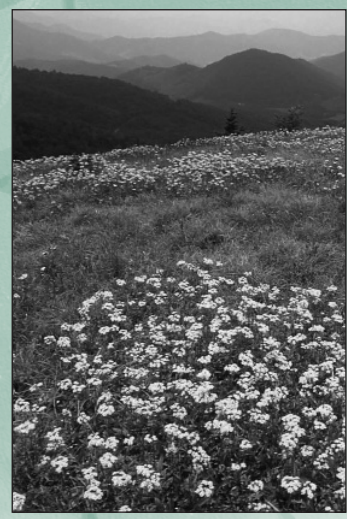
Communicable and Environmental Disease Services Annual Report 2004-2005

Tennessee Department of Health

Communicable and Environmental Disease Services



2004-2005 Annual Report

Tennessee Department of Health

Communicable and Environmental Disease Services

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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

September 7, 2004 – Dr. Wendy Long bids farewell to the public health nurses from across the state as they set to prove to the nation that Tennessee really is the Volunteer State by lending a helping hand to those coastal residents affected by Hurricane Ivan.

Source: Tennessee Department of Health

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 1995 through 2005 and builds upon the 1999, 2000, 2001, 2002 and 2003 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 PH1600 is used for written reports to the health department. It can be obtained by calling your local health department or CEDS at 615-741-7247/800-404-3006. It can also be downloaded from the CEDS website at http://tennessee.gov/health. Click on Programs, and then click on Communicable and Environmental Disease Services. CEDS as well as regional and local health departments welcome questions about disease reporting.

Notifiable disease data are submitted electronically by the Tennessee Department of Health to the Centers for Disease Control and Prevention on a 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.

D. Isolate Characterization at the State Laboratory

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

E. Emerging Infections and the Emerging Infections Program

An important emphasis of CEDS is on new and emerging infections. These include antibiotic resistant infections and emerging foodborne pathogens, such as *Cyclospora cayetanensis*, *E.coli* O157:H7, *Listeria* and multi-drug resis-

[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.

tant *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).

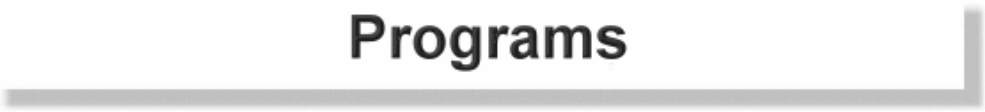
The core activity of the EIP is active surveillance of laboratory-confirmed cases of reportable pathogens. Laboratory directors and staff, physicians, nurses, infection control practitioners, and medical records personnel are key participants in EIP. Components of the EIP in Tennessee investigate foodborne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

F. Communicable and Environmental Disease Services Website

Further tabulations of data regarding disease surveillance in Tennessee are available at the CEDS web site. To access the web site, go to http://www.tennessee.gov/health. Click Programs, and then click on Communicable and Environmental Disease Services.

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

Step 2:
Click on Programs



Step 3:
Click on Communicable and Environmental Disease Services

- Alcohol and Drug Abuse Services
- Bioterrorism
- Breast and Cervical Cancer Screening Program
- Chemical Terrorism
- Communicable and Environmental Disease Services
- Health Maintenance Organizations (HMOs)
- Immunizations
- Laboratory Services
- Lead Poisoning Prevention
- Local Health Departments
- Maternal and Child Health
- Minority Health

G. 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	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	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	Stephanie Hall, MD	stephanie.hall@knoxcounty.org	Janice Johnson, RN	janice.johnson@knoxcounty.org
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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

H. List of Notifiable Diseases

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

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

Anthrax
Botulism
- 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

Physicians required to report all blood lead test results ≥ 10 μg/dl

Revised 6/04

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

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

Salmonella species, including *S. Typhi*
Shigella species
Corynebacterium diphtheria
Brucella species
Mycobacterium species
Legionella species
Clostridium tetani
*Listeria species**
Plasmodium species
Vibrio species
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 37247-0801
Phone 615-262-6300

For U.S. Mail

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

J. Tennessee Population Estimates, 2005

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	2,909,019	<1	80,130	45-49	450,237
Female	3,049,066	1-4	314,305	50-54	412,380
RACE /SEX	**POPULATION**	5-9	395,044	55-59	362,928
White Male	2,383,198	10-14	415,258	60-64	281,033
White Female	2,463,829	15-19	411,299	65-69	221,804
Black Male	474,462	20-24	404,497	70-74	178,022
Black Female	532,104	25-29	396,468	75-79	144,537
Other Male	51,359	30-34	415,306	80-84	105,636
Other Female	53,133	35-39	419,020	85+	92,206
TOTAL	**5,958,085**	40-44	457,975		

K. 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.

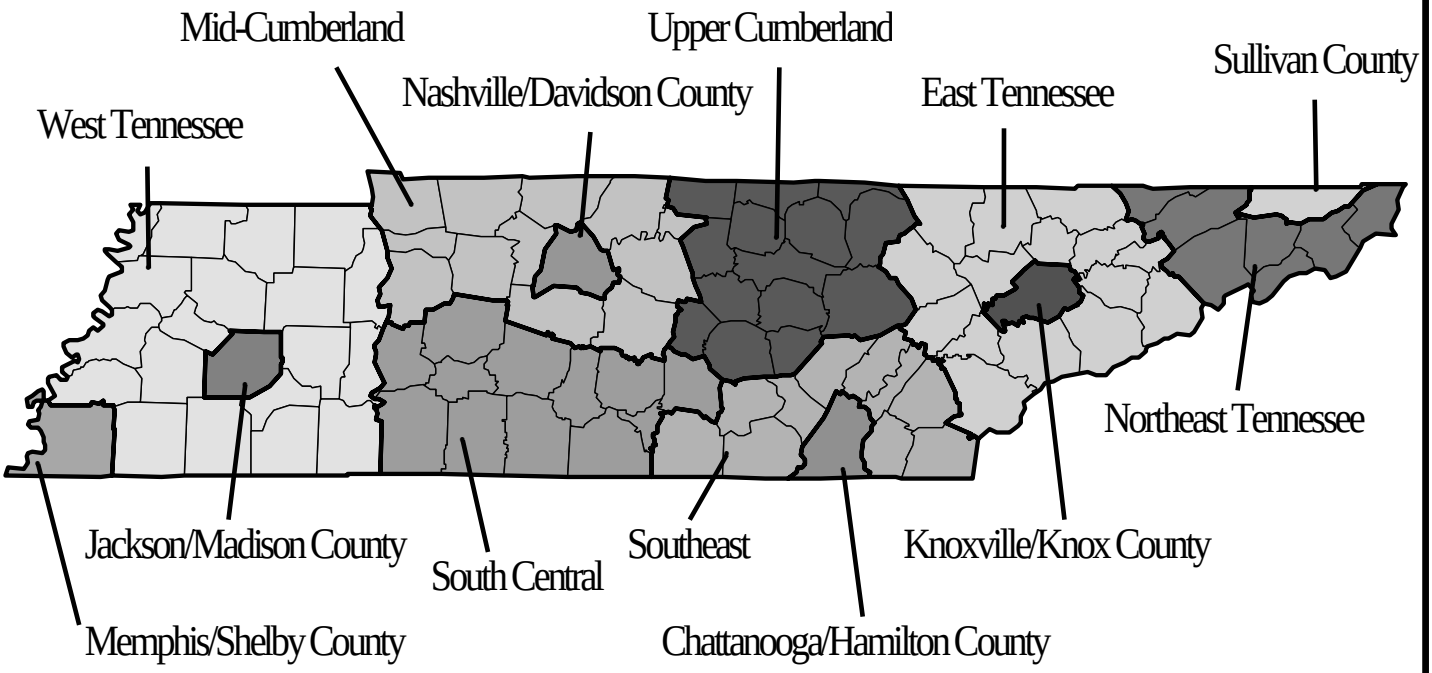
The non-metropolitan regions are comprised of the seven clusters of counties shown in the map.

L. Notes on Sources Utilized in Preparing the Report

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

Disease rates for the United States come from the Centers for Disease Control and Prevention. Summary of notifiable diseases, United States, 2004, MMWR 2006; 53, No.53. The 2005 Summary of Notifiable Diseases has not been released.

