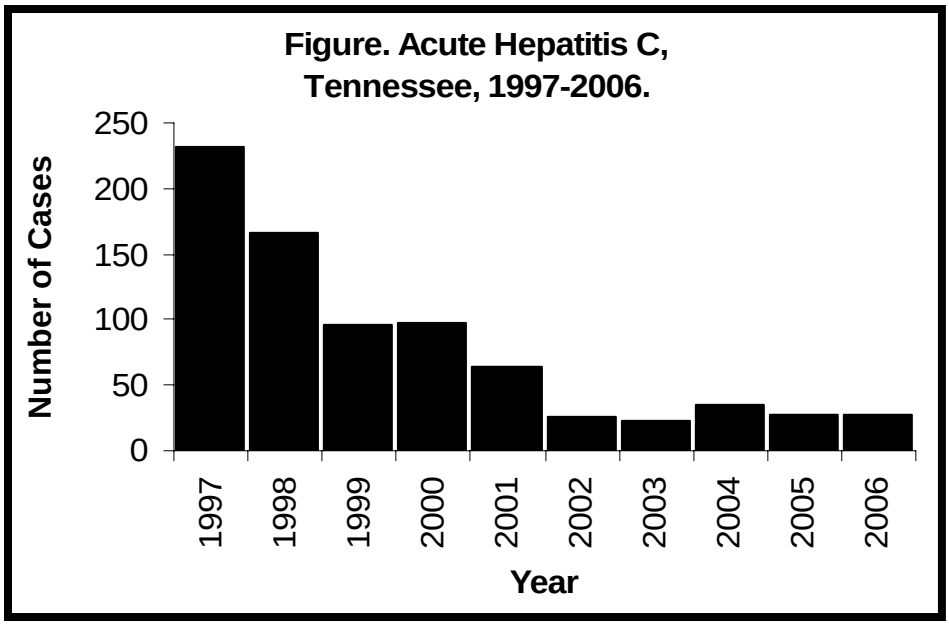
The Tennessee Department of Health receives the test results and counsels all women who are reported as HBsAg positive. The department also identifies and treats their contacts, confirms that the information is in medical records, ensures that the delivering hospital has a record of the mother's status and that it has HBIG and vaccine available.

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

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. Eighty percent of persons have no signs or symptoms. Jaundice occurs in <20% of patients, and abnormalities in liver function tests generally are less pronounced than abnormalities in patients with hepatitis B virus infections. 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 70% of infected adults, limited data indicate that <10% of infected children develop chronic hepatitis, and <5% develop cirrhosis. Deaths from chronic liver liver disease occurs in 1-5% of infected persons. Infection with HCV is the leading reason for liver transplantation among

adults in the United States. In Tennessee during 2006, the number of reported cases of acute HCV has remained at 28 (0.5 cases per 100,000 persons) as shown in the **figure**.



The prevalence of HCV infection in the general population of the United States is approximately 1.6%. The seroprevalence is 0.2% for children younger than 12 years of age and 0.4% for adolescents 12 to 19 years of age. The seroprevalence varies among populations according to their associated risk factors. Infection is spread primarily by parenteral exposure to blood of HCV infected people. HCV is spread through sharing needles or "works" when "shooting" drugs, through needlesticks or sharps exposures on the job, or from an infected mother to her baby during birth. Persons at risk for HCV infection might also be at risk from infection with hepatitis B virus (HBV) 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 generally is 1 to 2 weeks.

There is no vaccine to prevent hepatitis C. The number of new HCV infections per year has declined from an average of 240,000 in the 1980s to approximately 26,000 in 2004. Most infections are due to illegal injection drug use. Transfusion-associated cases occurred prior to blood donor screening, but now occurs in <1 per 2 million transfused units of blood. Approximately 4.1 million (1.6%) Americans have been infected with HCV, of whom 3.2 million are chronically infected. The risk for perinatal HCV transmission is about 4%. If coinfected with HIV the risk for perinatal infection is about 19%. 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 for genotype 1 and in up to 8 out of 10 persons for genotype 2 and 3. Drinking alcohol can make liver disease worse.

C. Meningitis/Encephalitis and Septicemia

Erin Holt (above), Epidemiologist, assisted Drs. Rand Carpenter and John Dunn during an intensive rabies investigation at the 2006 Tennessee Walking Horse Celebration.

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 1999, 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 in Tennessee.
- To determine molecular epidemiologic patterns and microbiologic characteristics of public health relevance for isolates causing invasive infections from select pathogens.
- To provide an infrastructure for further research, such as special studies aimed at identifying risk factors for disease, post-licensure evaluation of vaccine effectiveness 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.

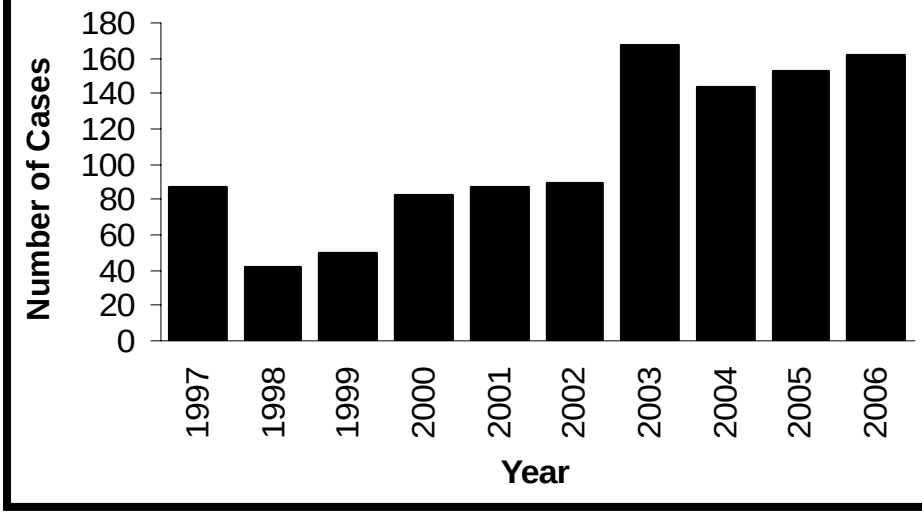
Under the auspices of ABCs, a number of studies have been undertaken to reach some of the objectives listed above. An assessment of the effectiveness of current prenatal group B strep-

tococcus screening guidelines was completed in 2002. An evaluation of compliance with current guidelines is underway. Evaluations of the effectiveness of influenza vaccine in young children and meningococcal conjugate vaccine in teenagers are underway.

Group A Streptococcal Disease

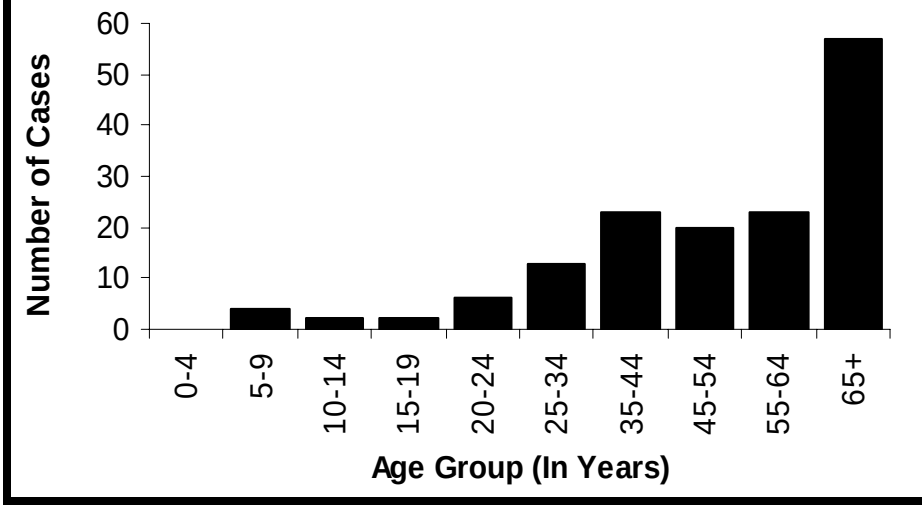
Reporting of group A streptococcal disease (GAS) began in 1996 in Tennessee. Case reports increased dramatically from 1999 to 2000 and again from 2002 to 2003. Since 2003, rates have remained fairly stable **(Figure 1)**. The 2006 Tennessee GAS rate (2.7 cases per 100,000 persons) was lower than the 2005 United States rate of 3.6 cases per 100,000 persons.

Figure 1. Number of Cases of Invasive Group A *Streptococcus* , Tennessee, 1997-2006.



Tennessee data indicate that GAS cases were most frequent in persons aged 65 and over (7.5 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 continued the upsurge with an 88% increase in cases from 2002 to 2003. Since 2003, rates have decreased slightly, but remained stable for the oldest age group.

Figure 2. Number of Cases of Invasive Group A *Streptococcus*, by Age Group, Tennessee, 2006.



GAS rates in the metro areas ranged from 1 case per 100,000 persons in Jackson/Madison County to Nashville/Davidson County with a rate of 5.5 cases per 100,000 persons. The West region had the highest rate (3.2 cases per 100,000 persons) of GAS among rural regions of Tennessee.

Nationally, Streptococcal Toxic Shock Syndrome (STSS) and Necrotizing Fasciitis (NF) each accounted for approximately 5% and 7% respectively 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.

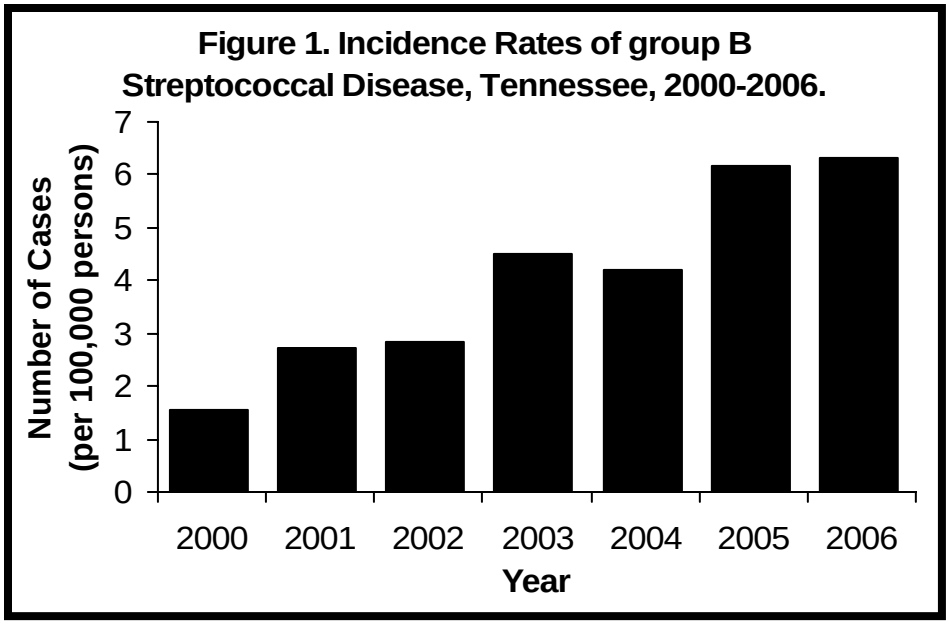
GAS invasive disease occurs primarily among the elderly, the immunosuppressed, those with chronic cardiac or respiratory disease, and diabetes. Persons with skin lesions (i.e. children with varicella) and intravenous drug users are other groups at risk for invasive GAS. Blacks (3.3 cases per 100,000 persons) are more often affected than whites (2.1 cases per 100,000 persons), while other races

(non-black, non-white) are affected the most (12.0 cases per 100,000). 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: 38.6 million).

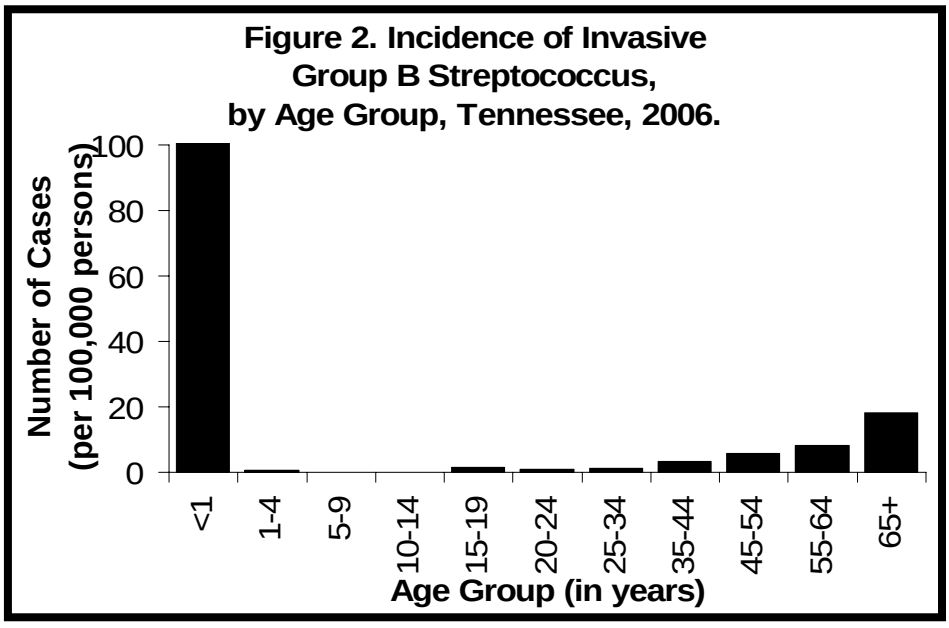
Worldwide, rates of GAS invasive disease, STSS and NF increased from the mid-1980s to early 1990s. Rates of invasive disease have been stable over the last 5 years throughout the United States. Increases in the rate and severity of GAS invasive disease are associated with increases in the prevalence 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 postsurgical GAS cases.

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. Required reporting of invasive GBS cases in Tennessee began in 2000 when only 87 were reported. In 2006, 379 were reported, for a rate of 6.3 per 100,000 population. **(Figure 1)**



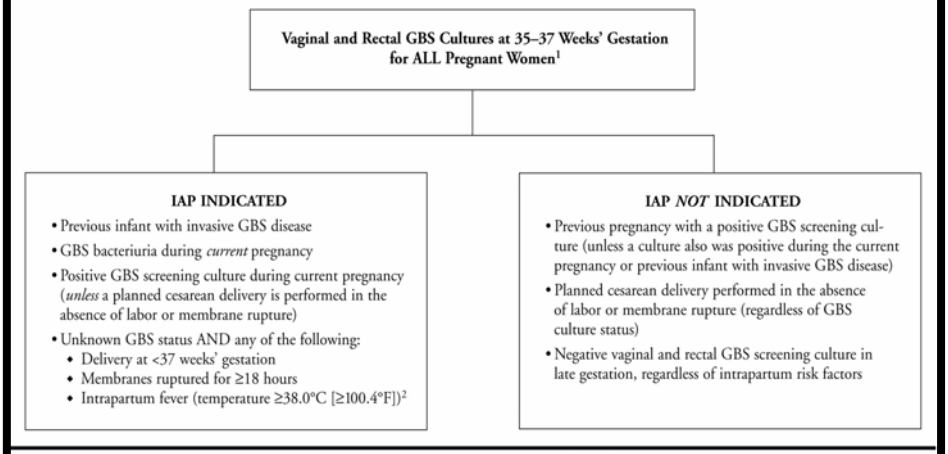
Those persons at greatest risk of developing infection are newborn babies, pregnant women, those age 65 and older as well as other adults with underlying illnesses, such as diabetes mellitus or liver disease. Rates of disease in Tennessee are highest for infants (<1 year old) (101.1 per 100,000 persons), followed by those age 65 years or older (18.1 per 100,000 persons). **(Figure 2)**



Infection in newborns is classified into two distinct categories: early-onset disease (0-6 days old) and late-onset disease (7-89 days old). Early-onset disease is characterized by sepsis, respiratory distress, apnea, shock and pneumonia. Early-onset infection is either acquired *in utero* or during delivery. Newborns delivered at less than 37 weeks gesta-

tion are more likely to develop early-onset disease when compared to full term infants. It appears that late-onset disease is caused by maternal carriage in some cases and the specific cause in others is unknown. Infants with late-onset disease typically develop meningitis or sepsis. An average of 4% of early- and late-onset patients die from their illness. A total of 77 GBS cases in infants age 0-89 days were reported in Tennessee in 2006. Early-onset cases accounted for 48 (62%) of 77 cases under 90 days of age and late-onset disease accounted for 29 (38%) of 77 cases.

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.

The recommended guidelines for diagnosis and treatment of GBS, which were first adopted in 2002, employ a single screening-based approach urging physicians to screen all pregnant women by vaginal and perirectal GBS culture between 35 and 37 weeks gestation. Colonized women are then offered antibiotics at the time of labor. Increased surveillance and awareness may be partly responsible for the increase in incidence in 2006. Efforts have been made over the past two years to improve physician awareness of the new guidelines statewide and to target areas with a history of lower screening rates. This effort to decrease GBS disease in infants complements the Department of Health campaign to lower infant mortality.

A follow up study of compliance with screening in pregnancy is currently underway in the four largest metropolitan areas of the state. This will provide a comparison to the most recent measure of prenatal screening which was conducted for 1998-1999 births.[1]

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.

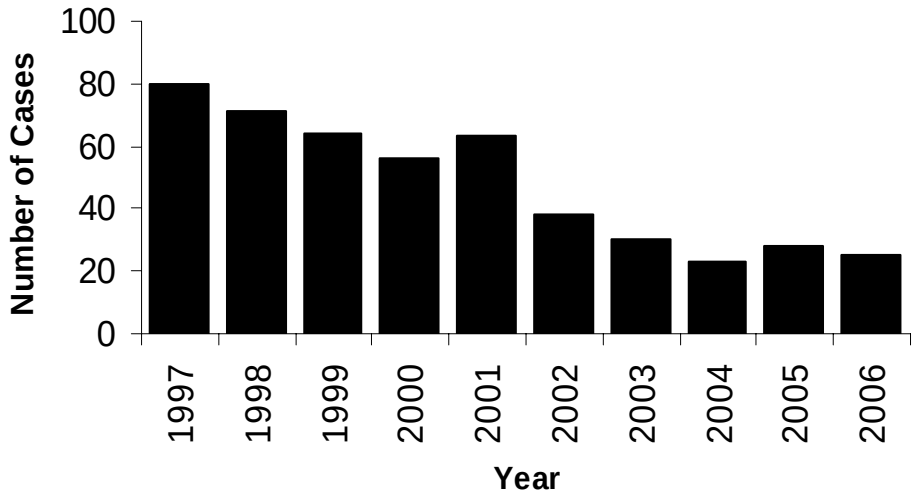
Surveillance is conducted statewide through the National Electronic Disease Surveillance System (NEDSS) and the Emerging Infection Program's Active Bacterial Core Surveillance (ABCs). Immediate reporting via telephone is required in Tennessee followed with a written report within one week. Serogrouping of meningococcal isolates is performed routinely at the Tennessee Department of Health Laboratory.