Tennessee's Department of Health Regions



M. Tennessee's Department of Health Regions: Counties and Population, 2005

East (Population 697,378)

County	Population	County	Population
Anderson	71,975	Loudon	41,610
Blount	112,074	Monroe	41,669
Campbell	40,860	Morgan	20,523
Claiborne	30,989	Roane	53,326
Cocke	35,064	Scott	22,345
Grainger	21,840	Sevier	77,553
Hamblen	60,310	Union	19,431
Jefferson	47,809		

Mid-Cumberland (Population 922,344)

County	Population	County	Population
Cheatham	38,768	Rutherford	203,987
Dickson	45,826	Stewart	13,292
Houston	8,223	Sumner	140,685
Humphreys	18,469	Trousdale	7,651
Montgomery	144,724	Williamson	144,222
Robertson	59,487	Wilson	97,010

Northeast (Population 333,174)

County	Population	County	Population
Carter	57,464	Johnson	18,203
Greene	64,841	Unicoi	17,894
Hancock	6,853	Washington	112,102
Hawkins	55,817		

South Central (Population 364,980)

County	Population	County	Population
Bedford	40,945	Lincoln	32,510
Coffee	50,414	Marshall	28,395
Giles	30,170	Maury	74,003
Hickman	24,186	Moore	5,968
Lawrence	41,329	Perry	7,734
Lewis	11,890	Wayne	17,436

Southeast (Population 310,571)

County	Population	County	Population
Bledsoe	12,868	McMinn	51,196
Bradley	92,686	Meigs	11,718
Franklin	40,714	Polk	16,469
Grundy	14,759	Rhea	29,580
Marion	28,380	Sequatchie	12,201

Upper Cumberland (Population 320,816)

County	Population	County	Population
Cannon	13,440	Overton	20,669
Clay	8,106	Pickett	5,125
Cumberland	50,127	Putnam	66,235
DeKalb	18,350	Smith	18,846
Fentress	17,300	Van Buren	5,651
Jackson	11,441	Warren	39,977
Macon	21,568	White	23,981

West (Population 528,714)

County	Population	County	Population
Benton	16,838	Haywood	19,920
Carroll	30,066	Henderson	26,591
Chester	16,426	Henry	31,761
Crockett	15,068	Lake	7,967
Decatur	11,850	Lauderdale	28,449
Dyer	38,129	McNairy	25,165
Fayette	31,295	Obion	32,921
Gibson	48,640	Tipton	55,867
Hardeman	29,618	Weakley	35,642
Hardin	26,501		

Metropolitan Regions (Population 2,480,108)

County	Population	County	Population
Davidson	592,446	Madison	95,487
Hamilton	312,491	Shelby	928,648
Knox	396,741	Sullivan	154,295

SECTION II.

Tennessee Reported Cases, 1995-2005

August 2005 — Central Office staff conducted an observational study at area petting zoos and fairs to assess human behaviors, hand hygiene and environmental contamination.

Source: Tennessee Department of Health

Reported Cases, by Year of Diagnosis, Tennessee, 1995-2005

DISEASE	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
AIDS	930	881	749	790	650	674	606	663	600	694	809
Botulism, Foodborne	0	1	0	0	2	0	0	0	0	0	0
Botulism, Infant	0	0	0	1	2	1	4	3	1	1	0
Brucellosis	0	2	1	1	0	0	1	0	0	1	0
California/LaCrosse Encephalitis	*	1	8	9	6	19	17	15	14	13	2
Campylobacteriosis	346	335	299	285	251	272	364	298	448	438	403
Chlamydia	13,152	13,121	12,501	13,717	14,216	15,073	15,556	16,042	21,034	22,513	23,041
Cryptosporidiosis	1	5	17	11	12	12	25	60	41	55	44
E. coli 0157:H7	0	45	46	55	53	59	50	51	35	48	45
Ehrlichiosis	*	2	5	6	19	46	20	26	31	20	24
Giardiasis	146	155	175	207	159	184	190	188	187	251	225
Gonorrhea	13,894	11,710	11,018	11,840	11,366	11,877	10,144	9,348	8,717	8,475	8,619
Group A *Streptococcus*	*	13	87	42	50	83	87	89	167	144	152
Group B *Streptococcus*	*	*	*	*	*	87	157	164	264	245	368
Haemophilus influenzae	*	29	31	33	36	26	48	37	58	53	93
Hepatitis B Surface Antigen Positive, Pregnant	*	*	*	2	3	36	104	103	109	115	104
Hepatitis A	1,993	737	407	224	190	154	187	122	202	96	149
Hepatitis B, Acute	640	517	437	266	228	213	272	128	212	221	153
Hepatitis C, Acute	958	373	232	166	96	97	64	26	23	35	28
Hemolytic Uremic Syndrome	*	3	1	1	8	12	10	7	14	16	10
HIV	1,080	972	966	840	803	1,127	805	833	549	586	665
Legionellosis	25	27	32	23	23	14	30	20	37	44	40
Listeriosis	*	6	14	13	7	13	9	12	9	16	12
Lyme Disease	29	25	47	45	39	28	30	27	19	25	18
Malaria	10	14	12	16	7	13	14	4	7	13	14
Measles (indigenous)	0	2	0	1	0	0	0	0	0	0	1
Meningicoccal Disease	51	62	81	69	61	56	63	38	30	23	27
Meningitis, Other Bacterial	*	*	41	36	44	52	54	39	28	28	16
Methicillin-Resistant *Staphylococcus aureus*	*	*	*	*	*	*	*	*	*	946	1,972
Mumps	6	1	9	2	0	2	1	2	5	4	3
Penicillin-Resistant *Streptococcus pneumoniae*	*	6	82	192	291	266	226	125	133	153	163
Penicillin-Sensitive *Streptococcus pneumoniae*	*	*	*	*	*	353	500	471	493	534	807
Pertussis	210	27	42	41	40	41	72	119	82	179	213
Rocky Mountain Spotted Fever	33	47	38	31	55	57	87	81	74	99	139
Rubella	1	0	0	2	0	1	0	1	0	0	0
Salmonellosis, Non-Typhoidal	463	507	439	587	548	693	724	853	736	776	820
Shigellosis	390	216	285	884	622	344	124	175	396	570	507
Syphilis, Congenital	33	33	38	13	11	18	24	11	2	9	19
Syphilis, Early Latent	1,129	957	984	659	649	627	553	390	227	206	205
Syphilis, Late Latent	529	472	595	499	426	511	570	424	461	400	359
Syphilis, Neurological	10	7	9	15	12	14	10	17	6	7	8
Syphilis, Primary	283	279	235	143	223	162	89	40	43	24	62
Syphilis, Secondary	623	571	512	424	418	370	242	128	93	106	155
Tetanus	1	1	2	1	0	0	1	1	0	2	0
Toxic Shock *Staphylococcus*	5	1	2	4	3	3	1	2	1	2	1
Toxic Shock *Streptococcus*	*	*	*	6	5	1	0	0	1	0	0
Trichinosis	0	3	1	4	0	0	0	1	2	0	1
Tuberculosis	465	504	467	439	382	383	313	308	285	277	299
Tularemia	2	1	0	0	0	1	6	4	3	2	7
Typhoid	1	3	1	2	1	2	1	1	3	4	3
Vancomycin Resistant *Enterococci*	*	*	46	322	447	524	711	649	802	406	278
Yersiniosis	*	*	*	*	*	7	14	19	24	26	18

Number of Reported Cases of Selected Notifiable Diseases with Rates per 100,000 Persons, by Age Group, Tennessee, 2005

DISEASE		<1Y	1-4	5-14	15-24	25-44	45-64	≥65
	Total population	80,130	314,305	810,302	815,796	1,688,769	1,506,578	742,205
AIDS Cases	Number	0	0	*	46	508	235	19
	Rate	0.0	0.0	–	5.6	30.1	15.6	2.6
Campylobacteriosis	Number	33	57	44	38	103	91	33
	Rate	41.2	18.1	5.4	4.7	6.1	6.0	4.4
Chlamydia	Number	37	*	421	16762	5487	279	10
	Rate	46.2	–	52.0	2054.7	324.9	18.5	1.3
Gonorrhea	Number	7	*	146	5081	2895	445	25
	Rate	8.7	–	18.0	622.8	171.4	29.5	3.4
Group A Streptococcus	Number	4	7	4	8	22	60	48
	Rate	5.0	2.2	0.5	1.0	1.3	4.0	6.5
Hepatitis A	Number	1	6	22	23	49	39	8
	Rate	1.2	1.9	2.7	2.8	2.9	2.6	1.1
HIV Cases	Number	*	0	*	142	387	130	*
	Rate	–	0.0	–	17.4	22.9	8.6	–
Meningococcal Disease	Number	6	2	9	5	2	1	3
	Rate	7.5	0.6	1.1	0.6	0.1	0.1	0.4
Pertussis	Number	70	29	36	13	27	30	9
	Rate	87.4	9.2	4.4	1.6	1.6	2.0	1.2
Rocky Mountain Spotted Fever	Number	0	1	21	17	34	46	20
	Rate	0.0	0.3	2.6	2.1	2.0	3.1	2.7
Salmonellosis, Non-Typhoid	Number	126	129	126	72	129	131	93
	Rate	157.2	41.0	15.5	8.8	7.6	8.7	12.5
Shigellosis	Number	10	152	209	29	68	22	3
	Rate	12.5	48.4	25.8	3.6	4.0	1.5	0.4
Syphilis, Early Latent	Number	0	0	0	35	132	36	*
	Rate	0.0	0.0	0.0	4.3	7.8	2.4	–
Syphilis, Late Latent	Number	0	0	0	41	201	87	30
	Rate	0.0	0.0	0.0	50.3	119.0	57.7	40.4
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	6	42	13	*
	Rate	0.0	0.0	0.0	0.7	2.5	0.9	–
Syphilis, Secondary	Number	0	0	*	43	90	20	*
	Rate	0.0	0.0	–	5.3	5.3	1.3	–

SECTION III.

Disease Summaries

A. Foodborne Disease

To help identify the risk factors for infants with campylobacteriosis and salmonellosis, a case-control study was conducted from 2002-2004 in Tennessee. During the analysis phase of the study, a new risk factor among infants was identified — riding in a shopping cart with meat and/or poultry placed next to them.

Source: Tennessee Department of Health

The Tennessee FoodNet Program

The Foodborne Diseases Active Surveillance Network (FoodNet) is the principal foodborne disease component of CDC's Emerging Infections Program (EIP). FoodNet is a collaborative project of the CDC, ten EIP sites (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New York, New Mexico, Oregon and Tennessee), the U.S. Department of Agriculture (USDA) and the Food and Drug Administration (FDA). The project consists of active 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 44.5 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

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 is planned to begin in early 2006.

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.

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.

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

Campylobacteriosis

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

Since 1995, rates of campylobacteriosis have been steadily declining. However, in 2001 there was a sharp increase to 6.3 cases per 100,000 persons. Although the rate decreased by 1.2 cases per 100,000 persons in 2002 (to 5.1 cases per 100,000 persons), the rate of disease in 2003 (7.7 cases per 100,000 persons) surpassed all of those since 1995. During the years 2004 and 2005, rates of disease (7.4 cases per 100,000 persons and 6.8 cases per 100,000 persons, respectively) began to creep back towards the rates of the mid-1990s **(Figure 1).**

Active laboratory surveillance for *Campylobacter* is carried out statewide under the auspices of the FoodNet program. Unlike other foodborne pathogens, isolates for *Campylobacter* 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 2004, the rate of disease in this population was 22.3 cases per 100,000 persons; the rate in 2005 was 23.8 cases per 100,000 persons <5 years of age. The risk for those under the age of one is even greater (49.7 cases per 100,000 persons in 2004 and 46.2 cases per 100,000 persons in 2005).

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. During the years 2004 and 2005, the rate of disease varied region to region across the state, with the highest rate in the Chattanooga/Hamilton County metropolitan area in 2004 (10.9 cases per 100,000 persons) and the Southeast Region in 2005 (10.5 cases per 100,000 persons). The lowest rates of the state were found in the Memphis/Shelby metropolitan area for both 2004 and 2005 (4.0 cases per 100,000 persons and 2.7 cases per 100,000 persons, respectively).

Figure 1. Incidence of Campylobacteriosis, by Year, Tennessee, 1995-2005.

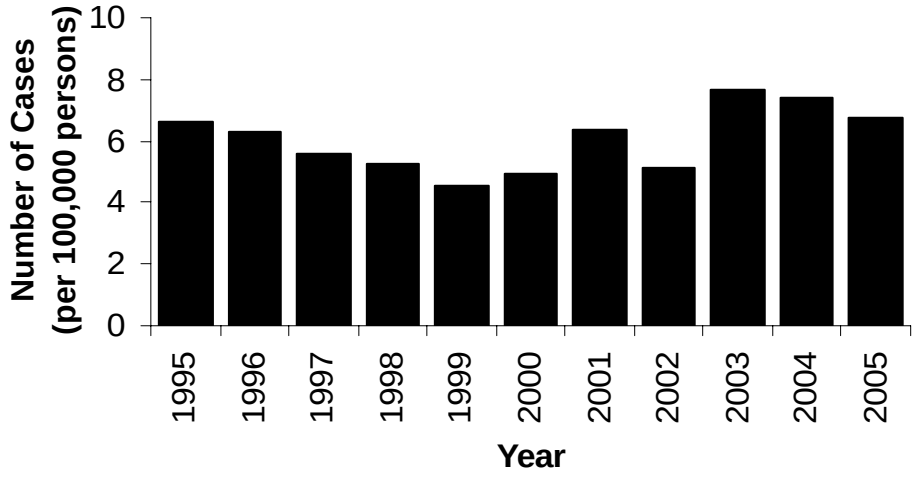
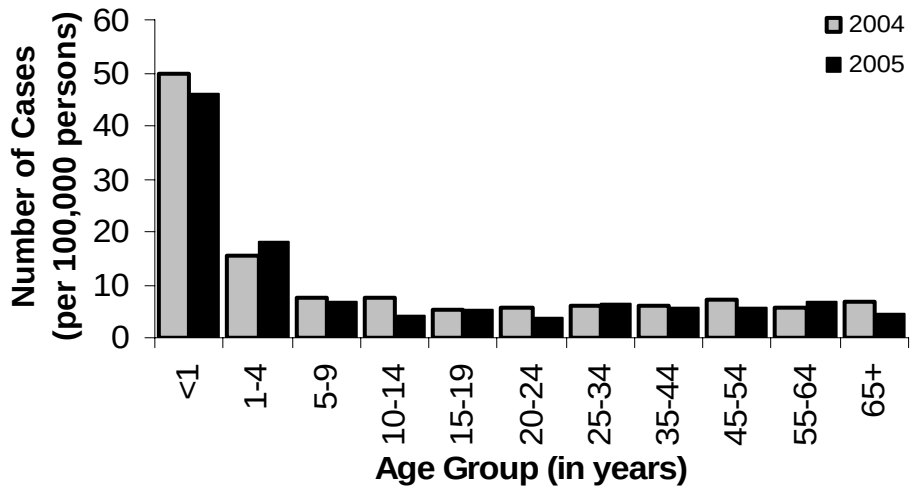
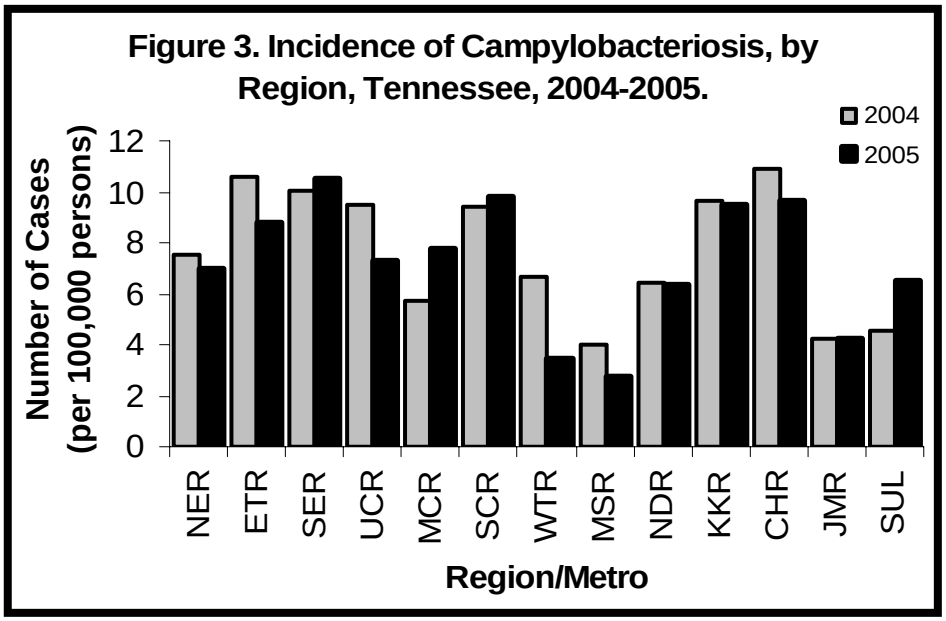


Figure 2. Incidence of Campylobacteriosis, by Age Group, Tennessee, 2004-2005.



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 2005 preliminary FoodNet data, Georgia reported the lowest rate of disease, with 6.5 cases per 100,000 persons, while California reported a rate quadruple that (28.0 cases per 100,000 persons).