The number of cases reported in Tennessee has declined since 1997. Twenty-five cases (0.4 cases per 100,000 persons) were reported in

[1] Eisenberg E, Craig AS, Gautam S et al. Prevention Strategies for Perinatal Group B Streptococcal Disease: Beyond Screening. *Ped Infect Dis J* 2005;24:520-524.

2006 (**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.

Figure. Number of Invasive Meningococcal Disease Cases, Tennessee, 1997-2006.



Methicillin-resistant *Staphylococcus aureus* (MRSA)

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a bacterium that is resistant to antibiotics such as methicillin, oxacillin, penicillin and amoxicillin. Staphylococcal infections, including MRSA, occur most frequently among persons in hospitals and healthcare facilities (such as nursing homes and dialysis centers) who have weakened immune systems. MRSA in healthcare settings commonly causes serious and potentially life-threatening infections such as blood-stream infections.

MRSA infections that are acquired by persons who have not been recently (within the past year) hospitalized or had a medical procedure (such as dialysis, surgery, catheters) are know as community associated (CA-MRSA) infections. Staphylococcal or MRSA infections in the community are usually manifested as skin infections, such as pimples and boils, and occur in otherwise healthy people. CA-MRSA infections have been frequently mistaken for "spider-bites". Incision and drainage is very important in the management of skin and soft tissue infections.

For statewide reporting, invasive disease is defined as isolation of MRSA from a normally sterile site (i.e., specimen source is blood, cerebrospinal fluid (CSF), pleural, pericardial, peritoneal or joint fluid or bone); medical record review is not performed. Sputum, wound, urine and catheter tip isolates are not counted. Repeat isolates within 30 days are not counted.

Invasive MRSA was made reportable in Tennessee in June 2004. From July to December of 2004, there were 882 cases (30 cases per 100,000 persons) of MRSA reported. In 2005, the number of cases increased more than two-fold to 1,978 cases, with 2,005 cases in 2006 (33 cases per 100,000 persons).

Invasive MRSA infections are a major public health problem; MRSA is the most common reportable communicable disease in Tennessee (after chlamydia and gonorrhea). Most (87%) invasive MRSA are hospital-associated. Prevention efforts in healthcare settings need to focus on both the prevention of infections (central line-associated blood-stream infections, ventilator associated pneumonia, and surgical site infection) and the prevention of transmission of MRSA within healthcare facilities.

Rabies

In 2006, Tennessee had no documented human rabies cases but experienced a substantial increase in animal rabies cases compared to 2005. The increase was due to resurgence in the number of rabid skunks tested. Of continuing concern is the emergence of raccoon variant rabies in northeast and southeast Tennessee. The Tennessee Department of Health is continuing to work collaboratively with state and federal agencies to slow the west-

ward spread of raccoon rabies. Tennessee relies heavily on United States Department of Agriculture - Wildlife Services to conduct enhanced surveillance and the Oral Rabies Vaccination (ORV) campaign.

Domestic animal submissions accounted for the vast majority of animal testing conducted by Tennessee Department of Health Laboratories in 2006. There were 2,276 animals tested in state laboratories, including 802 dogs and 616 cats. Most submissions came from larger metropolitan areas. In 2006, 131 cases of animal rabies were confirmed statewide, an increase of 173% compared to 2005. Tennessee has three rabies vector species (RVS): bats, skunks, and as of April 2003, raccoons. Each of these RVS is infected with a host-adapted rabies virus variant. These three RVS accounted for 120 (92 %) of the 131 animal rabies cases. The remaining 11 (8%) rabies cases in 2006 were among foxes and domestic animals infected with one of the three RVS host-adapted virus variants. The dramatic increase in 2006 animal rabies cases is attributable to resurgence in the number of rabid skunks tested from middle Tennessee. Although the resurgence in laboratory-confirmed skunk rabies cases was substantial, it is consistent with numbers of rabid skunks seen in previous years (**Table**). This increase may reflect temporal cycles (**Figure 1**) in the natural history of north-central skunk variant rabies in its enzootic host, the Striped Skunk, *Mephitis mephitis*. Bat rabies cases were reported sporadically from various counties throughout the state and occurred most commonly in the summer months. In 2006, there were nineteen rabies-positive bats. Three raccoons in northeast Tennessee infected with raccoon-variant rabies were confirmed, two from Unicoi County and one from Johnson County. Two other raccoon-variant rabies cases were documented, one each in a domestic cat from Unicoi County and a fox from Bradley County.

A total of seven cases of animal rabies occurred among domestic animals in 2006. In addition to the previously mentioned Unicoi County cat, 2 other cats, 2 dogs, and 2 cattle were infected with rabies. One cat from Sumner County, which attacked and bit a person resulting in rabies post-exposure prophylaxis for the victim, was infected with rabies virus characterized as the variant associated with the Eastern Red Bat (*Lasiurus borealis*). Both the dogs (Bedford and Lincoln counties) and cattle (Smith and Maury counties) were infected with north-central skunk variant rabies.

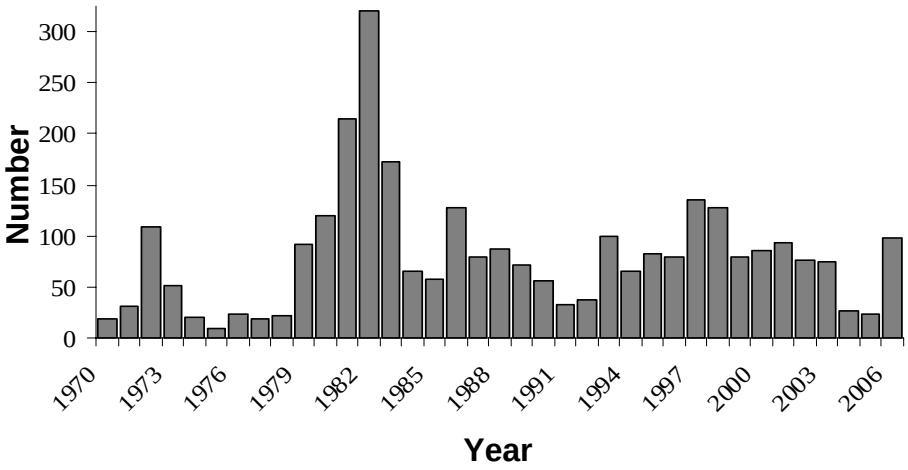
Although not recorded as a Tennessee rabies case, a rabid horse from Missouri resulted in a large public health effort following human exposures at a mass gathering. On September 7, 2006, the Tennessee Department of Health was notified of a horse that tested positive for rabies. The virus was eventually characterized as the subtype associated with the Big Brown Bat (*Eptesicus fuscus*). The horse had been stabled at the 2006 Tennessee Walking Horse National Celebration in Shelbyville, Tennessee. Although not competing in the Walking Horse show, the horse was ridden on the grounds and accessible to the public while exhibiting neurologic signs of rabies. According to reports from the Celebration organizers, approximately

Table. Animals Testing Positive for Rabies by Species, Tennessee, 1997-2006.

Species	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Skunk	135	127	79	88	98	76	74	27	23	98
Bat	8	5	10	15	11	27	15	11	16	19
Dog	3	6	5	3	2	2	3	1	1	2
Raccoon	0	0	0	0	0	1	4	8	4	3
Fox	1	1	1	0	0	1	2	1	3	4
Horse	2	1	0	0	0	0	4	0	1	0
Cattle	0	1	0	0	0	1	0	0	0	2
Cat	0	0	0	1	0	0	1	0	0	3
Goat	0	1	0	0	0	0	0	0	0	0
Opossum	0	0	0	0	0	0	0	1	0	0
Total	**149**	**142**	**95**	**107**	**111**	**108**	**103**	**49**	**48**	**131**

150,000 persons attended the event from multiple states and countries. Health department staff issued national and state health alerts and press releases, conducted media interviews, and mailed approximately 4,200 letters to ticket holders and exhibitors in 35 states, Canada and Germany. Fifty-three persons were identified who had potential exposure to the rabid horse. Four previously immunized persons were advised to receive a booster and five persons were advised receive rabies post-exposure prophylaxis. In addition, approximately 15 persons (owners and handlers of the rabid horse) were reportedly advised to receive rabies post-exposure prophylaxis following consultation by state and local public health officials in Missouri. The response identified at-risk persons and provided consultation regarding the need for post-exposure treatment. Additionally, the response appears to have effectively limited unnecessary evaluation and treatment.

Figure 1. Laboratory-confirmed Rabies in Skunks (*Mephitis mephitis*), Tennessee, 1970-2006.



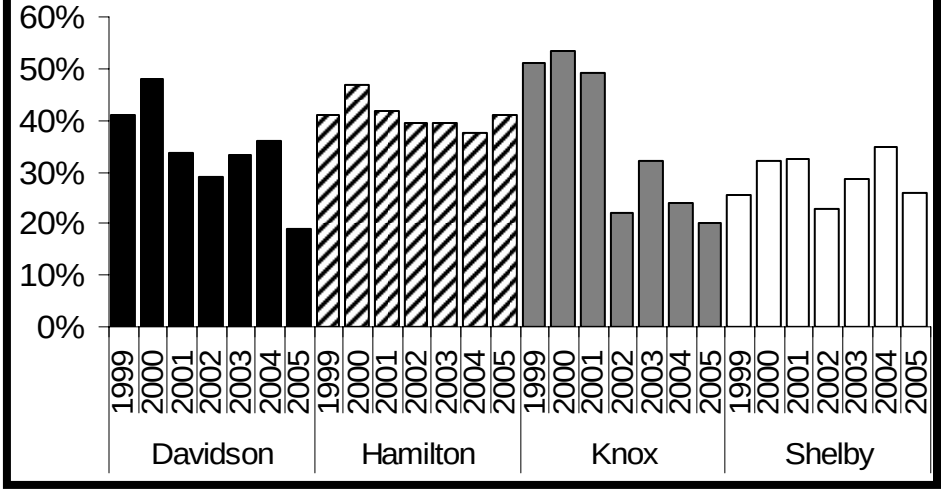
Tennessee remains committed to cooperating with the United States Department of Agriculture-Wildlife Services Rabies Program to prevent the spread of raccoon-variant rabies in east Tennessee. In 2006, twelve counties were included in the ORV campaign in northeast Tennessee: Greene, Grainger, Hamblen, Hancock, Hawkins, Sevier, Sullivan, Washington, Cocke, Jefferson, Unicoi, and Carter. Over 400,000 baits were dispersed over 2,700 square miles by ground and aerial crews. The ORV campaign in southeast Tennessee included Hamilton, Marion, Sequatchie, McMinn, Bradley, Bledsoe, Rhea, Meigs, Monroe, and Polk counties. Over 350, 000 baits were dispersed over 2, 000 square miles by ground and aerial crews. Containing or slowing the spread of raccoon-variant rabies westward into Tennessee will require continued support from USDA-WS and other partners.

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. In 2006 there were 837 cases (14 cases per 100,000 persons) reported in Tennessee.

Because of alarming rates of drug resistance in the late 1990's (**Figure 1**), the Tennessee Department of Health has formed appropriate antibiotic use coalitions in Davidson and Knox counties with the aim to reduce inappropriate

Figure 1. Proportion of Invasive Pneumococcal Isolates Not Susceptible to Penicillin in Major Metropolitan Areas, Tennessee, 1999-2005.



use of antibiotics and to reduce the spread of antibiotic-resistant bacteria that cause many upper respiratory illnesses Participants included physician groups, managed care organizations, hospitals, pharmaceutical companies, nurse practitioner groups, childcare centers, schools and others interested in preventing antibiotic resistance. Parents of young children and practitioners were educated about the importance of appropriate antibiotic use, and use of the pneumococcal conjugate vaccine (Prevnar®) in young children was encouraged.

D. Sexually Transmitted Diseases

Staff from the Metropolitan Nashville/Davidson County Health Department volunteered their time to offer free STD and HIV testing to county residents at a local area park in 2006.

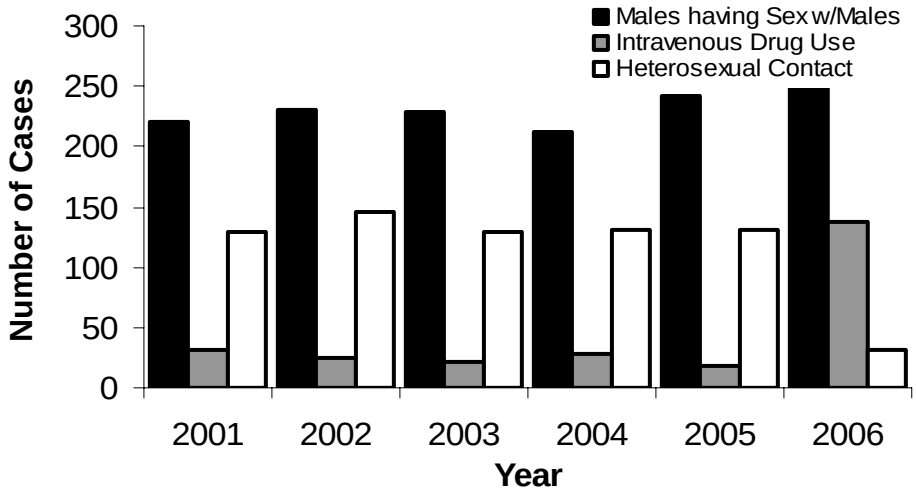
Source: Tennessee Department of Health

Human Immunodeficiency Virus (HIV)

Human Immunodeficiency Virus (HIV) has been a reportable disease in Tennessee since 1992. Through the year ending December 31, 2006, a total of 7,788 HIV cases were reported to the State of Tennessee Health Department HIV/AIDS/STD Section. The combined cumulative total of reported HIV/AIDS cases, including the 2006 data, was 20,262.

When considering the total number of HIV cases recorded since data have been collected in Tennessee, approximately 59% of all cases reported were among blacks and 74% were among men. As shown in the **figure**, the most common behavioral risk factor for contracting HIV infection was men having sex with men (MSM). Heterosexual sex with partners infected with HIV/AIDS was the second leading risk factor.

Figure. Major HIV Risk Factors, Tennessee, 2001-2006.



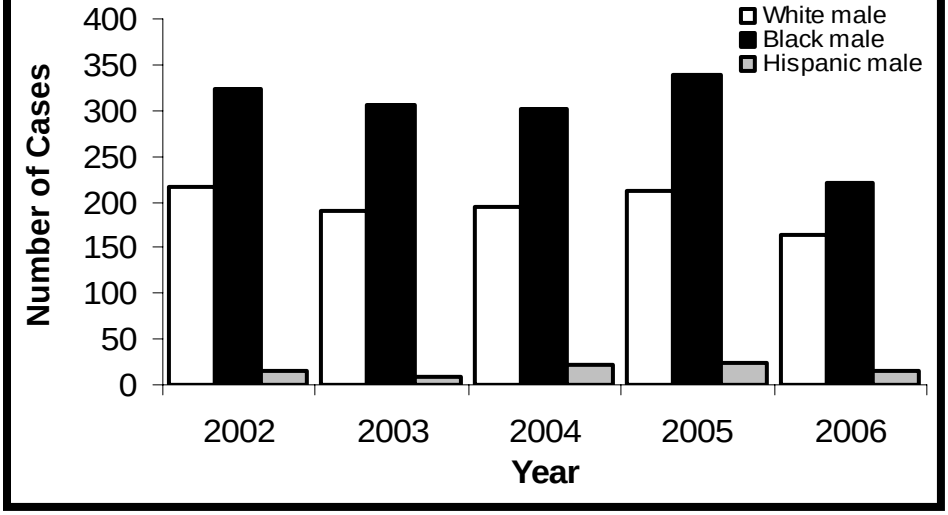
During 2006, all 95 counties in Tennessee reported cases of individuals living with HIV. Incidence of HIV for 2006 remained the highest in the Tennessee's urban centers with Memphis/Shelby County reporting the greatest rate of infection per 100,000 followed in rank order with lesser rates of infection by Nashville/Davidson County, Chattanooga/Hamilton County, Knoxville/Knox County, and Jackson/Madison County. In 2006, the statewide incidence rate of HIV was approximately 16.3 per 100,000 people.

Acquired Immunodeficiency Syndrome (AIDS)

The cumulative total number of AIDS cases reported since 1982, the year AIDS data were first collected, through 2006 were 12,474. For the past five years, the number of AIDS cases reported each year has remained relatively constant averaging approximately 700 cases per year. Highly active anti-retroviral therapy (HAART) and other advances in medical treatment have greatly improved the quality of life among persons living with AIDS.

When comparing the incidence of AIDS by race/ethnicity, the ratio of AIDS incidence remained constant at approximately 32% of reported cases among whites and 62% among blacks

Figure 1. Number of Male AIDS Cases, by Race, Tennessee, 2002-2006.



for data from 2002 through 2006. AIDS cases among the Hispanic population averaged two to four percent of reported cases over the same period of time. The rate of AIDS among males has been higher historically than the

rate of AIDS among females. **Figures 1 and 2** depict the changes in the number of cases among males by race and among females by race, respectively.

In 2006, 284 new AIDS cases were reported in Tennessee. As with HIV, the incidence of AIDS is highest in Tennessee's urban centers with Memphis/Shelby County reporting the greatest rate of infection per 100,000 followed in rank order with lesser rates of infection by Nashville/Davidson County, Chattanooga/Hamilton County, Knoxville/Knox County, and Jackson/Madison County. The statewide AIDS incidence rate was 10.0 per 100,000 persons in 2006.

Reported HIV/AIDS deaths totaled 251 persons in 2006. The annual death rate for the past five years, shown in **Figure 3**, included individuals diagnosed with HIV/AIDS who died from complications due to their illness or other causes including suicide, motor vehicle crashes, and so on. From the time reporting began until 12/31/06, the total number of deaths among those with HIV/AIDS was 6,709.

Figure 2. Number of Female AIDS Cases, by Race, Tennessee 2002-2006.