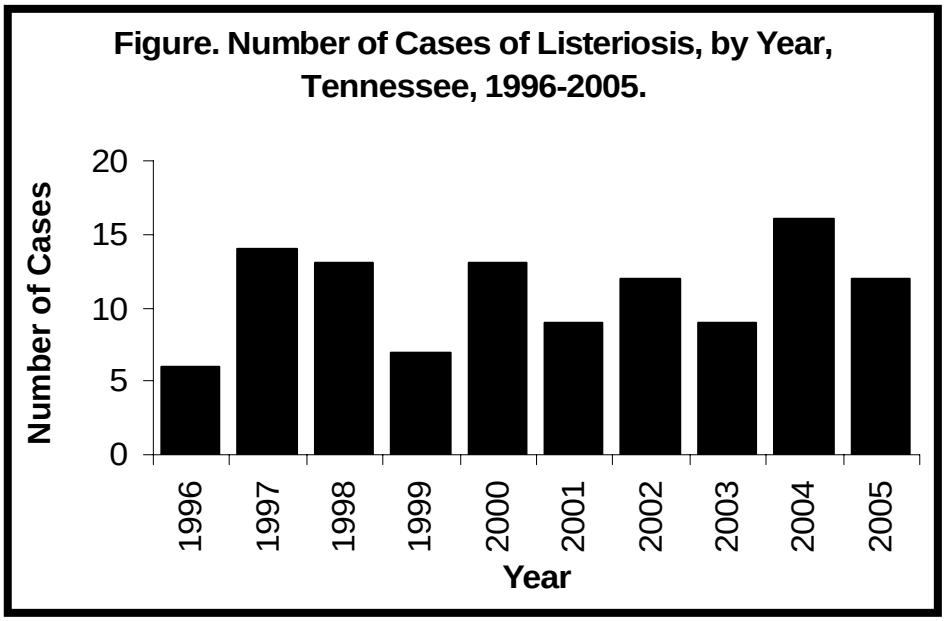


To better understand this variation, FoodNet has undertaken several studies – an analysis of hospitalization rates, a survey of laboratories, a survey of the general population and a survey of physicians. None have fully explained the differences. Examination of the differences in food consumption preferences within those participating sites in FoodNet has been proposed. One hypothesis is that 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 recently completed. Analysis is currently underway and 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. The number of cases in Tennessee has remained fairly constant since 1998.

Among FoodNet sites in 2004, rates per 100,000 persons ranged from a low of 0.10 in Minnesota to a high of 0.51 in Connecticut. The overall rate in FoodNet sites was 0.27 cases per 100,000 persons. In Tennessee, the rate was 0.27 cases per 100,000 persons. In 2004, Tennessee reported 16 cases, and in 2005, Tennessee reported 12 cases **(Figure)**.

In 2000, a three-year long FoodNet listeriosis case-control study was inaugurated. It was designed to identify risk factors for listeriosis and to describe the spectrum of illness in patients with the disease. To date, 174 cases and 378 controls have been enrolled. Analysis of this study was completed in 2004. Underlying medical conditions of enrolled cases have included use of oral steroids, cancer, diabetes, chemotherapy, end-stage renal disease, organ transplants, lupus and HIV/AIDS.

Salmonellosis

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

The annual incidence rate of salmonellosis in 2000 through 2005 was evidently higher than the rates in 1995 through 1999 **(Figure 1).** A total of 776 and 820 cases were reported to the health department in 2004 and 2005, representing a 5% and 11% increase from 736 cases in 2003 respectively. The overall rate in 2004 and 2005 each was 13 cases per 100,000 persons, as compared to the

Figure 1. Incidence of Salmonellosis, Tennessee, 1995-2005.

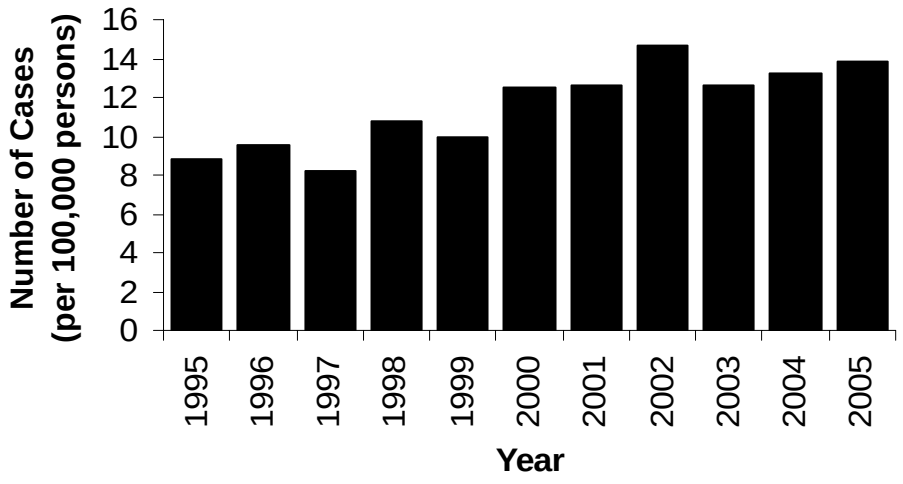
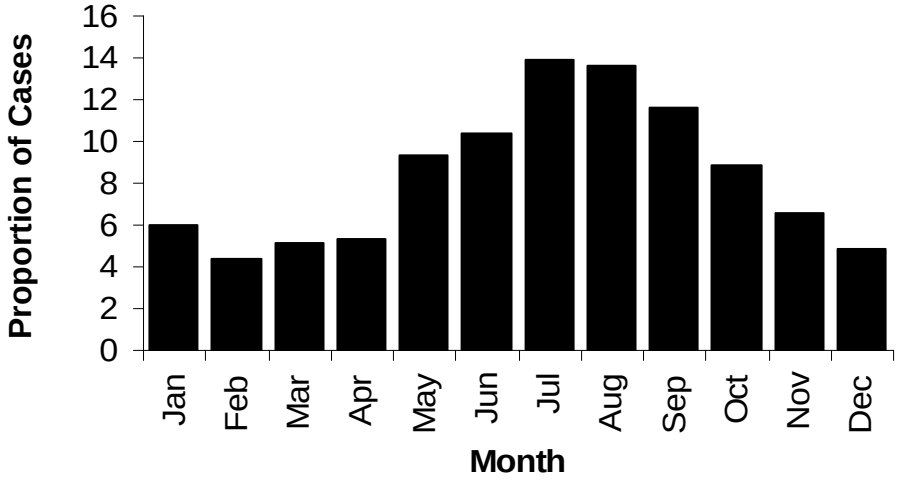


Figure 2. Proportion of Salmonellosis cases, by Month, Tennessee, 1995-2005.



1995 rate of 8.8 cases per 100,000 persons in Tennessee and the 2004 rate of 14.5 cases per 100,000 persons in United States. The National Health Objective 2010 for incidence of salmonellosis is 6.8 per 100,000 persons.

The rates of infection also varied by region. The western portions of the state had the highest rates of *Salmonella* infections in 2005. Shelby County, Jackson/Madison County, and West Tennessee Region reported 50 cases per 100,000 persons, compared with 13 cases per 100,000 persons each in Mid- Cumberland Region and Davidson County and 11 cases per 100,000 persons each in Upper Cumberland Region and East Tennessee Region.

From 1995 to 2005, 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 last decade, 67% of cases were reported during the months of May through October. In 2004 and 2005, salmonellosis peaked in August with 109 (14.1%) and 115 (14.1%) cases respectively.

As shown in **Figure 3**, from 1995 to 2005, *Salmonella* was isolated most frequently from children under 5 years of age, who accounted for 34% of all salmonellosis cases. In 2004 and 2005, the incidence rates of salmonellosis were respectively 145 and 157 cases per 100,000 persons for infants under the age of one and 48 and 41 cases per 100,00 persons for children 1-4 years of age. The distribution of isolates between the sexes was similar during the ten-year period.

Figure 3. Incidence of Salmonellosis, by Age Group, Tennessee, 1995-2005.

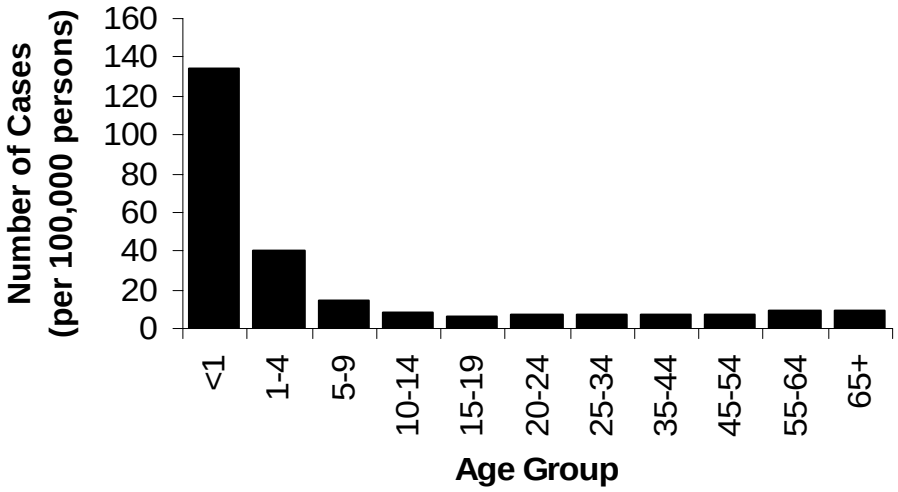


Figure 4. The Top 5 Serotypes of Salmonella, Tennessee, 1997-2005.