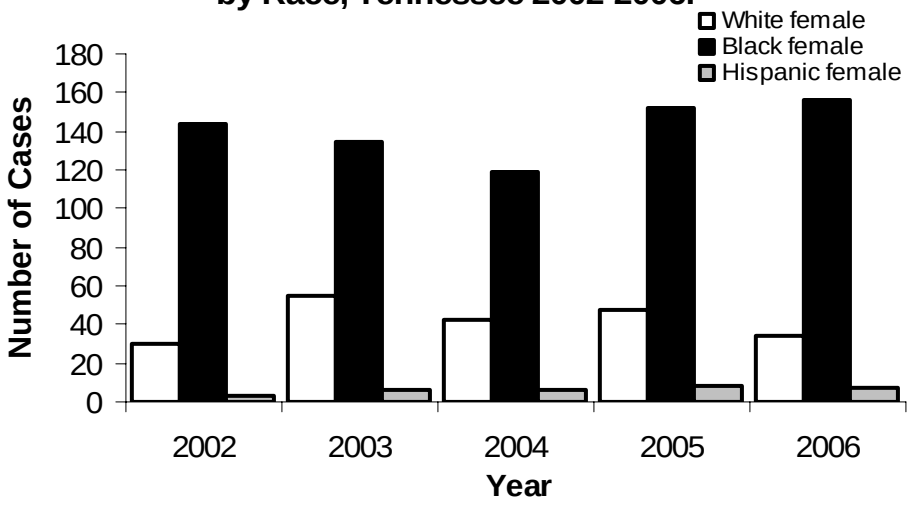
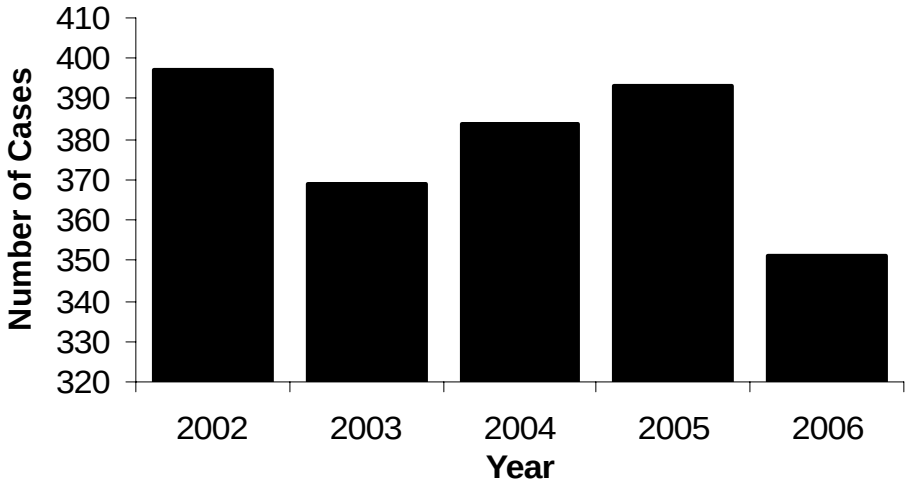


Figure 3. Number of AIDS Deaths, Tennessee, 2002-2006.



Pediatric HIV/AIDS Due to Perinatal Risk

Since 1992, 1,316 infants were reported as perinatally exposed to HIV. As of 12/31/06, 128 infants received a confirmatory diagnosis of pediatric HIV, and 78 infants were diagnosed with pediatric AIDS. A total of 769 infants born to HIV/AIDS infected mothers were tested as children and subsequently found to be uninfected by the virus following the evaluation period. Data were not adjusted to account for infants who may have been perinatally exposed, but were not reported.

Improved medical interventions, including administration of antiretroviral agents during pregnancy and shortly after birth as well as special procedures during delivery, have reduced the likelihood that HIV/AIDS positive mothers will transmit the disease to their infants.

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 infer-

tility, 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. The number of reported *Chlamydia* cases rose steadily from 1,880 cases in 1988 to 6,787 cases in 1994. 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 2006 increased to 25,320.

Figure 1. Incidence of *Chlamydia trachomatis*, by Gender and Race, Tennessee, 2006.

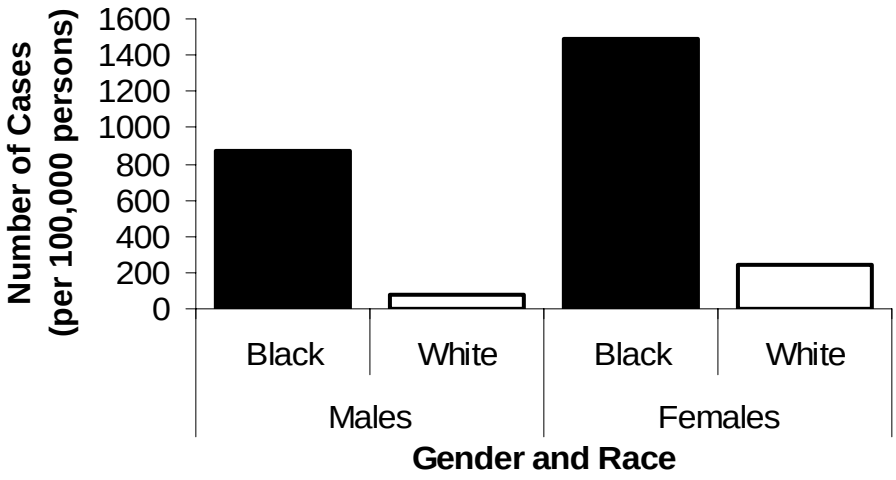
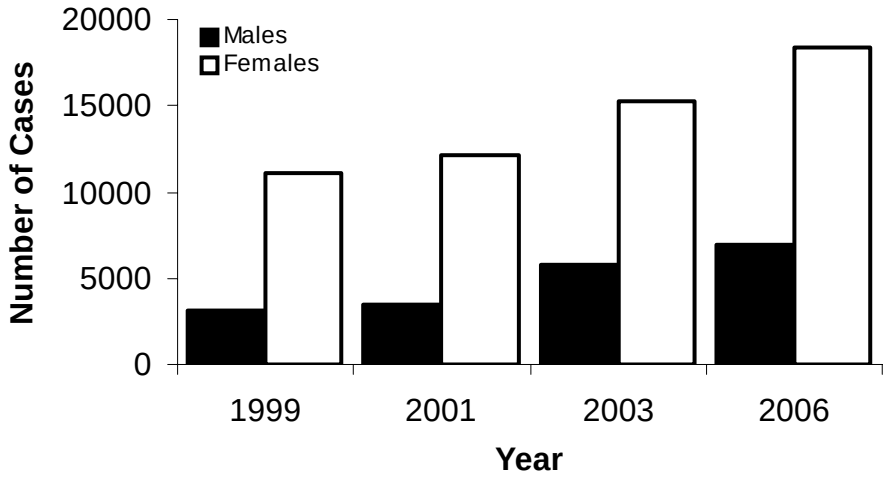


Figure 2. Number of Cases of *Chlamydia trachomatis*, by Gender, Tennessee, 1999-2006.



In 2006, 87% of *Chlamydia* morbidity occurred among patients aged 15-19 years (9,125) and 20-29 years (12,882). Females comprised 72% of all reported cases (**Figure 1**); this reflects the fact that most *Chlamydia* tests are performed on women visiting family planning, maternity and STD clinics. Additionally, 44% percent of female morbidity was reported among blacks and 33% among whites, while 21% had no race category identified. There were 869 cases per 100,000 population among black males and 81 cases per 100,000 population among white males with *Chlamydia* in 2006. There were also 1,490 cases per 100,000 population among black females and 242 cases per 100,000 population among white females with *Chlamydia* (**Figure 2**). Black females aged 20-29 years have the highest rate of infection with 4,609 cases per 100,000 persons. Moreover, screenings of just over 104,611 patients for *Chlamydia* in health department STD, prenatal and family planning clinics, in 2006, resulted in a range of 6% to 16% 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 10% in 2006. The increase can be attributed to more sensitive laboratory testing methods implemented in February 2003.

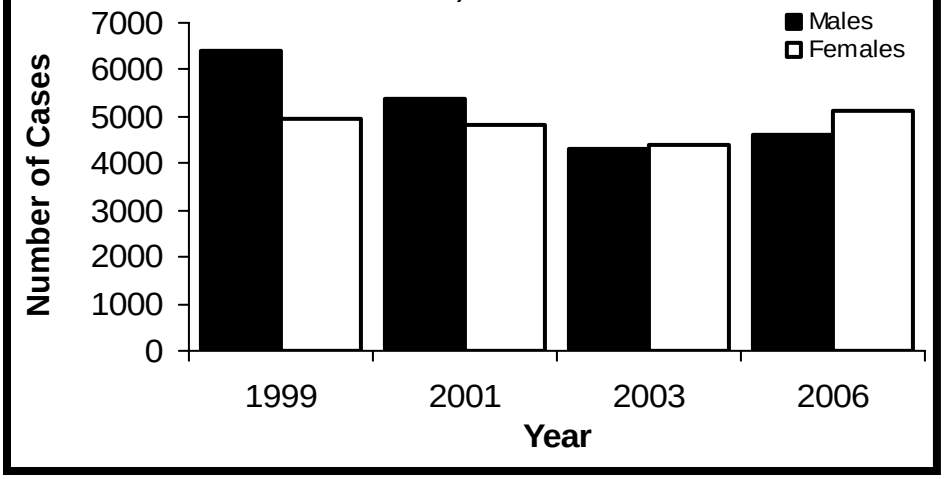
**Positivity rates were calculated by dividing the number of positive tests for each region by the total number of tests.*

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),

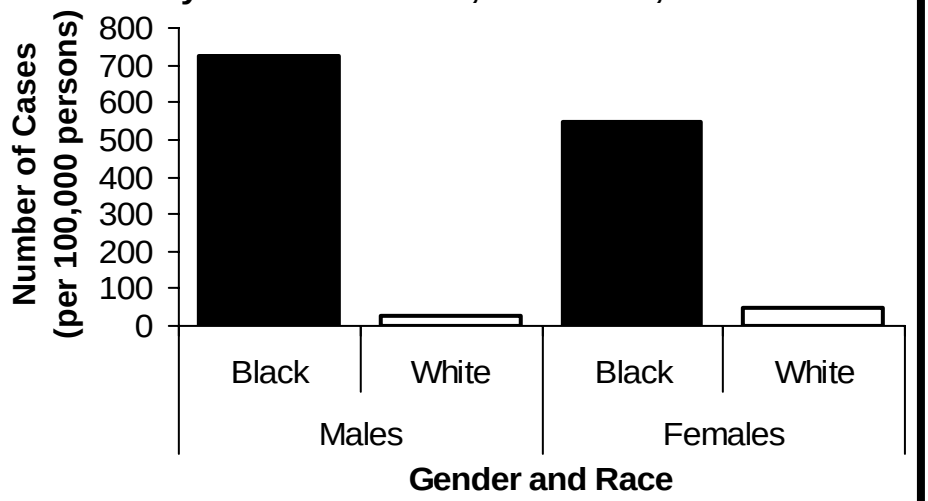
uterus (womb) and fallopian tubes (egg canals) in women, and in the urethra (urine canal) in both men and women. The bacterium can also grow in the mouth, throat, eyes and anus. CDC estimates that more than 700,000 persons in the U.S. get new gonorrheal infections each year, of which only about half 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.

Figure 1. Number of Cases of *Neisseria gonorrhoeae* , by Gender, Tennessee, 1999-2006.



Following a record high of 35,362 *Gonorrhea* cases reported in 1976 (rate=817 cases per 100,000 persons), the number decreased by 73% to 9,694 cases in 2006 (rate=161 cases per 100,000 persons). In 2006, there were 4,590 reported cases of *Gonorrhea* among males and 5,104 reported cases among females (**Figure 1**). The metropolitan regions of the state have consistently accounted for 76% of the state's morbidity during this time period. In 2006, 66% of all reported cases of *Gonorrhea* in Tennessee were among blacks. Additionally, there were 725 cases per 100,000 population among black males and 26 cases per 100,000 population among white males with *Gonorrhea* in 2006. There were also 549 cases per 100,000 population among black females and 50 cases per 100,000 population among white females with *Gonorrhea* (**Figure 2**). This is in contrast to the first half of the 1990s, when cases decreased dramatically; the decrease in reported cases has been less striking in the past few years. In The overall rate of 161 per 100,000 persons was well above the *Healthy People 2010* national goal of 19.

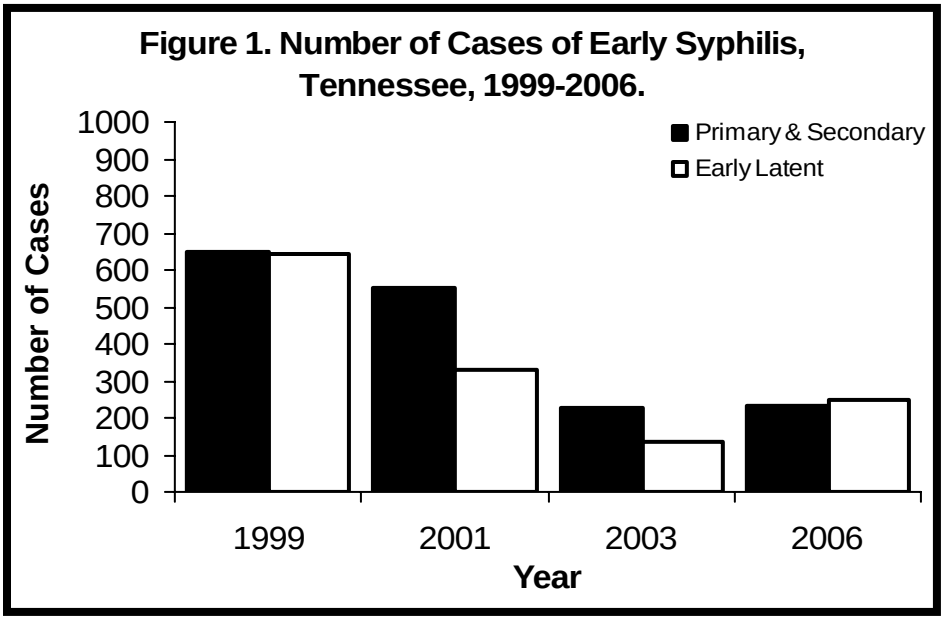
Figure 2. Incidence of *Neisseria gonorrhoeae* , by Gender and Race, Tennessee, 2006.

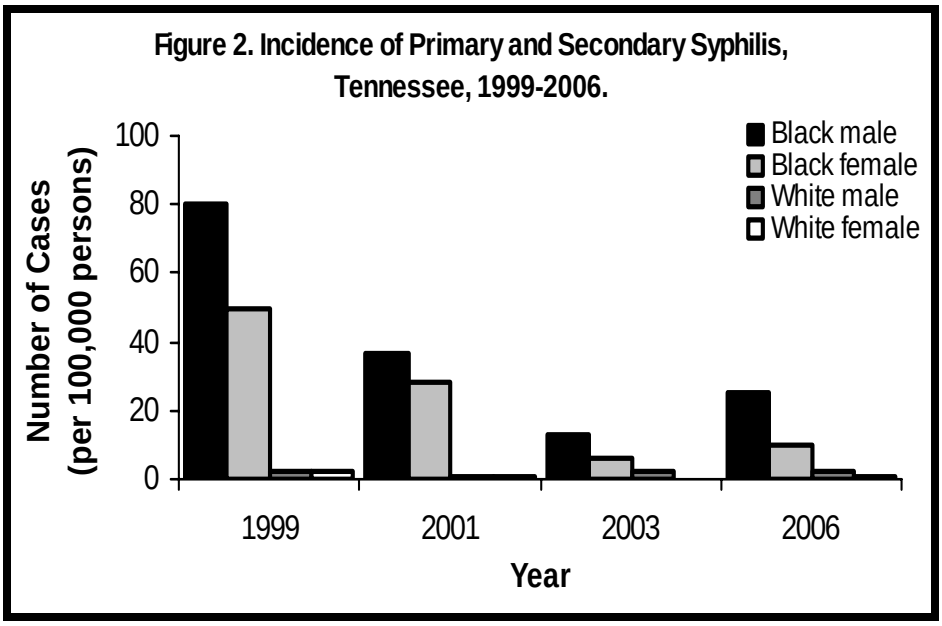


In 2006, women aged 15-19 had higher rates of *Gonorrhea* (946 cases per 100,000 persons) than women aged 20-29 (614 cases per 100,000 persons). The rate of *Gonorrhea* in men aged 20-29 was 565 cases per 100,000 persons in 2006. Additionally, screening approximately 104,611 patients for *Gonorrhea* in health department STD, prenatal and family planning clinics in 2005 detected a range of 4-10% positivity rates in metropolitan areas and 1-3% 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 can transfer the disease to their unborn children. Many people infected with syphilis do not have any symptoms for years, yet remain at risk for serious complications if they are not treated. Although transmission occurs from persons with sores who are in the primary or secondary stage, many of these symptoms 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 40% of the state's population; however, they account for 87% of 482 cases of early syphilis (primary, secondary and early latent) cases in 2006 (**Figure 1**). 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 2006, two metropolitan areas, Shelby County and Davidson County, reported 567 and 166 cases, respectively, or 72% of the state's total syphilis cases. The seven remaining rural regions comprise 60% of the state's population but accounted for only 13% of the early syphilis cases in 2006.

Early syphilis cases are higher among males than females. In addition, early syphilis rates among both black males and females are disproportionately high. Blacks make up 17% of the state's population, but historically represent about 74% of reported early syphilis cases. In 2006, the rate for early syphilis within Tennessee was 8 cases per 100,000 persons; the rate for blacks was 35. When looking at primary and secondary syphilis, the rate among white males was 2 cases per 100,000 population, and the rate among white females was 1 case per 100,000 population. Furthermore, the rate was 25 cases per 100,000 population among black males and 10 cases per 100,000 population among black females (**Figure 2**). In 2000, the

overall syphilis rate was 30 cases per 100,000 persons. However, in 2006, the overall syphilis rate was 17 cases per 100,000 persons. This represents a 43.3% decrease during this time frame. Among blacks, the overall syphilis rate was 152 cases per 100,000 persons in 2000, and 71 cases per 100,000 persons in 2006. This represents a 53% decrease for blacks during this time. In 2000, blacks aged 20-29 years and 30-39 years had rates of 285 and 312 cases per 100,000 persons, respectively. By 2006, the rate for the age group of 20-29 years had fallen to 109 cases per 100,000 persons, representing a 33% decrease. Additionally, the rate for the age group of 30-39 years had fallen to 140 cases per 100,000 persons, representing a 55% decrease in 2006.