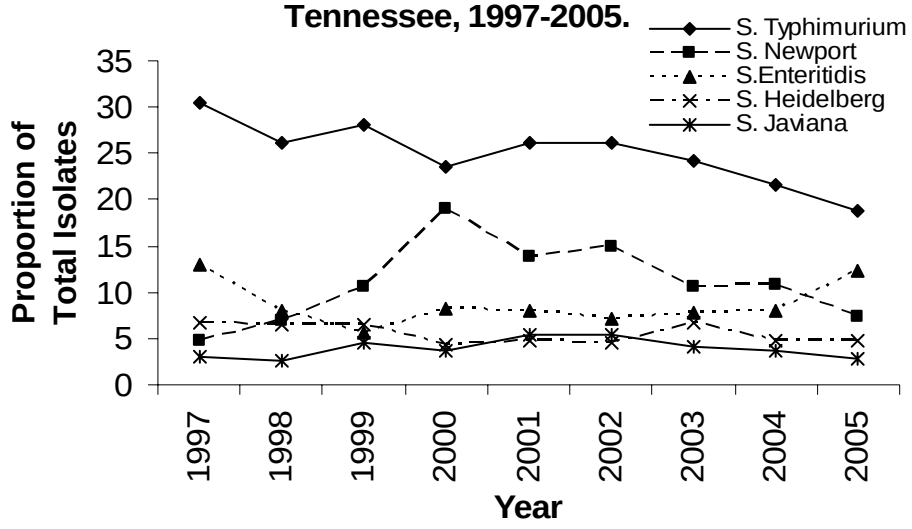
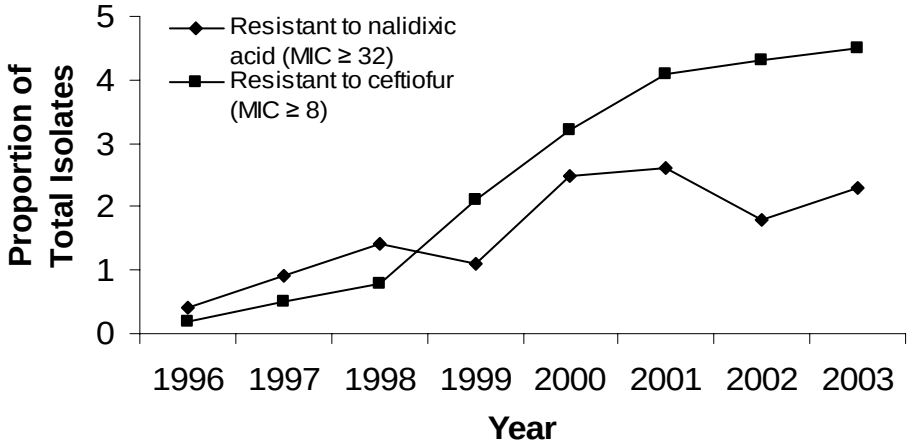


Figure 5. Proportion of non-Typhi *Salmonella* resistant to nalidixic acid or ceftiofur, Unites States, 1996-2003.



The three most common serotypes of *Salmonella* (S. Typhimurium, S. Enteritidis and S. Newport) accounted for 40% of all Salmonella isolates sent to Tennessee Department of Health State Laboratory in 2004 and 2005 (**Figure 4**). Four cases of S. Typhi in 2004 and three more cases in 2005 were laboratory confirmed and linked to international travel to endemic areas.

Nationwide, antimicrobial resistance among non-Typhi *Salmonella* has increased in number for important antimicrobial agents like ampicillin and trimethoprim/sulfamethxazole. In recent years, resistance to third-generation cephalosporines (e.g., ceftiofur), and quinolones (e.g. nalidixic acid) increased as depicted in **Figure 5**. In Tennessee, resistance to ceftiofur increased from 2% in 2001 to 3% in 2002, while resistance to nalidixic acid was 1% and 0% in the same years. The clinical outcomes due to multidrug resistance like potential treatment failure, increased duration of illness, and increased length of hospitalization are proposed for a new FoodNet study on multidrug resistant *Salmonella* in early 2006.

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.

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.

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 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.

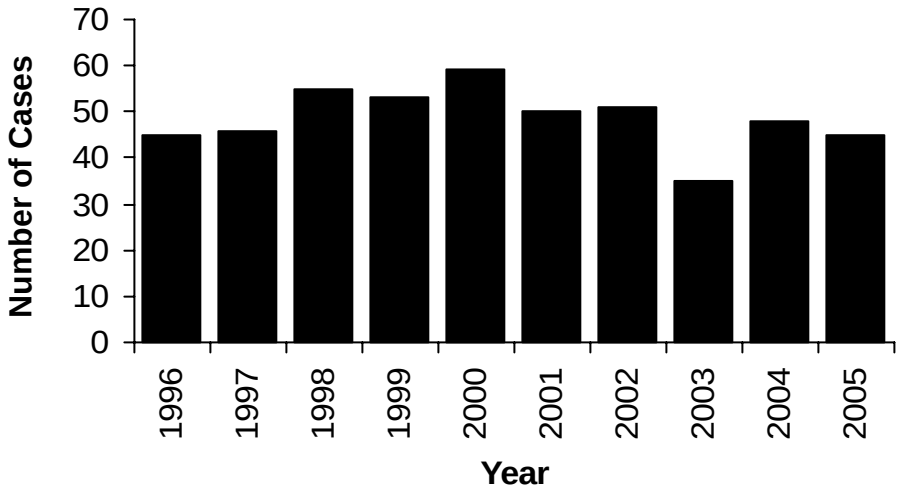
Laboratory Diagnosis

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, 1996-2005.



In 2004, 53 cases of STEC were reported to the Tennessee Department of Health, of which 48 were confirmed to be *E. coli* 0157. In 2005, 45 of 47 reported STEC infections were due to *E. coli* O157 **(Figure)**.

In 2004, 14 cases of HUS were reported in persons under 18 years of age. Of these, laboratory evidence of a preceding *E. coli* O157 infection was obtained in 13 (93%). In 2005, of 10 cases of HUS in persons under 18 years of age, 9 (90%) had evidence of a preceding *E. coli* O157 infection.

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 7.2 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), it is apparent that shigellosis is in the midst of its third five-year cycle of intermittent increase **(Figure 1).**

In 2004, there were 570 cases of shigellosis reported in Tennessee (9.7 cases per 100,000 persons). This represents a significant increase in incidence, more than 40%, from the previous year. The majority of those cases were concentrated in the Southeast region (31.8%) and the Chattanooga/ Hamilton County metropolitan area (29.7%), which were both experiencing community-wide outbreaks of a clonal strain of *Shigella*. Although the number of cases decreased to 507 (8.5 cases per 100,000 persons) in 2005, the major concentration of cases shifted from the southeastern portion of the state to the middle Tennessee area. The Nashville/Davidson County metropolitan area accounted for 51.2% of all cases in the state, with Mid-Cumberland region coming in at a distant second (25.7%).

The driving factor in many shigellosis outbreaks is daycare-associated cases, including attendees, employees or the family members of either group. Of those 507 cases reported in 2005, close to 70% were under the age of ten

Figure 1. Incidence of Shigellosis, by Year, Tennessee, 1990-2005.

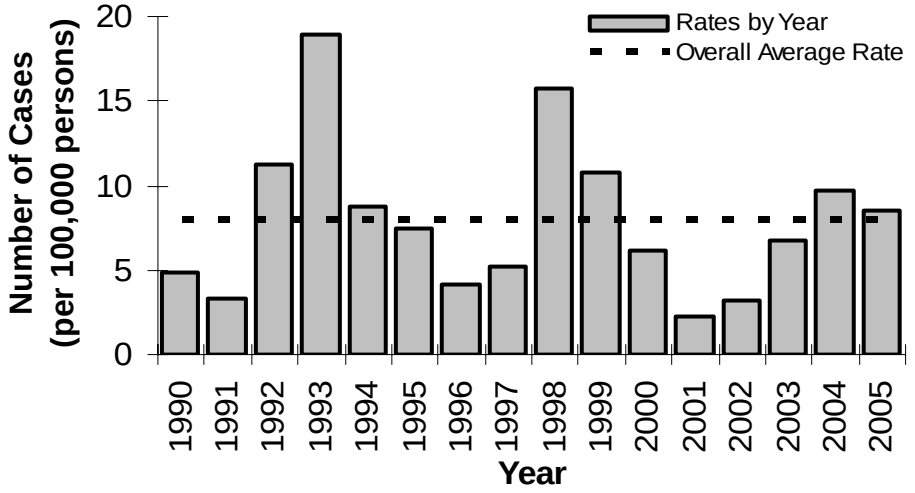
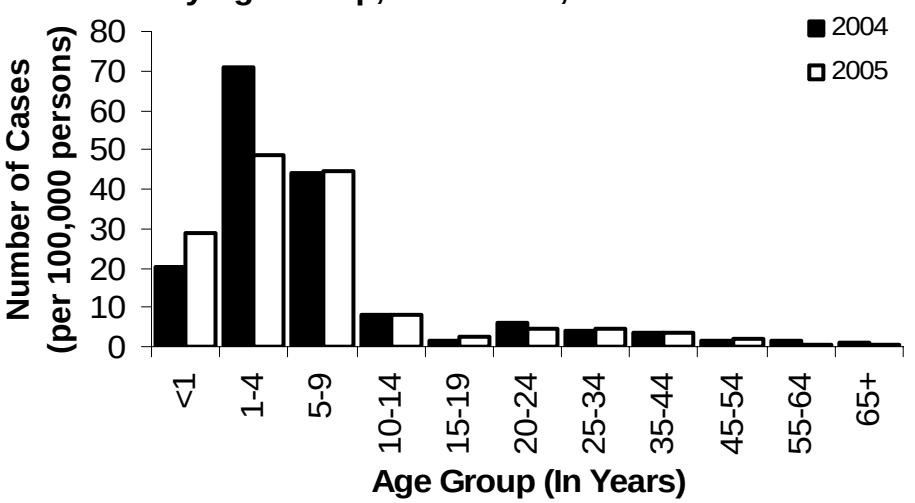


Figure 2. Incidence of Shigellosis, by Age Group, Tennessee, 2004-2005.



(for a rate of 44.5 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 – 48.4 cases per 100,000 persons **(Figure 2).**

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.

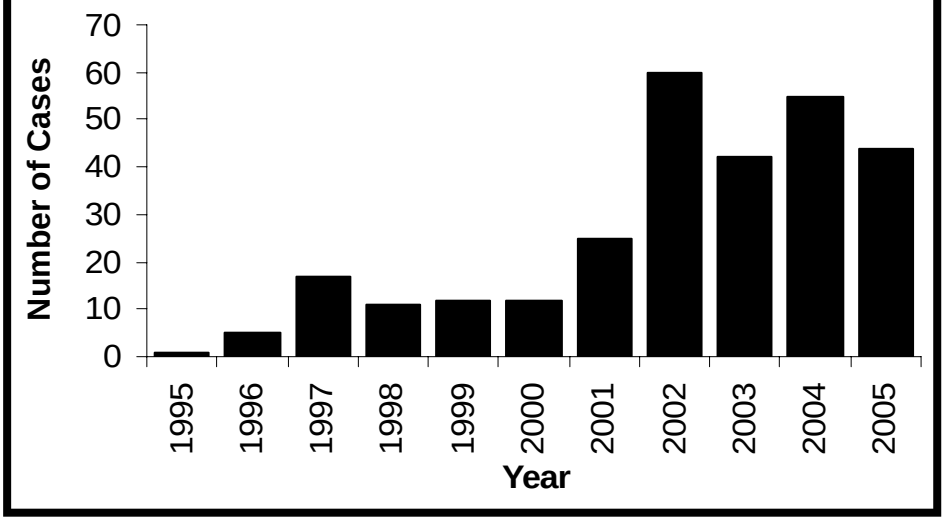
Food and Waterborne Parasitic Diseases

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 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 in 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.

Figure. Number of Cases of Cryptosporidiosis, by Year, Tennessee, 1995-2005.



In 1993, the largest waterborne outbreak in U.S. history was caused by this pathogen. An estimated 403,000 persons served by the South Milwaukee, Wisconsin, water plant became ill, constituting a 52% attack rate. Several immunocompromised patients died.

The reported number of cases 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 2004 (55 cases) and 2005 (44 cases) reveal that the numbers appear 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 2004. In Tennessee, the rate was 0.93 cases per 100,000 persons; in Minnesota the rate was 2.28 and in Georgia it was 1.94. The overall incidence in the nine FoodNet sites was 1.43 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.

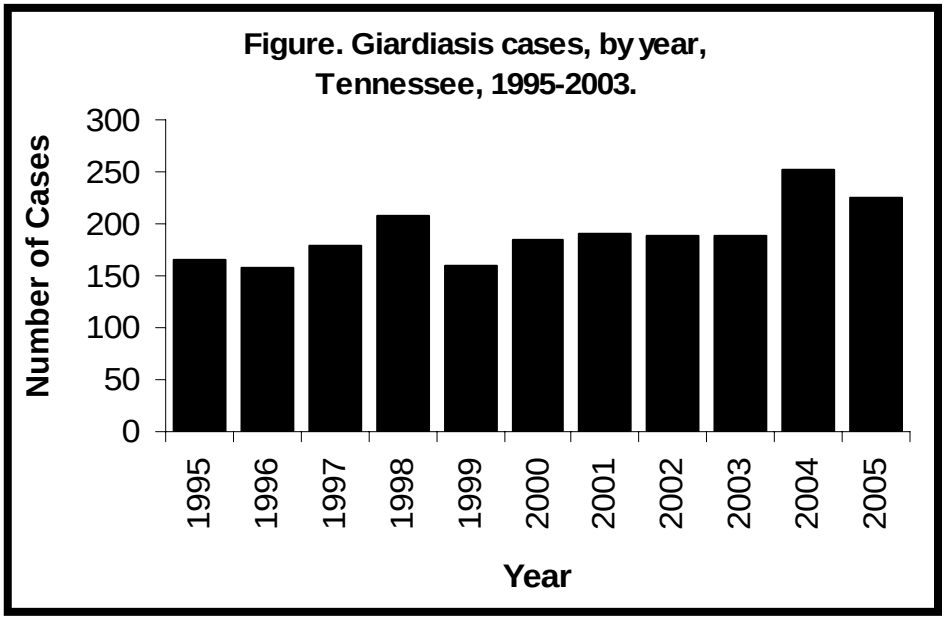
The incidence of Cyclospora infections in this country is not known, but it is thought to be low. Among all FoodNet sites for 2004, 15 cases were reported with an overall incidence rate of 0.03 per 100,000 persons. In Tennessee, there was one case reported in 2002 and none in 2003 and 2004. In 2005, three cases were reported in Tennessee.

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 2005.

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.

Figure. Giardiasis cases, by year, Tennessee, 1995-2003.



The **figure** depicts the number of cases of giardiasis reported in Tennessee from 1995 through 2005; the numbers have remained fairly constant ranging from a low of 146 in 1995 to a high of 251 and 225 in 2004 and 2005 respectively. For the eleven-year period 1995-

2005, giardiasis infections 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.

In 2004, 16 foodborne disease outbreaks were reported in Tennessee (**Table**). The increasing use of pulsed-

Figure 1. Reported Foodborne Disease Outbreaks, Tennessee, 1993-2005.

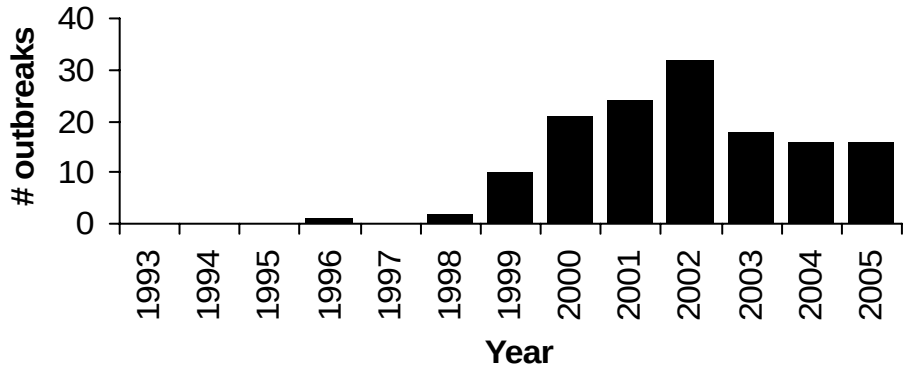
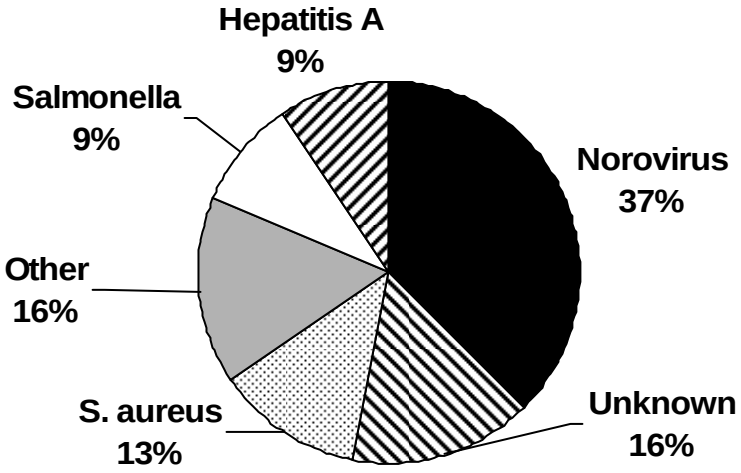


Table. Reported Foodborne Disease Outbreaks, Tennessee, 2004-2005.