Syphilis has disproportionally affected Tennessee residents for numerous years. In 2001, the state had two major cities with populations greater than 200,000 (Memphis and Nashville) among the top ten cities in the nation with syphilis. Furthermore, in 2004, Memphis had the 11th highest rate per 100,000 population of cities with primary and secondary syphilis. In 2005, the rate of syphilis in Memphis among males was 101 cases per 100,000 population and for females, the rate was 69 cases per 100,000 population.

In 2006, 249 cases were diagnosed with primary or secondary syphilis, 233 with early latent (less than one year) syphilis, 434 were late or latent cases and 7 were congenital cases. Statewide, the 249 primary and secondary cases combined represent a rate of 4.1 cases per 100,000 persons. Even with recent declines in syphilis morbidity, this is considerably greater than 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

Public health personnel administer influenza vaccine during their yearly vaccination campaign in Putnam County. Community members received influenza vaccine in standard and drive-through clinics which have been modeled after those in mass vaccination plans.

Source: Tennessee Department of Health

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 each of the following 10 vaccine preventable diseases: diphtheria, tetanus, pertussis, polio, measles, mumps, rubella, *Haemophilus influenza* type b, hepatitis B and varicella. In recent years, the incidence of these diseases 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, a disease to which neither vaccine nor natural disease results in lifelong immunity, the occurrence of these diseases is very low. **Table 1** below depicts the number of cases reported from 2003 to 2006.

As these diseases have become increasingly uncommon, progress in the 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 kindergarten and children enrolled in day care centers with more than 12 children that are licensed by the Department of Human Services (**Table 2**). School and daycare surveys are conducted to determine compliance with state school and daycare immunization requirements.

The survey of 24-month-old children is the most valuable because it assesses on-time immunization; a marker of optimal protective benefit from vaccination. 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 characterizing a target population on which to focus to further improve immunization levels.

For the purposes of the survey of 24-month-old children, complete immunization is defined as having received four doses of diphtheria-tetanus-pertussis (DTaP) vaccine, three doses of polio vaccine, one dose of measles-mumps-rubella (MMR) vaccine, three doses of Haemophilus *influenza* type b (Hib) vaccine, three doses of hepatitis B vaccine (HBV) and one dose of varicella vaccine (VZV). Together, these are known as the "4:3:1:3:3:1" immunization series. 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 historical comparability, those data are shown in some figures, but the more comprehensive measure is more meaningful for estimating the percent of children receiving all recommended vaccines by 24 months of age. A graph comparing survey results

Table 1. Vaccine-Preventable Disease Morbidity, Tennessee, 2002-2006.

Disease	Pertussis	Diphtheria	Tetanus	Polio	Measles	Mumps	Rubella	Hepatitis B	*H. influenza* type b <5 yo
2002	119	0	1	0	0	2	1	128	5
2003	82	0	0	0	0	5	0	213	8
2004	179	0	2	0	0	4	0	221	0
2005	213	0	0	0	1	3	0	153	4
2006	179	0	1	0	1	11	0	173	0

Table 2. Immunization Survey Results, Tennessee, 2006.

Survey	Immunization Level
24-Month-Old Children*	82.40%
Day Care Center Enrollees**	92.80%
Public Kindergarten Survey**	97.10%
Private Kindergarten Survey**	97.99%

* "4:3:1:3:3:1" series complete

** Compliance with State Immunization Requirements

Figure 1. 2006 Tennessee Immunization Survey of 24-Month-Old Children: Percent with Age-Appropriate Immunization Levels by Vaccine.

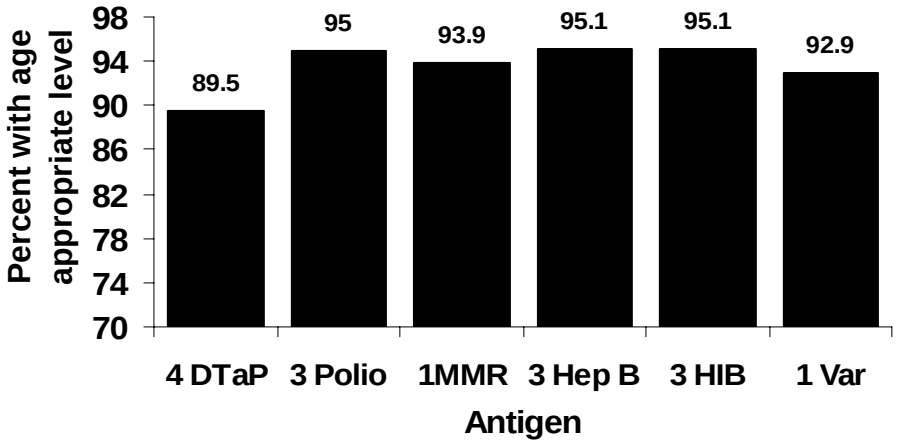


Figure 2. 2006 Tennessee Immunization Survey of 24-Month-Old Children: "4:3:1" and "4:3:1:3:3:1" Percent Immunized on Time: 2000 to 2006.

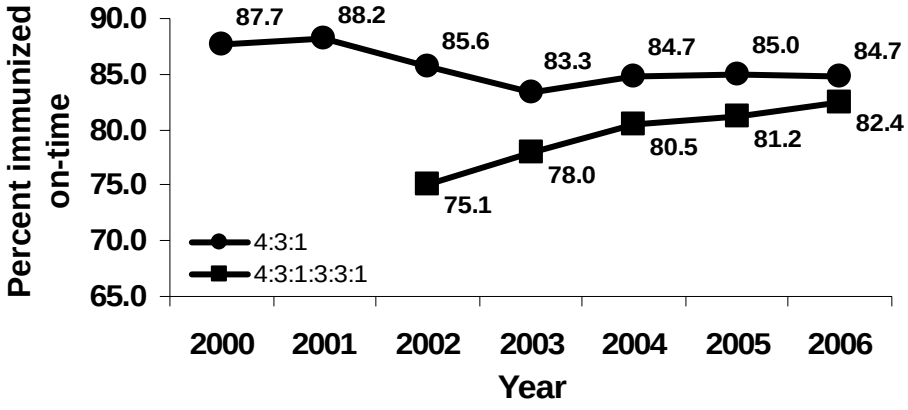
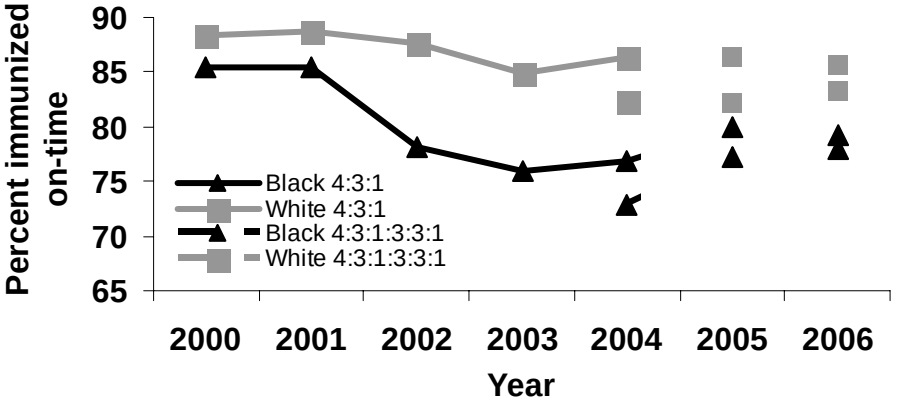


Figure 3. 2006 Tennessee Immunization Survey of 24-Month-Old Children: Trends in On-time Immunization Coverage Disparities (Black vs. White): 2000-2006.



since 2000 and more detailed results of the 2006 surveys are presented below (**Figures 1-3**).

Findings from the 2006 Survey

The 2006 survey identifies 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. African-American children.

The key findings of the 2006 survey include:

a. The 4:3:1:3:3:1 on-time level has increased 1.2 percentage points from 2005 to 82.4%.

b. Assessed individually, vaccination against all antigens are in excess of 90% on-time coverage, except DTaP 4, at 89.5%.

c. Immunization levels for 4:3:1:3:3:1 are higher for those in private practice as a group than public health departments; one contributing factor may be that a higher percentage of patients seen in public health clinics have at least one risk factor for delayed immunization: 40.9% compared to 24.7% in private practices.

d. The point estimate of series complete levels for TennCare enrollees compared with non-TennCare enrollees, was 2.1 percentage points lower.

e. Although historically a protective factor, on-time immunization rates of WIC-enrolled children were

12.1 percentage points lower than those not enrolled.

f. The disparity in on-time immunization of black and white children, which had become pronounced in 2002 and had grown to 9.6 percentage points in the 2004 survey, diminished sharply in 2005 and was measured at 5.4 percentage points, which is comparable to pre-2002 gaps.

g. The proportion of children receiving all immunizations in private practice clinics remains high at 67.3%, with only 10.8% of children in the survey vaccinated entirely at public health clinics.

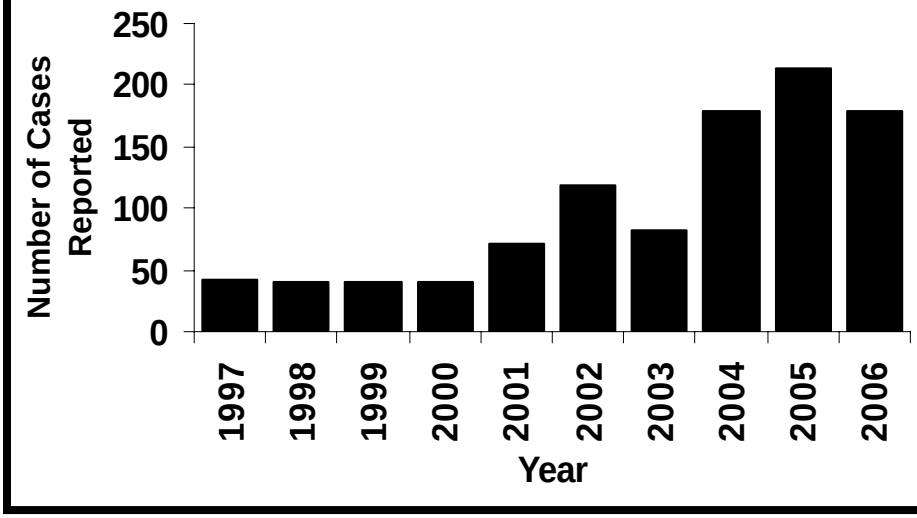
The current Childhood and Adolescent Immunization Schedule is presented at the end of this section. It can be accessed at www.cdc.gov/nip. This is the website of Center for Disease Control and Prevention's National Immunization Program; it contains valuable information for both clinicians and the lay public about vaccines and vaccine-preventable diseases.

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 are at greatest risk from complications or death from pertussis, but the disease causes significant illness in adolescents and adults, who account for more than half of all reported cases and are often the source of illness in infants. 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 1997 to 2006 in Tennessee.

Figure. Number of Cases of Pertussis Reported in Tennessee, 1997-2006.



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. There are an estimated 800,000-3 million cases of *B. pertussis* infection each year in the United States; most cases among adults and older children are not recognized as pertussis and can be transmitted to susceptible infants.

Childhood immunization against pertussis has reduced the disease burden in that population; the introduction of a vaccine to protect older children and adults aged 11-64 in 2005 (Tetanus, diphtheria, pertussis, or "Tdap") will boost waning immunity following childhood immunization and has the potential to shrink the reservoir of *B. pertussis* disease among adolescents and adults. The vaccine is recommended to replace the next tetanus-diphtheria booster for all children and adolescents aged 11-64 years.

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.

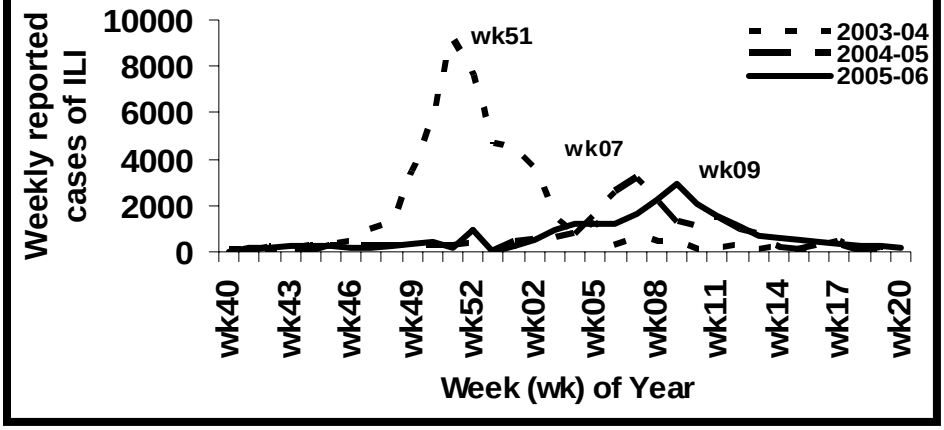
Complications of tetanus include the following: laryngospasms; fractures of the long bones; hyperactivity of the autonomic nervous system; secondary infections, such as sepsis, pneumonia, decubitus ulcers (due to long hospitalizations, in-dwelling catheters, etc.) and aspiration pneumonias. The fatality 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.

In Tennessee, tetanus is a rare disease; a total of 4 tetanus cases have been reported since 2002. The current general recommendation for prophylaxis of tetanus is a primary series of 3 doses of a tetanus-containing vaccine and a booster dose every 10 years.

Influenza

Influenza virus causes seasonal epidemics of disease annually between October and May. The infection causes an illness characterized by acute onset of fever, muscle aches, sore throat, cough and fatigue. Illness lasts about 5-7 days. It is most often transmitted through respiratory droplets or by self-inoculation after touching surfaces contaminated by infected respiratory secretions, then touching one's eyes, nose or mouth. Influenza and its complications result in the deaths of an average of 36,000 Americans each year, 90% of them aged 65 years and older.

Figure. Total number of cases of influenza-like illness (ILI) reported weekly in Tennessee October to May (weeks 40-20) during the 2003-4, 2004-5 and 2005-6 influenza seasons.



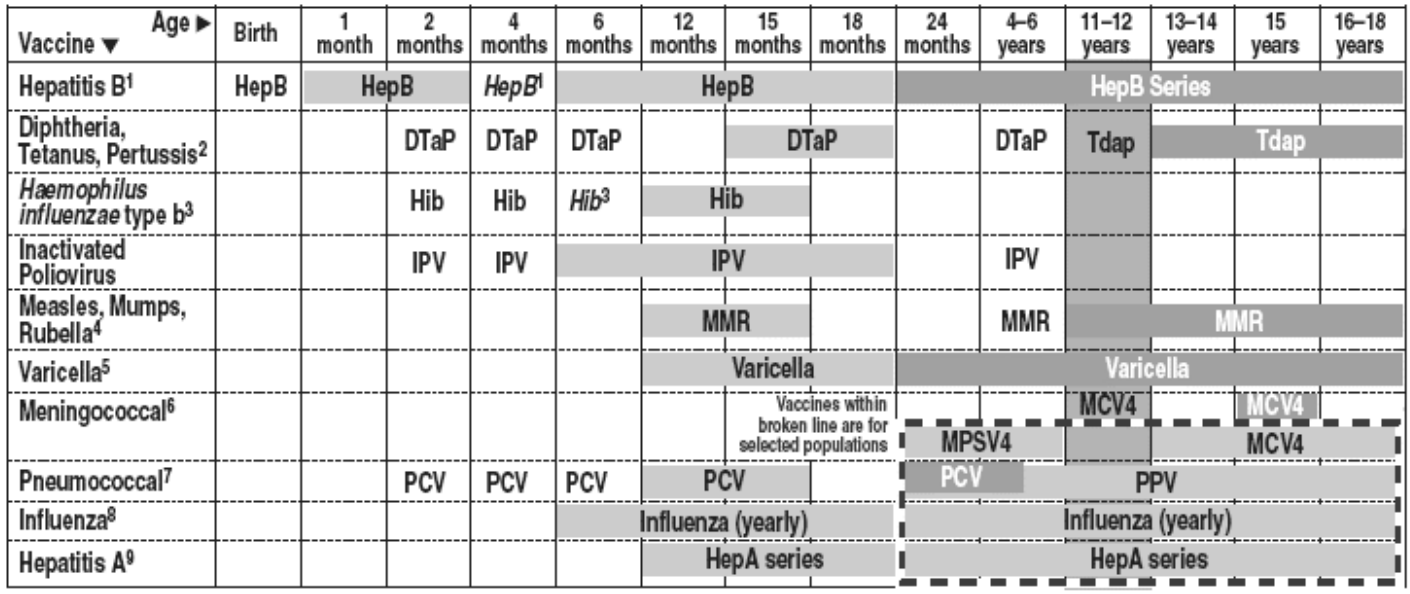
Periodically, new strains of influenza emerge to which humans have little or no immunity. These strains may emerge directly from an animal strain (e.g., an avian influenza) or may result from the mixing of genetic material from human and animal strains. Such strains are capable of causing a worldwide epidemic, known as a pandemic and cause illness in 20-40% of the world's population. Influenza pandemics also typically result in a greater proportion of deaths occurring among persons younger than 65 years.

There are several systems used to track influenza virus activity in Tennessee and nationally. The Sentinel Provider Network (SPN) consists of healthcare providers who report the proportion of patients seen each week with influenza-like-illness ("ILI," defined as fever with cough or sore throat). SPN participants also submit specimens for culture at the State Public Health Laboratory from ILI patients in order to permit further characterization of circulating influenza strains. Although non-specific, the number of persons with ILI rises dramatically when influenza virus is circulating in the community. The number of cases of ILI in health departments and clinics are reported to the state health department weekly. The **figure** shows the

number of cases reported weekly from October through May (weeks 40-20) during the 4 influenza seasons from the fall of 2002 through spring 2006. The variation in the timing and height of the peak week of influenza activity is typical; on average, influenza peaks in Tennessee in late January or early February.

Annual vaccination each fall is the best way to prevent seasonal influenza. Vaccination is most important for persons at higher risk of hospitalization or death from illness and the people who care for them; these groups include the elderly, small children, pregnant women, persons with chronic illnesses, their healthcare providers and their families.