ONSET	COUNTY	# ILL	ETIOLOGY	SITE	SUSPECTED VEHICLE
1/29/2004	Madison	23	Norovirus	Prison	Unknown
2/4/2004	Sullivan	37	Norovirus	Workplace	Unknown
4/23/2004	Carter	3	Norovirus	Restaurant	Unknown
5/24/2004	Blount	13	Cyclospora	Private home	Basil
6/1/2004	Hamilton	26	Bacillus cereus	Restaurant	Fried rice
6/7/2004	Davidson	3	S. Heidelberg	Restaurant	Egg custard
6/20/2004	Henderson	15	Norovirus	Picnic	Unknown
7/15/2004	Knox	41	Norovirus	Restaurant	Iceberg lettuce
8/22/2004	Davidson	30	Staph aureus	Restaurant	Tres leches cake
10/1/2004	Shelby	19	Unknown	Catered event	Turkey
10/29/2004	Hardin	20	Unknown	Restaurant	Salad bar
11/18/2004	Hardeman	36	Staph aureus	Restaurant	Turkey/dsg/gravy
11/23/2004	Knox	6	Giardia	Workplace	Chicken salad
12/1/2004	Davidson	6	Yersinia	Community	Chitterlings
12/12/2004	Cumberland	30	Norovirus	Church	Unknown
12/28/2004	Tipton	16	Norovirus	Restaurant	Unknown
2/4/2005	Shelby	30	S. Enteritidis	Restaurant	Unknown
3/3/2005	Campbell, Anderson	23	Hepatitis A	Restaurant	Tomatoes
3/14/2005	Sumner	14	Norovirus G2	Restaurant	Unknown
4/4/2005	Cocke	16	Staph (suspected)	Potluck	Unknown
5/4/2005	Blount	113	Norovirus G1	School	Unknown
5/15/2005	Madison	18	Norovirus G1	Catered party	Multiple foods
5/23/2005	Rutherford	6	Hepatitis A	Restaurant	Tomatoes
5/24/2005	Putnam	33	Unknown	Cafeteria	Unknown
6/12/2005	Davidson	8	Unknown	Restaurant	Unknown
7/14/2005	Putnam	2	E. coli O157:H7	Private Home	Hamburger
7/30/2005	Knox	50	Staph aureus	Catered event	Bar-b-que
8/1/2005	Hamilton	18	S.Heidelberg	Restaurant	Unknown
8/28/2005	Hamilton	5	Hepatitis A	Restaurant	Oysters
11/4/2005	Hardin	11	Norovirus G1	Restaurant	Unknown
11/17/2005	Anderson	100	Unknown	School	Unknown
12/20/2005	Rutherford	15	Norovirus G1	Workplace	Unknown

field gel electrophoresis (PFGE) to determine relatedness of bacteial 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 etiology in foodborne disease outbreaks. In 2004-2005, over 80% of reported foodborne disease outbreaks had a laboratory-confirmed etiology identified compared to a national average of only about one-third of outbreaks with a confirmed etiology.

Figure 2. Etiology of Reported Foodborne Disease Outbreaks, Tennessee, 2004-2005.



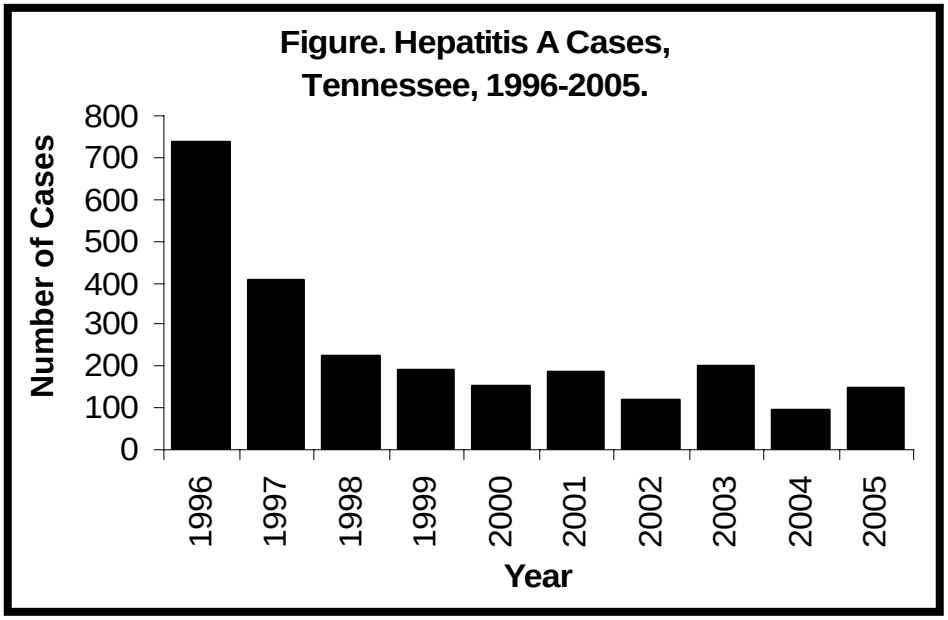
B. Hepatitis

May 2005 — During a foodborne outbreak of Hepatitis A, staff from the East Tennessee Regional office review the questionnaire they were to administer during their case-control study.

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 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 (i.e., the fecal-oral route). 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 Tennessee, an epidemic of hepatitis A occurred in 1995 in Shelby County where almost 1600 of the nearly 2000 cases occurred as shown in the **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 in 2004 or 2005 (96 cases and 149 cases, respectively).

Among cases of hepatitis A infection reported to the CDC, the identified source 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 other men, and the sharing of needles. 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 if one always washes their 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

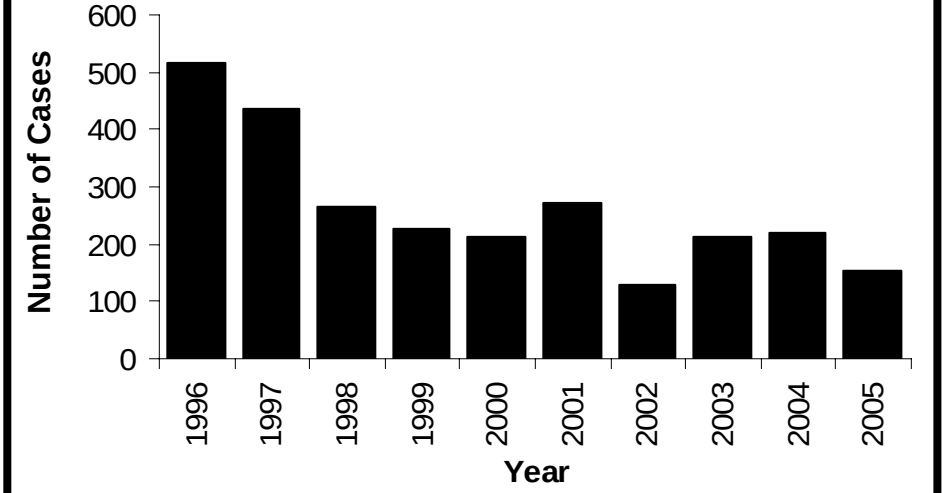
Vaqta. These two vaccines are approved for people 1 year of age and older. Twinrix, a hepatitis A/B combination vaccine, was recently approved by FDA for use in adults >18 years of age.

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.

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

Figure. Acute Hepatitis B Cases, Tennessee, 1996-2005.



Hepatitis B case reports for 2004 and 2005 (221 cases and 153 cases, respectively) combined in Tennessee are at about the same level as experienced in the years 2002 and 2003 combined 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.

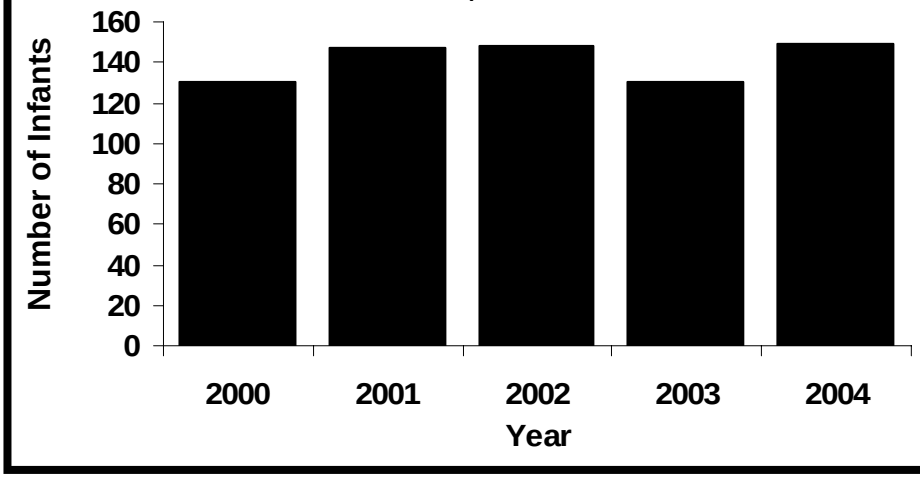
Hepatitis B vaccine, which has been available since 1982, is the best protection against HBV infection. Routine vaccination of 0–18 year olds and vaccination of risk groups of all ages is recommended. The number of new infections per year in the United States has declined from an average of 260,000 in the 1980s to about 74,000 in 2003. The highest rate of disease occurs in 20–49 year olds with the greatest decline among children and adolescents due to routine hepatitis B vaccination. Approximately 1.25 million Americans are chronically infected with HBV of 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, 2000-2004.