FIGURE. Recommended childhood and adolescent immunization schedule, by vaccine and age — United States, 2006



This schedule indicates the recommended ages for routine administration of currently licensed childhood vaccines, as of December 1, 2005, for children through age 18 years. Any dose not administered at the recommended age should be administered at any subsequent visit, when indicated and feasible. Indicates age groups that warrant special effort to administer those vaccines not previously administered. Additional vaccines might be licensed and recommended during the year. Licensed combination vaccines may be used whenever any components of the combination are indicated and other components of the vaccine are not contraindicated and if approved by the Food and Drug Administration for that dose of the series. Providers should consult respective Advisory Committee on Immunization Practices (ACIP) statements for detailed recommendations. Clinically significant adverse events that follow vaccination should be reported through the Vaccine Adverse Event Reporting System (VAERS). Guidance about how to obtain and complete a VAERS form is available at http://www.vaers.hhs.gov or by telephone, 800-822-7967.

Range of recommended ages Catch-up immunization Assessment at age 11–12 years

F. Vectorborne Diseases

As part of her senior research thesis, Erin Moody, a pre-medical student at Union University in Jackson, is sampling mosquitoes using CDC light traps in an investigation by the Vector-Borne Diseases Branch of an outbreak of eastern equine encephalitis.

Source: Tennessee Department of Health

Arboviral Diseases

La Crosse Encephalitis (LAC)

La Crosse encephalitis virus is the most medically significant of all the California sero-group viruses reported in the US. 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 an increase in case incidence has been detected in the Mid-Atlantic States in recent years. **Figure 1** depicts the states that reported cases with case counts during 2005. Five of the eight bordering states reported La Crosse encephalitis cases in 2005. La Crosse encephalitis is the leading cause of pediatric arboviral encephalitis and considered an emerging disease in Tennessee.

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, this increase in cases is likely due to improved WNV human case surveillance in the United States (MMWR 2003, 51:53). In Tennessee, from 1998-2003, a median of 14 cases (average: 13; range: 6-19) were reported per year (**Table 1**). Incidence rates have ranged from 0.03-0.06 per 100,000 population in the United States (1998-2002) and 0.03-0.33 per 100,000 population in Tennessee (1998-2005). Since it has been reportable, the mildest years for the disease have been in 1999 and in 2005 nationwide as well as statewide. Since the disease is endemic in the eastern half of the United States, the incidence rates for the TN population will be higher than the incidence rates of the US population (**Table 1**). The incidence rates in TN have remained relatively consistent since 1998 indicating that the disease in endemic in the state. The incidence of only 2 cases in 2005 may have been due to lower abundance of vectors during that summer in Tennessee compared to other years. In Tennessee, the disease primarily occurs from late May through October with peak transmission in August (**Figure 2**). In 2006, Tennessee reported 7 cases, indicating that

Figure 1. Human California Serogroup Viral Encephalitis Cases, by State, 1964-2005.

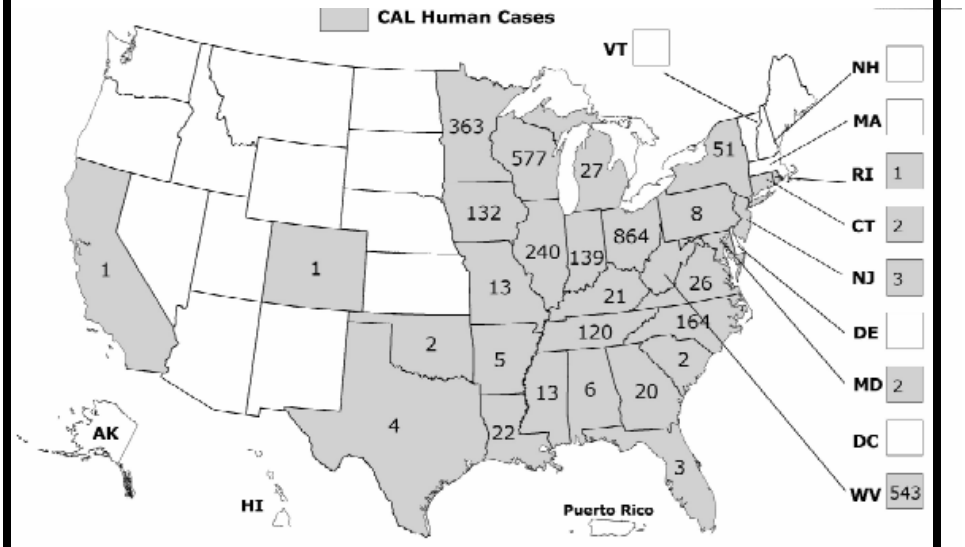


Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of La Crosse Encephalitis, by Year, Tennessee and the United States, 1997-2006.

	1997		1998		1999		2000		2001		2002		2003		2004		2005		2006	
	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR
TN	8	0.15	9	0.17	6	0.11	19	0.33	17	0.30	15	0.26	14	0.24	13	0.22	2	0.03	6	0.10
US	129	#	97	0.04	70	0.03	114	0.04	128	0.05	164	0.06	NA	NA	112	0.04	73	0.02	67	0.02

IR=Incidence Rate NA= Notifiable Diseases is not compiled # Not nationally notifiable

LAC virus continues to be an important vector-borne disease in eastern Tennessee.

Traditionally, *Ochlerotatus triseriatus* (eastern treehole mosquito) is the primary vector of LAC but in recent years *Aedes albopictus* (Asian tiger mosquito) have been associated with LAC encephalitis cases in eastern Tennessee. The dramatic increase in LAC cases in TN since 1996 has coincided with the arrival of *Ae. albopictus* in the eastern TN 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 cases) and Robertson (1 case) counties which adds to the increasing evidence that the virus is moving westward across the state due to the increasing presence of *Aedes albopictus* mosquito. In 2004, a case in Cocke county also emerged, suggesting that transmission TN is possible near the northeast region of the state as well. In 2006, the northeast region was directly affected with one case in Greene County.

La Crosse virus can result in mild to severe infections with fatalities rare (CFR <1%) and the ratio of inapparent infection to apparent infections ranges from 26:1 to over 1500:1. The majority of cases (93%) occur in children <15 years of age although adult cases are not uncommon. In fact, Tennessee reported a patient >65 years of age as a confirmed La Crosse encephalitis case in 2003. Although deaths are rarely associated with this disease, Tennessee reported a death of a child in the 1-4 year old age group in 2006 (**Table 2**). In 2004 and 2005, there were no deaths due to La Crosse encephalitis. Although most cases occurred in white children, there was one African American child who was affected in 2005. Among white children, 21% were of Latin ethnicity in cases occurring during 2004-2005.

The primary risk factors for the disease are children <16 years old that are active outdoors, reside in woodland habitats with numerous natural (tree holes) and artificial (tires, gutters etc.) containers present capable of supporting a resident *Oc. triseriatus* and *Ae. albopictus* population. Traditionally, the rural poor were the most affected sector of the population although increasingly suburban families are 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

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

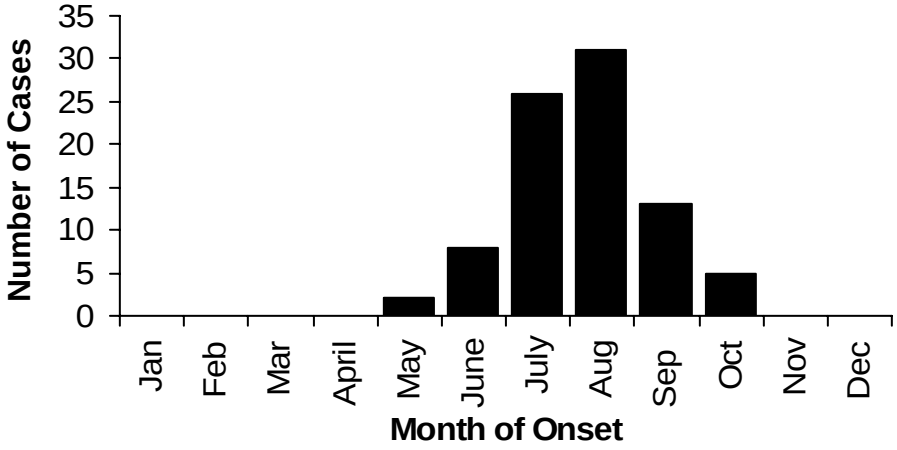


Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of La Crosse Encephalitis, by Age Group, Tennessee and the United States.

	<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 (2005)	0	0.00	0	0.00	2	0.25	0	0.00	0	0.00	0	0.00	0	0.00
TN (2006)	0	0.00	1	0.12	6	0.74	0	0.00	0	0.00	0	0.00	0	0.00
US (2005)	0	-	16	-	44	-	4	-	1	-	2	-	6	-

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 the breeding site as adults, reducing stagnant water sources around the home is critical to reduce disease risk. Since the primary mosquito vectors develop in containers as small as tin cans and are active during the day, use of adulticides by organized community mosquito control is not effective. Organized community mosquito control programs should focus on public education and homeowner/community source reduction.

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

Additional reading:

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Erwin PC, Jones TF, Gerhardt RR, Halford SK, Smith AB, Patterson LE, Gottfried KL, Burkhalter KL, Nasci RS, Schaffner W. La Crosse Encephalitis in eastern Tennessee: Clinical, environmental, and entomological characteristics from a blinded cohort study. Am J Epi 2002;155:1060-1065.

Gottfried KL, Gerhardt RR, Nasci RS, Crabtree MB, Karabatsos N, Burkhalter KL, Davis BS, Panella NA, Paulson DJ. Temporal abundance, parity, survival rates, and arbovirus isolation of field-collected container inhabiting mosquitoes in eastern Tennessee. J Am Mos Cont Assoc 2002;18:164-172.

Malaria

Malaria is a mosquito-borne disease caused by a parasite. People with malaria often experience fever, chills, and flu-like illness. Left untreated, they may develop severe complications and die. Each year 350-500 million cases of malaria occur worldwide, and over one million people die, most of them young children in sub-Saharan Africa.

Since 1995, there have been 134 cases of malaria reported in Tennessee. None of these cases are thought to have been acquired locally but rather have been imported cases, i.e. U.S. natives traveling to malaria endemic regions or non-natives coming from these regions to the U.S. Although 27 counties have reported cases, most of these have been from Davidson (31%) and Shelby (16%) counties which have large non-native and native populations that are more likely to travel abroad. Tennessee averages about 12 cases of malaria per year (**Table 1**), which is comparable to other vector-borne diseases in the state such as La Crosse and West Nile encephalitis. All age groups report malaria in Tennessee (**Table 2**). In the U.S. there have been 13,594 cases of malaria from 1995-2004, almost 1% of these from Tennessee. Of the approximately 1300 cases of malaria per year diagnosed in the U.S., about 73% are from U.S. nationals and 27% are foreign-born. Almost 70% of all U.S. reported malaria cases have a travel history to continental Africa. Occasionally small outbreaks of malaria continue to occur in the U.S. due to the

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of Malaria, by Year, Tennessee and the United States, 1997-2006.

Year		TN	US	Year		TN	US
1997	No.	11	1544	2002	No.	15	1337
	IR	0.15	0.58		IR	0.26	0.46
1998	No.	16	1227	2003	No.	4	1278
	IR	0.17	0.45		IR	0.24	0.44
1999	No.	9	1540	2004	No.	13	1324
	IR	0.11	0.56		IR	0.22	0.45
2000	No.	13	1402	2005	No.	14	NA
	IR	0.33	0.50		IR	0.23	NA
2001	No.	14	1383	2006	No.	9	NA
	IR	0.30	0.49		IR	0.15	NA

NA= Notifiable Diseases is not compiled IR= Incidence Rate

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of Malaria, by Age Group, Tennessee, 2006.

<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
0	0.00	0	0.00	0	0.00	1	0.12	3	0.24	5	0.25	0	0.00

presence of *Anopheles* mosquitoes in the U.S. that may come in contact with travelers returning or arriving to the U.S. from a malaria endemic region. This has been referred to as "airport" malaria. Even though malaria has been eradicated from the U.S., it continues to be a public health concern due the potential of re-introduction. Even without established transmission zones of malaria, we still see large numbers of cases annually. Travelers should take the appropriate precautions when traveling to areas with malaria.

The CDC recommends the following:

- Visit your health care provider 4-6 weeks before foreign travel for any necessary vaccinations, as well as a prescription for an antimalarial drug, if needed. (There are no vaccines against malaria).
- Take your antimalarial drug exactly on schedule without missing doses.
- Wear insect repellent to prevent mosquito and other insect bites. Your insect repellent should contain DEET as its active ingredient. To prevent malaria, wear insect repellent if out of doors between dusk and dawn when the mosquito that transmits malaria is biting.
- Wear long pants and long-sleeved clothing.
- Sleep under a mosquito bed net (preferably one that has been treated with insecticide) if you are not living in screened or air-conditioned housing.

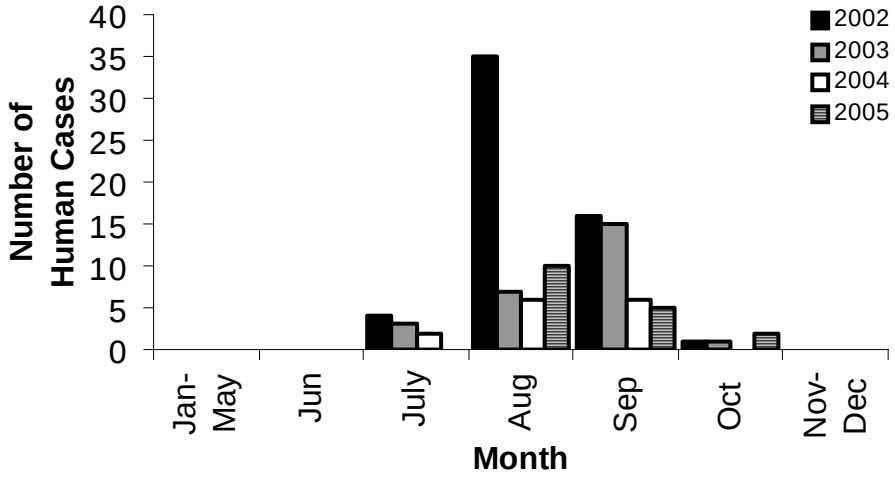
West Nile Fever/Encephalitis

The natural transmission cycle of West Nile virus (WNV) involves birds and bird feeding mosquitoes. When the viral load builds in the bird population, as the summer progresses there is an increased risk that bird/mammalian (opportunistic mosquitoes) feeding mosquitoes will come in contact with the virus and transmit the virus 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.

Tennessee reported 14 human cases in 2004, 18 cases in 2005 and 22 cases in 2006. These cases were found in 3 counties in 2004 and 4 counties in 2005 throughout the state but mainly focused in Shelby county with 12/14 cases in 2004 and 13/18 cases in 2005. In 2004 there were 17 horse cases that were scattered throughout the state. Only 7 horse cases were re-

ported in 2005. This difference is most likely due to increase in awareness of the need for vaccinating horses rather than a reduction of risk in 2005 since human cases went up slightly in 2005. The epidemic curve for human cases occurs from late July through early October with peaks in August and September which coincides with the primary mosquito vector activity (**Figure 1**). In 2005, human cases occurred later and ended later than in 2004. In 2006, there were 8 horse cases.

Figure 1. Distribution of West Nile Human Cases, by month, Tennessee, 2002-2005.



The incidence rate of West Nile virus in TN (0.97/100,000 population) and the US (1.06/100,000 population) were comparable (**Table 1**) during 2002, the largest outbreak year in TN. Since 2002, infection rates in TN have been going down and have always been lower than the national average infection rate. The infection rate in 2005 (0.30/100,000) was slightly higher than in 2004 (0.24/100,000). (**Table 2**). From 2003 to 2005, the rate of disease in various age groups has followed a consistent pattern of progressively increasing such that the highest rates are always seen in people 65 years of age and older. In 2004, 13/14 cases had neuroinvasive meningoencephalitis compared to 1/14 with uncomplicated fever. In 2005, 15/18 cases had meningoencephalitis and 3/18 had WN fever. About 50% percent of the cases in 2004-6 were in people over the age of 65. Over 80% of cases were in people over 40. In cases from 2004-6, over 30% of cases occurred in Africa Americans and the rest in whites.

In 2002, the blood industry discovered that the virus could be spread by blood donations. Blood banks developed diagnostic tools to test every blood donation to ensure the nations'

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of West Nile Virus, Tennessee and the United States, 2001-2006.

	2001		2002		2003		2004		2005		2006	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
TN*	0	0.00	56	0.97	26	0.44	14	0.24	18	0.30	22	0.37
US Total	NA	NA	310	1.06	969	3.30	2411	0.82	2901	0.98	4268	1.43

*6 fatalities in 2002 and 1 in each of 2003 and 2005. NA= Notifiable Diseases is not compiled

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

	<1 year		1-4 years		5-14 years		15-24		25-39		40-64 years		>65 years	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
TN (2004)	0	0.00	0	0.00	0	0.00	0	0.00	2	0.16	5	0.26	7	0.95
TN (2005)*	0	0.00	0	0.00	0	0.00	1	0.12	2	0.16	6	0.31	8	1.08
TN (2006)	0	0	0	0	0	0	1	0.12	2	0.16	8	0.40	11	1.46
US (2003)	10	0.26	14	0.09	47	0.11	135	0.34	405	0.65	1065	1.26	1159	3.31

*One Fatality in 2005.

blood supply remained safe. Through this screening process, WN virus viremic blood donors were identified and reported to state health departments. Three Tennesseans were identified as West Nile virus positive blood donors, through this system. One blood donor did develop disease symptoms and was subsequently identified as a case and the other two blood donors did not develop West Nile virus symptoms.

After a thorough review of the 2002 WN virus human cases, we found that WN virus infections lead to high rates of mortality and substantial persistent morbidity. People of advanced age with preexisting health conditions are particularly susceptible to severe neurological disease, long-term morbidity, and death from WN virus. Of WN virus meningoencephalitis patients over the age of 70 years, 42% had not returned to previous functional levels at least one year after acute 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 to populations at highest risk of severe sequelae.

Tick-borne Diseases

Ehrlichiosis

Human ehrlichiosis is an emerging tickborne disease that became nationally notifiable in 1999 although Tennessee has been tracking cases since 1996. As with many other arboviral diseases, human ehrlichiosis is probably underreported. Since the discovery of ehrlichiosis in the United States, two strains of human ehrlichiosis have been identified (**Table 1**). These include human monocytic ehrlichiosis (HME) and human granulocytic ehrlichiosis (HGE). Human monocytic ehrlichiosis is the only strain that has been reported in Tennessee. Human monocytic ehrlichiosis is transmitted to humans by the attachment and subsequent feeding of *Amblyomma americanum* (lone star tick) and *Dermacentor variabalis* (American dog tick) which are both ubiquitous in Tennessee.

HME is characterized by an acute onset of high fever, severe headache, myalgia, rigors and or malaise with leukopenia, thrombocytopenia, elevated liver enzymes and other nonspecific signs and symptoms. Rashes are not common but may occur in 20-30% of cases; they usually do not involve the palms or soles. More severe symptoms are expected in older individuals and in the immunocompromised. Approximately 68% of the cases are reported to be over the age of 40 years and 87% over the age of 25 years (**Table 2**). Typically, the case distribution is 55% for male and 45% for female (45%). In 2003, 52% of the cases were reported in the Mid-Cumberland region and Nashville/Davidson metropolitan area with another 29% of the cases being reported from the West Tennessee region and Memphis/Shelby metropolitan area. This trend is similar to previous years'

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

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

	<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 (2003)	0	0.00	1	0.32	2	0.25	1	0.12	6	0.48	12	0.64	9	1.41
TN (2004)	0	0.00	0	0.00	0	0.00	1	0.12	5	0.40	9	0.47	5	0.69
TN (2005)	0	0.00	1	0.33	2	0.25	1	0.12	2	0.16	9	0.46	9	1.21
US (2003)	1	0.00	4	0.03	7	0.02	9	0.02	37	0.06	97	0.12	59	0.17

Table 3. Reported Cases and Incidence Rates (per 100,000 persons) of Human Monocytic Ehrlichiosis, by Year, Tennessee and the United States, 2000-2006.

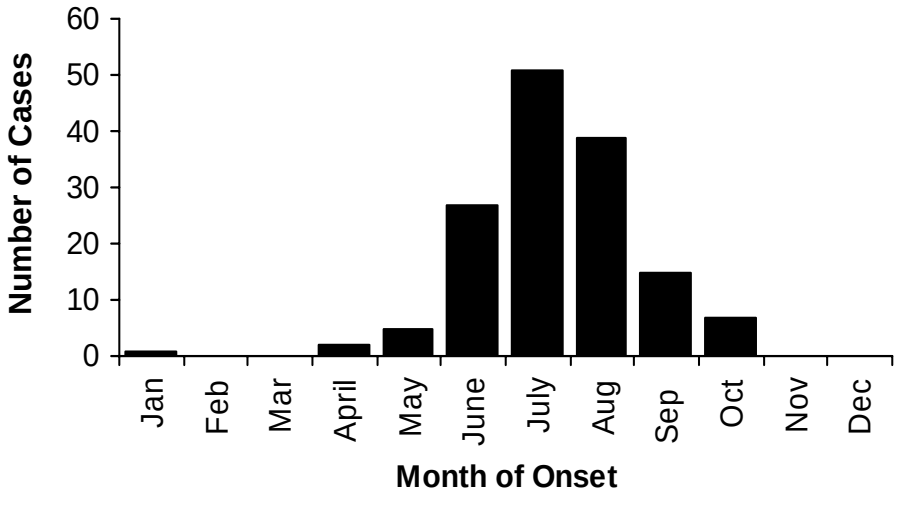
	2000		2001		2002		2003		2004		2005		2006	
	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR
TN	46	0.81	20	0.35	26	0.45	31	0.53	20	0.34	24	0.40	35	0.57
US	200	0.09	142	0.05	216	0.08	321	0.11	NA	NA	NA	NA	NA	NA

NA= Notifiable Diseases is not compiled IR= Incidence Rate

distributions in that approximately 76% of the cases reported since 1996 have been reported from those regions.

Peak incidence in Tennessee is May-October with peak activity in July and August (**Figure 1**). Since 2000, the incidence rate of ehrlichiosis in Tennessee has been consistently higher than the national rate (**Table 3**). In 2002, the incidence of ehrlichiosis in Tennessee was 0.45/100,000, five-fold higher than the overall US rate.

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



Lyme Disease and "Southern Tick Associated Rash Illness"

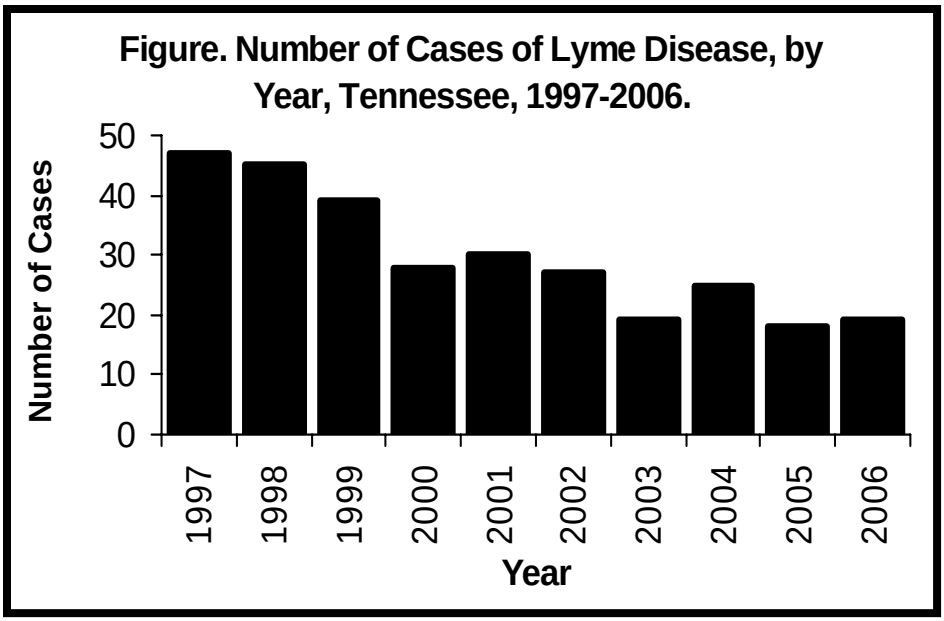
Lyme disease is caused by the spirochete *Borrelia burgdorferi*, which is transmitted to humans through the bite of infected *Ixodes* species ticks. Most Lyme disease is reported in the northeast and upper midwestern United States, with 95% of all cases reported nationally occurring in 12 states (Connecticut, 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 take in blood. *Ixodes* ticks are most likely to transmit infection after feeding for two or more days.

Lyme disease most often 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 reported in Tennessee since 1995. Most of these cases were diagnosed based on occurrence of the erythema migrans rash, but did not have laboratory confirmation. In contrast to Tennessee's incidence rate of 0.3 per 100,000 population in 2003, the national incidence rate in 2002 was 8.2 cases per 100,000 population.



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 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 possible 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 a tick-borne human disease caused by infection with the *Rickettsiaa rickettsii* pathogen. It is the most frequently reported tick-borne rickettsial disease in the United States and is likely underreported. There are approximately 22 rickettsial species found world wide although only 7 are human disease agents while the remainder are not pathogenic to humans. The primary tick vector in Tennessee is *Dermacentor variabalis* (American Dog Tick). *Rickettsia rickettsii* has been isolated from *Amblyomma americanum* (Lone Star Tick) but remains a minor vector with little significant impact of the transmission cycle. Both species of ticks are ubiquitous throughout Tennessee. *Rickettsia rickettsii* normally circulates in nature between ticks and small rodents (ground squirrels, chipmunks, mice and voles). As with many of zoonoses in the world, humans and companion animals (canines) are incidental hosts. The risk of RMSF human cases in tick infested areas is extremely low. Even in areas of human RMSF cases activity, only 1-3% of the tick population may carry the pathogen. Ticks are considered the vector as well as the reservoir of the pathogen. Maintenance of the

pathogen in nature is remarkable efficient and maintained by 3 independent transmission methods. The pathogen can be passed horizontally from a viremic rodent to a feeding tick which will remain infected for life. The pathogen is transovarially transmitted from the female tick to the offspring as well as venereal transmission of the pathogen from male to female during the mating process.

Tennessee reported 8% of the RMSF cases in the nation and 70% of the cases in the US were reported from TN and the 8 surrounding states. From 1995 to the present, the overall incidence rate in Tennessee has been consistently higher than the national incidence rates (**Table 1**). Tennessee incidence rates appear to be increasing gradually over time although this could be attributed to many factors such as increased patient testing and reporting. Within the past decade, there has been a dramatic rise in RMSF incidence in Tennessee and surrounding states. Incidence in Tennessee increased by 42% from 2004 to 2005 and by 63% from 2005 to 2006. Incidence rates increase in age groups over 25 years and peak in the 40-64 year old age groups (**Table 2**). Transmission can occur all year long in Tennessee, although the majority of cases are generally reported between April and September (**Figure 1**).

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. There have been cases of misdiagnosis due to the severe GI symptoms

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of Rocky Mountain Spotted Fever, by Year, Tennessee and the United States, 1997-2006.

Year		TN	US	Year		TN	US
1997	No.	38	409	2002	No.	81	1014
	IR	0.70	0.16		IR	1.40	0.39
1998	No.	31	365	2003	No.	74	1091
	IR	0.57	0.14		IR	1.27	0.38
1999	No.	55	579	2004	No.	98	1514
	IR	1.00	0.21		IR	1.66	0.52
2000	No.	57	495	2005	No.	139	NA
	IR	1.00	0.18		IR	2.33	NA
2001	No.	85	695	2006	No.	260	NA
	IR	1.50	0.25		IR	4.33	NA

NA= Notifiable Diseases is not compiled IR= Incidence Rate

Figure 1. Distribution of Rocky Mountain Spotted Fever Cases, by Month of Illness Onset, Tennessee, 1996-2005.

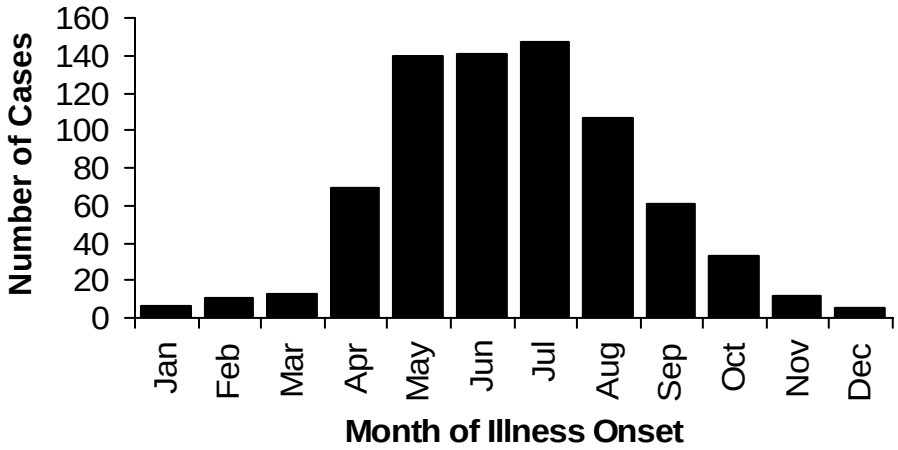


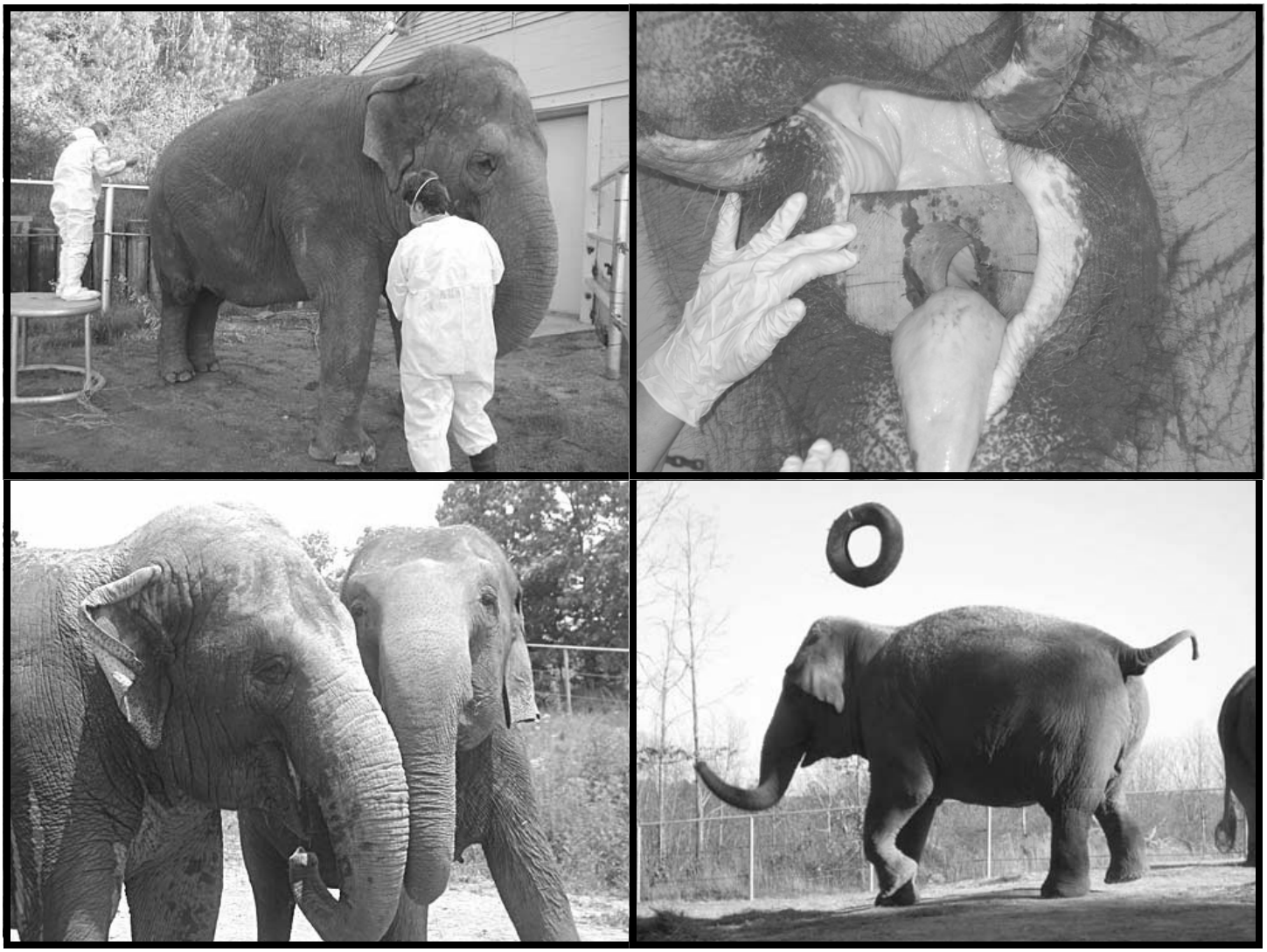
Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of Rocky Mountain Spotted Fever, by Age Group, Tennessee and the United States.

	<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 (2003)	0	0.00	3	0.97	6	0.75	3	0.37	15	1.21	37	1.97	9	1.41
TN (2004)	0	0.00	3	0.96	10	1.24	6	0.74	24	1.93	40	2.08	15	2.07
TN (2005)	0	0.00	1	0.33	21	2.59	17	2.08	24	1.95	56	2.85	19	2.56
US (2002)	4	0.11	43	0.28	137	0.33	100	0.26	227	0.36	437	0.52	148	0.42

that some patients experience. 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 and even with proper treatment, 2% will die.

Community supported prevention measures to reduce tick populations are not practical which makes public education prevention critical to reducing the chance of exposure. Ticks need to feed on host several hours before rickettsial transmission can occur. Transmission can not occur with ticks walking over the skin. For this reason, it is critical for people to perform full body tick checks after potential tick exposure. Swift identification and removal of the tick from the skin is critical for prevention.

G. Tuberculosis



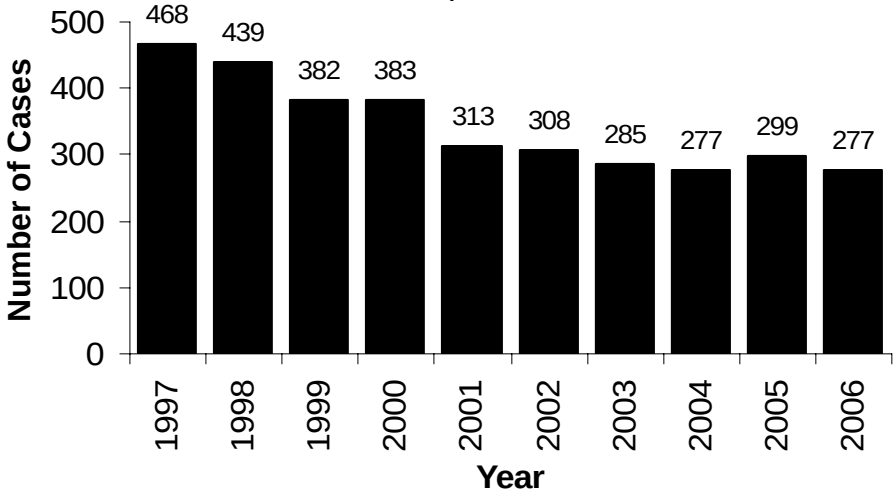
Since 1993, 5 distinct strains of human tuberculosis (TB) have been identified in 8 different captive elephant groups throughout the United States. In 2001, Misty, an Asian elephant residing at The Hawthorn Corporation in Illinois, was diagnosed with TB. In late 2004, Misty and companion Lota, who was in the advanced stages of TB, were confiscated by USDA and transferred to the Elephant Sanctuary in Tennessee. Lota succumbed to her disease weeks after her arrival. In 2005, the veterinarians at the Sanctuary designed a treatment for Misty based upon Lota's TB susceptibility patterns. It was not until 2006, after she had successfully completed a full year of treatment, that Misty was released from quarantine and moved to the Asian Elephant Habitat to be with the other elephants. It was at this time, Dr. John Dunn, State Public Health Veterinarian, visited the Elephant Sanctuary to assess the risk of Misty to the public's health, as well as the health of her caregivers.

Source (used with permission): The Elephant Sanctuary, Hohenwald, Tennessee (www.elephants.com)

Tuberculosis Elimination Program

Tennessee reported 277 cases of tuberculosis (TB) in 2006, which represented a decrease of 7.4% compared with the 299 TB cases reported in 2005. Corresponding to the decrease in cases was a decrease in Tennessee's TB case rate from 5.0 per 100,000 population in 2005 to 4.6 per 100,000 population in 2006, equaling the national case rate of 4.6 per 100,000. During 2006, Tennessee's two largest metropolitan areas had the highest incidence of TB disease in the state: Memphis/Shelby County reported 107 cases (case rate 11.7 per 100,000 population) and Nashville/Davidson County reported 60 cases (case rate 10.4 per 100,000 population). Until 2005, Tennessee experienced a steady decline of TB morbidity over the previous 10 years as illustrated in **Figure 1**. The 22 excess TB cases in 2005 compared to 2004 can be attributed in part to increased TB surveillance in Nashville and Memphis. The overall decrease in cases during 2006 may be due in part to increased targeted testing efforts in one region which experienced a decrease of 18 cases from 2005.

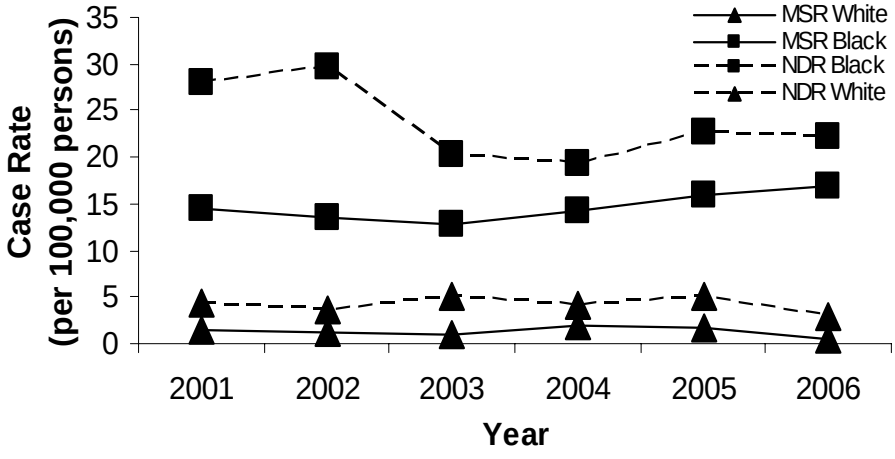
Figure 1. Number of Tuberculosis Cases, Tennessee, 1997-2006.



Racial and Ethnic Distribution

During 2006, the racial and ethnic distribution of TB cases in Tennessee changed very little from 2005. In 2006, Tennessee reported 45.5% of TB cases as black non-Hispanic, 33.9% as white non-Hispanic, 7.9% as Asian Pacific Islander, and 12.3% as Hispanic of any race; in 2005, the racial and ethnic distribution was 46.2%, 36.8%, 4.7% and 11.7% for the same categories, respectively. Of all black non-Hispanic cases reported in 2006, 62.7% were from Memphis/Shelby County (total of 79 cases) and 27.8% were from Nashville/Davidson County (total of 35 cases). In 2006, Memphis/Shelby County had a black non-Hispanic case rate of 17.0 cases per 100,000 population compared to 0.5 for white non-Hispanics. Also during 2006, Nashville/Davidson County had a case rate of 22.3 cases per 100,000 population compared to 2.8 for white non-Hispanics. **Figure 2** shows that the TB case rates among black non-Hispanic residents have been consistently and considerably higher in both metropolitan areas than the case rates for white non-

Figure 2. Non-Hispanic White & Non-Hispanic Black TB Case Rates, Memphis/Shelby & Nashville/Davidson Counties, 2001-2006.



- Population estimates are from the US Census Data and represent estimates at midpoint of each year.
- 2006 estimates are using 2005 population estimates and are preliminary.

Hispanic residents during the past five years. An effort is clearly needed to minimize and eventually eliminate the disparity in TB incidence between whites and blacks in Tennessee, especially in the state's largest metropolitan areas.

TB Genotyping Program

The implementation of a statewide TB genotyping program in 2004 has added a new dimension to the traditional investigation of TB epidemiology, and has greatly enhanced the understanding of the disease's complex transmission dynamics. A TB genotype cluster is comprised of two or more culture-positive TB cases whose *Mycobacterium tuberculosis* strain is determined to be matched genetically. Tennessee monitors the percentage of genotypically clustered cases in the state as a basic indicator of recent TB transmission. TB culture isolates that have genotyping patterns that match at least one other isolate in a jurisdiction's database are much more likely to represent recent transmission than isolates with unique genotypes. Therefore, the percentage of cases that are clustered can be compared to the percentage that are not clustered, providing a rough guide to the level of recent TB transmission occurring in a jurisdiction. Although the clustering percentage has its limitations, some of the uncertainty involved in using this method to estimate the frequency of recent transmission is minimized when used to monitor trends over time. This is attributed to the fact that any bias that applies to a particular TB program's population will be relatively constant over time. Tennessee's TB Elimination Program (TTBEP) is now monitoring the total clustering percentage in the state, as well as comparing the clustering percentages of US-born and foreign-born TB cases in order to determine any changes in transmission patterns.

The clustering percentage for TB cases in Tennessee has increased from 50.10% in 2004-2005 to 52.64% for 2004-2006. When the clustering percentages were compared in the US-born and foreign-born populations from 2004-2005 to 2004-2006; the clustering percentages increased from 58.50% to 61.06% and from15.40% to 19.83% respectively (**Table**).

In addition to monitoring the clustering percentages within the state, the TTBEP monitors data provided by the CDC that describe the number and percentage of isolates with a particular polymerase chain reaction (PCR) genotype in Tennessee, and the distribution of that PCR genotype across the United States. This information is useful for prioritizing cluster investigations because it reveals whether certain PCR genotypes are widely distributed across the U.S., are unique to Tennessee, or are indicative of possible interstate TB transmission.

Table. TB Clustering Percentages Tennessee & the United States, 2004-2006.

Categories	Case Counts	
	2004 - 2005	2004 - 2006
Tennessee Clustering Percentage**	50.10%	52.60%
# of US-born Submissions*	323	504
# of US-born Clustered isolates	189	308
US-Born Clustering Percentage	58.50%	61.10%
# of Foreign-Born Submissions*	78	121
# of Foreign-Born Clustered Isolates	12	24
Foreign-born Clustering Percentage	15.40%	19.80%

* Submissions = number of culture positive isolates submitted to the CDC contracted genotyping laboratory

** Clustering Percentage = (# clustered isolates / # submissions) X 100

TB Treatment

Adequate treatment of TB cases is dependent upon the susceptibility of the organism to available therapies. Tuberculosis drug susceptibility and resistance can only be determined following the growth of viable Mycobacterium tuberculosis cultures and, therefore, data regarding resistance are only descriptive of culture-positive TB cases. "Multi-drug resistant TB" (MDR-TB) refers to *M. tuberculosis* organisms that are resistant to both Isoniazid (INH) and Rifampin (RIF), both first-line drugs in the treatment of TB disease. MDR-TB can be described as either

"initial MDR," referring to patients whose TB strains were initially resistant to both INH and RIF, or "acquired MDR," referring to patients whose M. tuberculosis developed resistance to both INH and RIF during treatment. In 2005, Tennessee reported two initial MDR cases, with no reported case of acquired MDR-TB. There were no MDR-TB cases reported in 2006. Although reports of MDR-TB are uncommon in Tennessee, four cases in the past six years (1 case in 2000, 1 case in 2003, and 2 cases in 2005) were reported as having initial MDR-TB. Tennessee also reported two cases of acquired MDR-TB, one case in 2001 and one in 2002. As patients complete TB treatment, acquired MDR-TB statistics may change, especially for those cases whose treatment lasts more than 12 months or who are non-compliant with TB therapy.

Section IV.

Environmental Health

Springdale Creek Apartments in Shelby County were being constructed when it was realized that the site was impacted from chemical contamination. Lead contamination from an automobile junkyard and pesticide contamination from industry were deemed a hazard to public health. The contaminated soil was removed. Clean soil and landscaping were added for safe and normal use.

Source: David Borowski Tennessee Department of Health

Environmental Epidemiology

Environmental Epidemiology (EEP) is charged with protecting the public from exposure to chemicals associated with hazardous waste sites. Environmental Epidemiology works in all 95 Tennessee counties. Regional Environmental Epidemiologists provide local support to environmental public health projects in addition to their daily responsibilities. Team projects with other state agencies such as the Tennessee Department of Environment and Conservation (TDEC) and the Department of Agriculture are common.

Environmental Epidemiology has no state appropriated funding. Federal funding for the investigation of hazardous waste sites comes through a Cooperative Agreement that the Tennessee Department of Health has with the Agency for Toxic Substances and Disease Registry (ATSDR). Federal funding for environmental epidemiologic work comes from the HHS CDC Public Health Emergency Preparedness Cooperative Agreement.

2006 was a dramatic year of diversity in reporting for Environmental Epidemiology. Our first two Public Health Assessments were released as final reports. These reports were the culmination of many months of work which included government draft and public comment draft versions prior to the final publication being printed. Environmental Epidemiology continued to publish Health Consultations detailing investigations of hazardous waste sites. These reports present environmental public health conclusions and recommendations. A new type of report briefing emerged in 2006. Environmental Epidemiology began formally documenting work that was not as detailed as Health Consultations or Assessments require. These new internal works, termed *Technical Assists*, also provided public health guidance about how to prevent chemical exposure to Tennesseans.

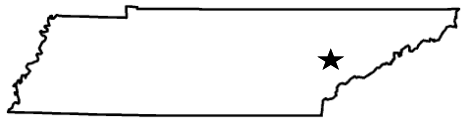
In support of these published projects, other environmental public health tools were also produced or performed. Fact sheets, report summaries, public meetings, media releases, interviews, and Internet pages were all made as supporting materials. For more information about specific environmental public health projects visit the Communicable and Environmental Disease Services Internet site. Examples of projects that were completed by Environmental Epidemiology in 2006 are included.

Public Health Assessments

Loudon County HAPs

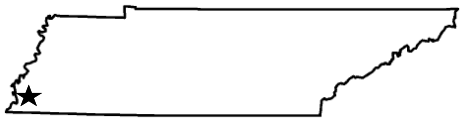
The US Environmental Protection Agency and the TDEC Division of Air Pollution Control monitor air quality in Tennessee. Three stations have been setup to measure the amount of hazardous air pollutants (HAPs) in the air. A monitoring station was placed in an industrial park in Loudon that had seven large industries and numerous air quality complaints. Loudon is within a geographic area known for air quality issues. Local citizens were concerned about air pollution affecting their health. The Loudon County Air Task Force, a local group of government agencies, businesses, industries, doctors, community groups, and concerned citizens were active in the area.

Through the formal Health Assessment process, Environmental Epidemiology reviewed the large data set, determined which of the 41 HAPs monitored might be of concern, and worked through the Task Force to respond back to the community. In addition, EEP reviewed health data for deaths, in-patient and out–patient hospitalizations and cancer incidence. Rates for Loudon County were compared to rates in a control county and in the State. The project took almost two years and included several public meetings, fact sheets, conference calls, draft reports, and peer review before being published as a lengthy report.



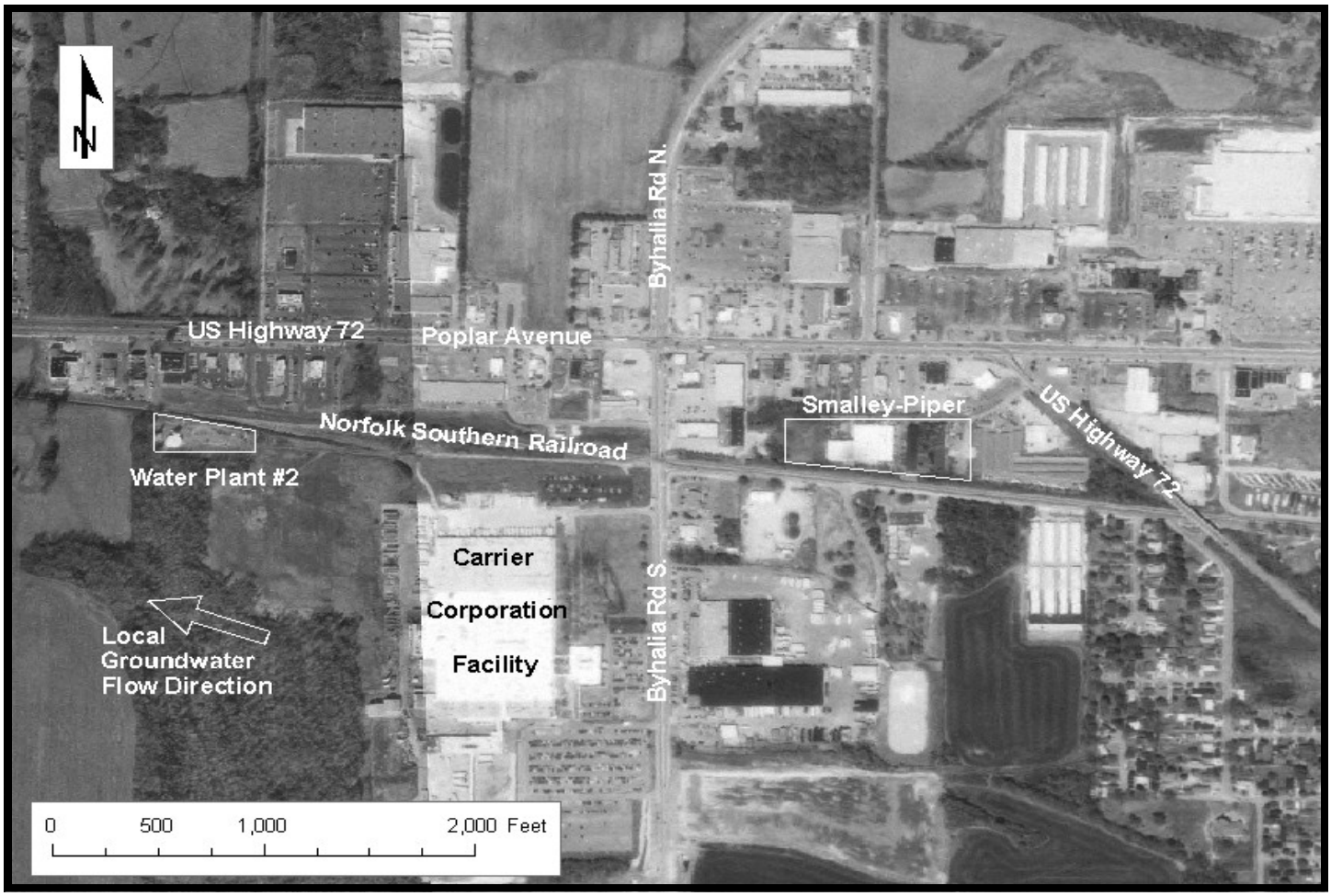
Hazardous Air Pollutants Monitor, Loudon County, Tennessee. *Source: David Borowski, Tennessee Department of Health.*

Smalley-Piper, Shelby County



Chromium was detected 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 in groundwater could impact the Town of Collierville's drinking water supply that provided 14,000 connections. The Health Consultation published by Environmental Epidemiology in November 2003, put the Smalley-Piper site on the fast track for Superfund action. The site was listed on the federal National Priorities List (NPL) of hazardous waste sites in need of attention.

Although chromium was detected in the source groundwater and to a lesser extent in the finished product water at one water plant, no concentrations that presented a health hazard were ever reported. The uncertainty of the future was perhaps the biggest issue for the project. As the Town of Collierville continued to grow, more source water would be needed. All stakeholders needed to be aware of the underground, out-of-sight chromium pollution. Through the Public Health Assessment process, EEP completed a series of draft reports for the government and public before publishing the final report for the Smalley-Piper site in May 2006. A public meeting was held to share the Health Assessment. Positive media coverage ran before and continued to run after the public meeting in Collierville-area newspapers. EEP helped to bring all of the local stakeholders to the table to interact. Now, town officials, local business, government agencies, and residents are all aware of the potential for

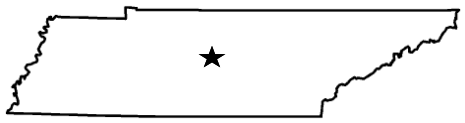


Aerial photograph of Smalley-Piper, and Water Plant #2. Groundwater flow is west northwest. Drawn groundwater by Water Plant #2 has been impacted. It appears that chromium in groundwater is migrating from Smalley-Piper, Shelby County, TN. *Source: USGS & NRCS*

EEP's Health Consultations

College Grove, Williamson County

The University of Tennessee at Chattanooga, along with Tennessee Technological University in Cookeville, received an Environmental Justice grant from the US EPA. The universities collected and analyzed soil samples from a private property owned by Glover. This property had formerly been used as an access point by the EPA to get into Chattanooga Creek to dredge polluted sediments from the creek. Gravel haul roads still exist and look like perfect trails for the Chattanooga Creek Greenway plan. Local citizens were not sure what to think. Several community leaders supported the investigation of the Glover Site by the universities. EEP was provided the data to review and report public health findings. Polycyclic aromatic hydrocarbons (PAHs) are present, but in many areas below health screening levels. No apparent health hazard was concluded. As of this report the US Environmental Protection Agency was still working to clean up Chattanooga Creek.



Mr. Milton Jackson addresses his fellow community members at a public meeting, Hamilton County, Tennessee. *Source: David Borowski, Tennessee Department of Health.*

Cypress Creek Sub-Area III, Shelby County

Some 50 years ago, industrial discharges into Cypress Creek in north Memphis were normal. Today, we understand that some of the wastes discharged contained persistent organic pesticides that can be harmful to human health. The TDEC Division of Solid and Hazardous Waste Management along with the Memphis and Shelby County Health Department, wrote EEP to express their concerns about the site. Together, they requested EEP get involved.

Cypress Creek has been channelized with concrete walls to aid with flood control. Unfortunately, during the construction, contaminated creek sediments were dredged and placed onto residential yards. Soil samples were collected from 129 residential properties along Cypress Creek. A Health Consultation that used a complex and cautious evaluation process showed that most yards would be safe. However, for approximately ten percent of the properties sampled, a health hazard was declared due to dieldrin levels. During a subsequent public meeting,

View of Cypress Creek within Sub–Area III, Shelby County, Tennessee. *Source: David Borowski, Tennessee Department of Health.*

TDEC presented their plan to cleanup the contaminated properties. At the same time, EEP shared our interest in following up with an exposure investigation to collect house dust to analyze for pesticide residues.

Former High Point Cleaners, Shelby County

TDEC Drycleaner Environmental Response Program (DCERP) asked EEP to review the air monitoring data from a building that was a former drycleaner facility in Memphis. The drycleaner facility was located in one of the center-most units of a six-unit commercial business suite. The units to either side of the former drycleaner facility were being used, one as a church. The soils and groundwater under the building are contaminated with drycleaner related solvents. DCERP personnel had concerns that drycleaner solvent vapor levels could be a potential health hazard for the other business suite occupants. The site was being assessed by DCERP and remediation activities were underway. Remediation work was completed and indoor air monitoring data was gathered. EEP continued to work with DCERP to assess all environmental public health questions concerning this former drycleaner site.

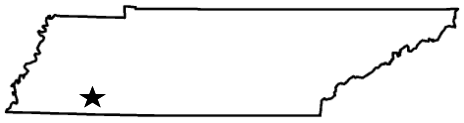
Drycleaner storefront in 2001, Former High Point Cleaners, Shelby County, Tennessee. *Source: Jim Gilbert, Tennessee Department of Environment and Conservation.*

Skyline Drive, Knox County

After several decades, a property adjacent to a large city dump had come into the spotlight. Children who grew up in Knoxville inherited their mother's property. The city asked for back taxes. The property had been used as an illegal dump (landfill) for decades. Rumors of construction debris, municipal garbage, and personal dumping were floating around. Following a site visit a health consultation was prepared. A remedial plan was put into place by TDEC. No exposure pathways were deemed complete.

Skyline Drive Dump Site, Knox County, Tennessee. *Source: Ron Clendening, Tennessee Department of Health.*

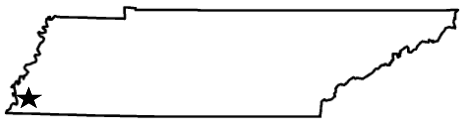
Clover Creek, Hardeman County



Federal workers often wade through Clover Creek to bust up beaver dams. This area was impacted decades ago by pesticide wastes and residues. The groundwater in the geographic area is considered spoiled. Upwelling of groundwater and vaporization of volatiles from soil including carbon tetrachloride and chloroform had been measured. TDH was asked to ensure that federal wildlife workers contacting contaminated waters or breathing vapors were safe.

Technical Assists

Springdale Creek Apartments, Shelby County



An apartment complex was being constructed when it was realized that the site was impacted from chemical contamination. The northern part of property had pesticide contamination from decades-old industrial discharges. The southern part of the property had residues from past use an automotive junkyard. The US Environmental Protection Agency did an emergency removal of lead in soils along the east-

ern property border that was shared with an elementary school playground. EEP has been working with TDEC and the Memphis Shelby County Health Department to protect future residents of the apartment complex from the contaminated soils. A Technical Assist was written to ensure that cleanup was done thoroughly.

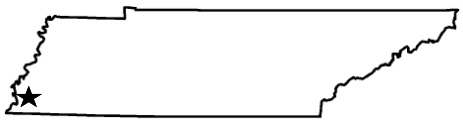
Springdale Creek Apartments, Shelby County, Tennessee. *Source: David Borowski, Tennessee Department of Health.*

Cherokee Trail Residential Development, Knox County

An environmental consultant requested EEP to comment on arsenic levels in soil. Their site-specific investigation showed that background levels of arsenic seemed high compared to common health guidance. A technical assist provided the environmental consultation with agreement by the state that in some areas of Tennessee background levels of arsenic in soil are indeed naturally elevated.

Cypress Creek, Shelby County

After a public meeting, Environmental Epidemiology worked with TDEC to provide Cypress Creek area residents additional resources. Although questions are answered during a public meeting, new questions tend to arise. EEP provided easy to read printed information as feedback to those who attended the meeting.



Other Projects

Environmental Epidemiology

EEP provided aggregate data from Health Statistics and the Tennessee Cancer Registry to the regional environmental epidemiologists and provided training in the use of SAS so that the regional environmental epidemiologists could use the data. The northeast, southeast, and the south-central regional offices are using the data and training to assist their health councils in prioritizing health needs and in answering questions about putative disease clusters.

Protocol for Assessing Community Excellence in Environmental Health (PACE EH)

Environmental Epidemiologists from across the state gathered in Nashville October 11 & 12, 2006 for a workshop on PACE EH. PACE EH is a tool used by communities to assess their environmental health needs. This protocol was developed by the National Association of County and City Health Officials in partnership with the CDC. To help Tennessee better understand this tool and its usage, Tom Struzick from the University

of Alabama at Birmingham's School of Public Health was invited to the workshop to share his experiences utilizing PACE EH throughout Alabama. Special thanks to Mr. Struzick as he proved to be both knowledgeable and enthusiastic. After this successful workshop, Tennessee communities were identified as potential PACE EH sites.

SECTION V.

Investigations and Outbreaks

In the summer of 2006, there were several cases, both children and adults, of *Clostridium difficile* identified at a local area daycare. Dr. Rand Carpenter led the investigation into this possible outbreak. Although there was no clear mode of transmission, the toddler (above) was recognized as the index case.

Source: Tennessee Department of Health

Highlighted Investigations and Outbreaks in Tennessee in 2006

The following section presents examples of investigations that highlight efforts of the Communicable and Environmental Disease Services section (CEDS) and health department personnel from across the state in 2006. 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.

Community-Associated Methicillin-Resistant *Staphylococcus aureus* Among Personnel at a Pediatric Clinic — Tennessee, 2006

Background: Ambulatory-care visits for skin and soft-tissue infections have increased dramatically in the United States, and community-associated (CA) methicillin-resistant *Staphylococcus aureus* (MRSA) is a frequent cause of these infections. Healthcare workers (HCWs) in outpatient settings can be at increased risk for MRSA infection. We investigated an outbreak of MRSA infections among personnel at a pediatric outpatient clinic.

Methods: Isolates from a clinic worker who died of MRSA sepsis were compared with MRSA isolates from staff nasal-swab cultures and clinic patient nasal swabs by using pulsed-field gel electrophoresis (PFGE). Clinic environmental samples were cultured to identify contamination by *S. aureus*. A questionnaire concerning hygiene and work practices was administered to personnel.

Results: We identified 16 skin and soft tissue infections in a 6 month period among 45 clinic staff with a completed questionnaire; three, including the deceased employee, had laboratory-confirmed MRSA. Nasal swabs indicated that 15/45 (33%) personnel were colonized with *S. aureus*, and 2/45 (4.4%) isolates were identified as MRSA. PFGE patterns of these two isolates were indistinguishable from the USA800 strain and did not match the pattern from the deceased employee's isolate (USA300). Among the sample of 262 patient swabs, 97 (37%) yielded *S. aureus*. Nine (3.4%) were identified as MRSA and represented a variety of PFGE patterns, with three indistinguishable from the USA300 strain. Of 71 environmental surfaces cultured, eight (11%) were contaminated with *S. aureus* (none were MRSA). The questionnaire indicated that standard precautions had been inconsistently applied when dealing with skin and soft-tissue infections among patients.

Conclusions: HCWs are increasingly exposed to persons with CA-MRSA. Standard precautions and environmental controls in outpatient settings are important methods of limiting HCW exposure.

National Outbreak of *Fusarium* Keratitis

Context: *Fusarium* keratitis is a serious corneal infection, most commonly associated with corneal injury. Beginning in March 2006, the Centers for Disease Control and Prevention received multiple reports of *Fusarium* keratitis among contact lens wearers.

Objective: To define the specific activities, contact lens hygiene practices, or products associated with this outbreak.

Design, Setting, and Participants: Epidemiological investigation of *Fusarium* keratitis occurring in the United States. A confirmed case was defined as keratitis with illness onset after June 1, 2005, with no history of recent ocular trauma and a corneal culture growing *Fusarium* species. Data were obtained by patient and ophthalmologist interviews for case patients and neighborhood-matched controls by trained personnel. Available *Fusarium* isolates from patients' clinical and environmental specimens were genotyped by multilocus sequence typing. Environmental sampling for *Fusarium* was conducted at a contact lens solution manufacturing plant.

Main Outcome Measures: Keratitis infection with *Fusarium* species.

Results: As of June 30, 2006, 164 confirmed case patients in 33 states and 1 US territory were identified. Of these, 14 were residents of Tennessee, 5 of whom required corneal transplants. Median age was 41 years (range, 12-83 years). Corneal transplantation was

required or planned in 55 (34%). One hundred fifty-four (94%) of the confirmed case patients wore soft contact lenses. Forty-five case patients and 78 controls were included in the case-control study. Case patients were significantly more likely than controls to report using a specific contact lens solution, ReNu with MoistureLoc (69% vs 15%; odds ratio, 13.3; 95% confidence interval, 3.1-119.5). The prevalence of reported use of ReNu MultiPlus solution was similar between case patients and controls (18% vs 20%; odds ratio, 0.7; 95% confidence interval, 0.2-2.8). *Fusarium* was not recovered from the factory, warehouse, solution filtrate, or unopened solution bottles; production of implicated lots was not clustered in time. Among 39 isolates tested, at least 10 different *Fusarium* species were identified, comprising 19 unique multilocus genotypes.

Conclusions The findings from this investigation indicate that this outbreak of *Fusarium* keratitis was associated with use of ReNu with MoistureLoc contact lens solution. Contact lens users should not use ReNu with MoistureLoc.

E. coli O157 Outbreak Associated with Recreational Water

In July, 2006 three cases of *E. coli* O157 were reported in Davidson County. All were children, and two were hospitalized with hemolytic uremic syndrome. Investigation revealed that all three patients had been swimming at the same beach at a middle Tennessee lake on July 4th. No other common exposures were identified. Testing of lake water on July 5th revealed high levels of coliforms, which can indicate fecal contamination. Testing approximately two weeks prior and two weeks after the outbreak showed very low coliform counts. There had been no recent heavy rains and no nearby animal pastures were identified, both of which could contribute to water contamination. Fecal contamination of the swimming area by another bather infected with *E. coli* O157 is one potential cause of this outbreak.

Foodborne Disease Outbreak due to *Salmonella* Anatum

In July, 2006 several cases of *Salmonella* Anatum from a single county were reported by the state public health laboratory. Ultimately, 55 case patients were identified, of whom 7 were hospitalized. Molecular fingerprinting of the *S.* Anatum isolates associated with this outbreak using pulse-field gel electrophoresis (PFGE) found that all isolates were indistinguishable by two enzymes. An epidemiologic investigation identified pulled pork barbecue from a single market as the likely vehicle in this outbreak. An environmental investigation of that establishment identified a number of violations of safe food practices, including storage of food at improper temperatures, inadequate cleaning, and opportunities for cross-contamination of food items. Several samples of prepared foods collected during the inspection had high bacterial loads on culture. No additional illnesses associated with the implicated establishment were reported after correction of foodhandling procedures.

Multistate Outbreak of *Salmonella* Typhimurium Due to Tomatoes

CDC and state health departments investigated a multistate outbreak of *Salmonella* Typhimurium in late 2006. A total of 186 cases were reported from 21 states, of whom 12% were hospitalized; 10 cases were reported in Tennessee. The majority of patients became ill in the last 2 weeks of September, 2006. An extensive epidemiologic investigation identified the source of the infections as tomatoes served in restaurants.

SECTION VI.

Public Health Emergency Preparedness Program

In October 2006, public health personnel from the Emergency Preparedness Program prepare for the Homeland Security Full Scale Exercise located in Knoxville. This exercise focused on the essential components needed to respond to a chemical nerve agent release. The movement of CHEMPACK chemical nerve agent antidotes was a primary objective of the exercise. Continued training elevates the level of preparedness in our state and is essential to ensuring our population is protected.

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, $18.6 million came from the Centers for Disease Control and Prevention (CDC) for improvements to state and local public health preparedness with the remaining $1.3 million 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. The SNS is a national repository of antibiotics, vaccines, chemical antidotes, antitoxins, life-support medications, intravenous (IV) fluids, airway maintenance supplies and medical/surgical items. It is designed to supplement and re-supply state and local public health resources, as well as other health care agencies in the event of a national emergency anywhere within the U.S. or its territories.

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. In 2004, the program received $17.8 million dollars and in 2005 $15.4 million dollars from the CDC's cooperative agreement grant. 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 disasters, both natural and manmade, outbreaks of other infectious diseases and other public health emergencies. With the focus shifting to an all hazards response, the program has been renamed the Public Health Emergency Preparedness Program.

Public Health Preparedness

The statewide Integrated Terrorism and Disaster Response Plan (ITDRP) expanded and became 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). Training to address the mental health needs of the public and of emergency response personnel has been developed.

As these and other future initiatives are approved, they will be integrated in to the ESF-8 and the TEMP. A high priority in the development of these plans is the inclusion of detailed processes concerning the receipt, staging, storing and distribution of assets from the SNS. The Tennessee Department of health received "green" status from the CDC for its level of preparedness to receive the Strategic National Stockpile (SNS) during an act of bioterrorism or a mass casualty event. CDC grades a state's preparedness using red, amber and green scale, with green being the highest rating.

The Public Health Emergency Preparedness Program is exploring the possibility of changing the department's volunteer organizational structure to that of a Medical Reserve Corps (MRC). If implemented, all of our 30,000 volunteers will be MRC volunteers. These volunteers are recruited to interface with hospitals and medical care providers in a public health emergency. Also, in order to better coordinate the mobilization of these community volunteers, regional health departments have filled the volunteer coordinator and 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 database of contact information of hospital and clinical labs has been developed, and information is shared with them as necessary. Training continues to be provided to hospital and sentinel laboratories across the state in isolation and diagnosis of potential bioterrorist agents. The Chemical Terrorism Laboratory is fully operational and validation of procedures to test clinical specimens for chemical terrorist agents is ongoing. Laboratory services has utilized grant funds to develop and equip four (4) Laboratory Response Network (LRN) Laboratories to test for bioterrorism agents. These regional laboratories located in Nashville, Knoxville, Jackson, and Memphis/Shelby County are to provide 24/7 response and testing.

The regional health department epidemiologists continue 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 utilize 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.

During an emergency, redundant communications systems were further 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 continue to be viable modes of communications for public health staff statewide. A more robust, computerized call-down system, the Tennessee Health Alert Network (THAN) has been implemented. This system contains two separated databases to be used for contacting public health employees, 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 utilized to facilitate multiple public health training sessions. The Preparedness Program continues to facilitate the delivery of education and training to key public health professionals. Tennessee TrainingFinder Real-time Affiliate Integrated Network (TN TRAIN) is being developed by TDH to provide access to numerous training and educational materials from across the state and nation. 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 2005, the Preparedness Program staff continued with the joint terrorism education and exercise program 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 were involved in several regional tabletop and full-scale exercises. The program is being conducted over a three-year period in the 11 Tennessee Office of Homeland Security Jurisdictional Districts. It is the goal to foster multi-agency collaboration through the combined, comprehensive scenario-driven tabletop and full-scale terrorism exercises and to simulate 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 Preparedness Program continues to focus on emergency response plans that incorporate risk communication and health information dissemination strategies. In a public health emergency (i.e. the identification of a case of H5N1 influenza), the number of asymptomatic, worried people rushing to emergency rooms, hospitals and their doctors would be overwhelming. 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

In 2003-2004, 9.6 million dollars and again in 2004-2005, 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 biological and chemical attacks and other outbreaks of infectious disease.

In 2004, the CHEMPACK Program was fielded in the State of Tennessee. This program preemptively placed chemical nerve agent antidotes throughout our state to augment our response capabilities to chemical nerve agents. HRSA funding was used to support construction of CHEMPACK storage locations.

SECTION VII.

Epidemic Intelligence Service

Dr. Rand Carpenter, Tennessee's Epidemic Intelligence Service Officer, with his wife Selena and two children Reid and Sam while on a skiing trip in 2006.

Source: Tennessee Department of Health

Epidemic Intelligence Service

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. Dr. Rose Devasia completed her assignment in Tennessee in June, 2005 (and went on to do an Infectious Diseases Fellowship at Vanderbilt University). Rand Carpenter, DVM began his EIS assignment in Tennessee in July, 2005.

Examples of recent EIS investigations in Tennessee include:

- Evaluation of a school-based influenza program.
- Evaluation of TennCare data to determine the proportion of persons seeking care for diarrheal illness who had stool cultures or were treated with antibiotics.
- Outbreak of MRSA skin infections among staff in a pediatric clinic
- Owner of a petting farm bitten by a rabid cat
- Scombroid poisoning related to tuna consumption at a restaurant
- Rabid horse associated with the Tennessee Walking Horse National Celebration
- Outbreak of *Salmonella Javiana* infections
- *Chlamydophila psittaci* illness in pet birds and two persons
- Investigation of Eastern Equine Encephalitis in a horse

Epidemic Intelligence Service Officers, 1970-2006
Tennessee Department of Health

Years	Name	Years	Name
1970-1971	G. Doty Murphy, MD	1988-1990	Ban Mishu, MD
1971-1972	David L. Freeman, MD	1990-1992	Peter A. Briss, MD
1972-1974	Bernard Guyer, MD	1992-1994	Steven M. Standaert, MD
1974-1976	David S. Folland, MD	1995-1997	Allen S. Craig, MD
1976-1977	R. Campbell McIntyre, MD	1997-1999	Timothy F. Jones, MD
1977-1979	Timothy J. Dondero, MD	1999-2001	Joseph F. Perz, DrPH
1980-1982	Tracy L. Gustafson, MD	2001-2003	David L. Kirschke MD
1982-1984	Michael D. Decker, MD, MPH	2003-2005	Rose Devasia, MD
1984-1986	William T. Brinton, MD	2005-2007	L. Rand Carpenter, DVM
1986-1988	Melinda Wharton, MD		

SECTION VIII.

Publications by CEDS and Tennessee EIP Authors, 2006

February 2006 – Robert Goff, Southeast Region's Emergency Response Coordinator, Dr. Calita Richards, Tennessee Department of Health's Assistant Director of Pharmacy, and Greg Galfano, Senior Planner for the Public Health Emergency Preparedness Program, took a break from the first-ever NACCHO Local, State, and Federal Public Health Preparedness Summit in Washington, D.C., for a photo opportunity in front of the White House.

Source: Tennessee Department of Health

Publications List

ATSDR Documents:

Bashor B, Omohundro E, Borowski DM, Miller S, Clendening R. Public Health Assessment: Smalley-Piper, Collierville, Shelby County, Tennessee, EPA Facility ID: TNN000407378. May 8, 2006. Agency for Toxic Substances and Disease Registry.

Bashor B, Omohundro E, Borowski DM, Miller S, Clendening R. Public Health Assessment: Loudon County Hazardous Air Pollutants, Loudon County, Tennessee. May 12, 2006. Agency for Toxic Substances and Disease Registry.

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Clendening R. Health Consultation: Clover Creek Workers (a/k/a Velsicol Chemical Corp.), Toone, Hardeman County, Tennessee, EPA Facility ID: TND980559033. July 12, 2006. Agency for Toxic Substances and Disease Registry.

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and non-outbreak restaurants. J Food Prot 2006;69:2697-2702.

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