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.

Hepatitis C

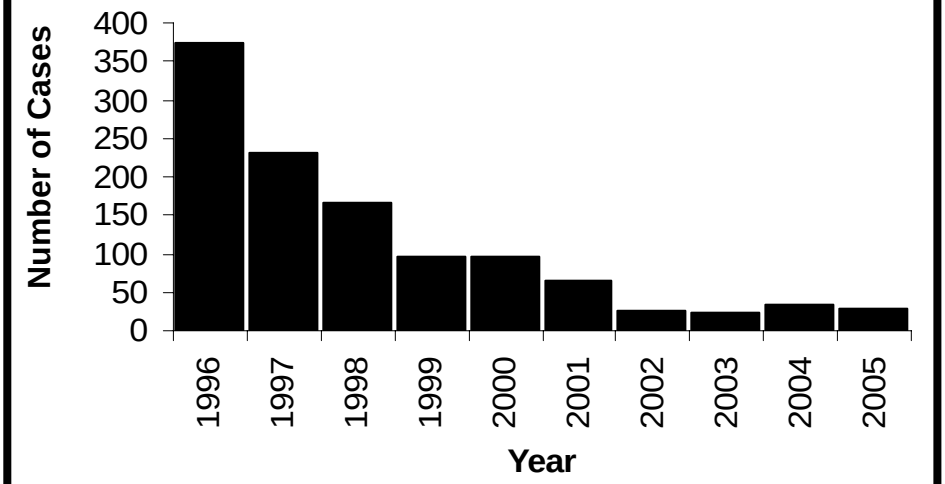
Hepatitis C virus (HCV) is a small, single-stranded RNA virus and is a member of the Flavivirus family. Multiple HCV genotypes and subtypes exist. The signs and symptoms of HCV infection are indistinguishable from those of hepatitis A or B. Acute HCV disease tends to be mild and insidious in onset, and most infections are asymptomatic. 80% 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 60–70% of infected adults, limited data indicate that <10% of infected children develop chronic hepatitis, and <5% develop cirrhosis. Infection with HCV is the leading reason for liver transplantation among adults in the United States. In Tennessee during 2004 and 2005, there were 35 and 28 cases respectively of acute HCV reported as shown in the **figure.**

The prevalence of HCV infection in the general population of the United States is approximately 1.8%. The seroprevalence is 0.2% for children 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.

Figure. Acute Hepatitis C, Tennessee 1996-2005.



C. Meningitis/Encephalitis and Septicemia

April 2005 — Drs. John Dunn and Rand Carpenter as they prepare to distribute oral rabies vaccine by hand in northeast Tennessee.

Source: Tennessee Department of Health

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.

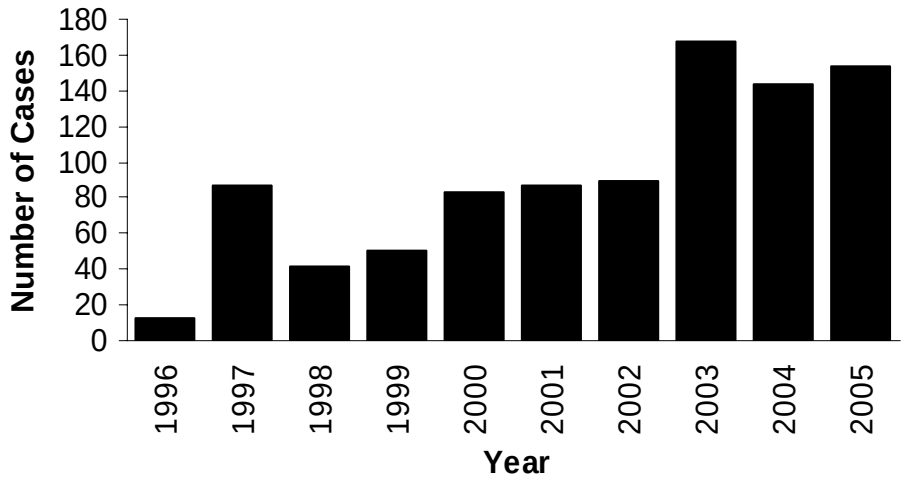
Under the auspices of ABCs, a number of studies have been undertaken to reach some of the objectives listed above. An assessment of the effectiveness of current prenatal group B strep-

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

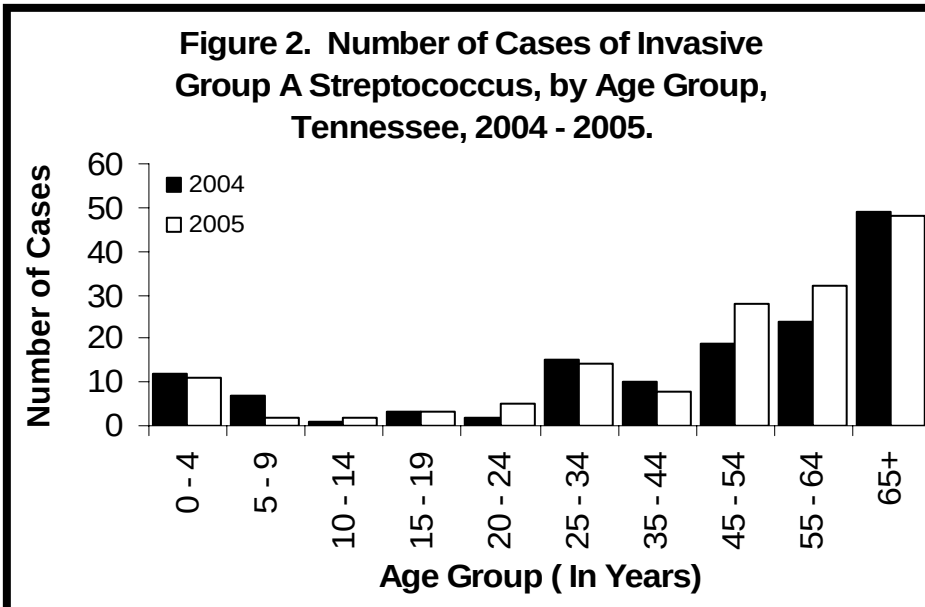
Reporting of group A streptococcal disease (GAS) began in 1996 in Tennessee. Case reports increased dramatically from 1999 to 2000 and again from 2002 to 2003. Since 2003, rates have remained fairly stable (**Figure 1**). Both the 2004 and 2005 Tennessee GAS rates (2.4 cases per 100,000 persons and 2.5 cases per 100,000 persons respectively) were lower than the 2004 United States rate of 3.4 cases per 100,000 persons.

Figure 1. Number of Cases of Invasive Group A Streptococcus, Tennessee, 1996-2005.



Tennessee data indicate that GAS cases were most frequent in persons aged 65 and over (6.7 cases per 100,000 persons in 2004 and 6.5 cases per 100,000 persons in 2005) (**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 from 2004 to 2005 for the oldest age group.

Figure 2. Number of Cases of Invasive Group A Streptococcus, by Age Group, Tennessee, 2004 - 2005.



GAS rates in the metro areas in 2004 ranged from 0 cases per 100,000 persons in Jackson/Madison County to Chattanooga/Hamilton County with a rate of 4.8 cases per 100,000 persons . In 2005, Jackson/Madison County held stable at 0 cases, while Chattanooga/Hamilton County's rate rose to 7.0 cases per 100,000 persons. Among the rural regions of Tennessee, the southeast region had the highest rate (4.6 cases per 100,000 persons) in 2004, while the east region reported the highest rate in 2005 (2.9 cases per 100,000).

Nationally, Streptococcal Toxic Shock Syndrome (STSS) and Necrotizing Fasciitis (NF) each accounted for approximately 6% and 8% 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. Whites and blacks had the same rate in 2004 (2.2 cases per 100,000 persons) while blacks showed a slight increase in 2005 (blacks 3.0 cases per 100,000 persons, whites 2.3 cases per 100,000 persons). There has been national passive surveillance for GAS invasive infection and STSS since 1995. Active laboratory-based surveillance for invasive GAS is currently conducted within the ten states that are participating in the Emerging Infection Program (total population: 29.7 million).

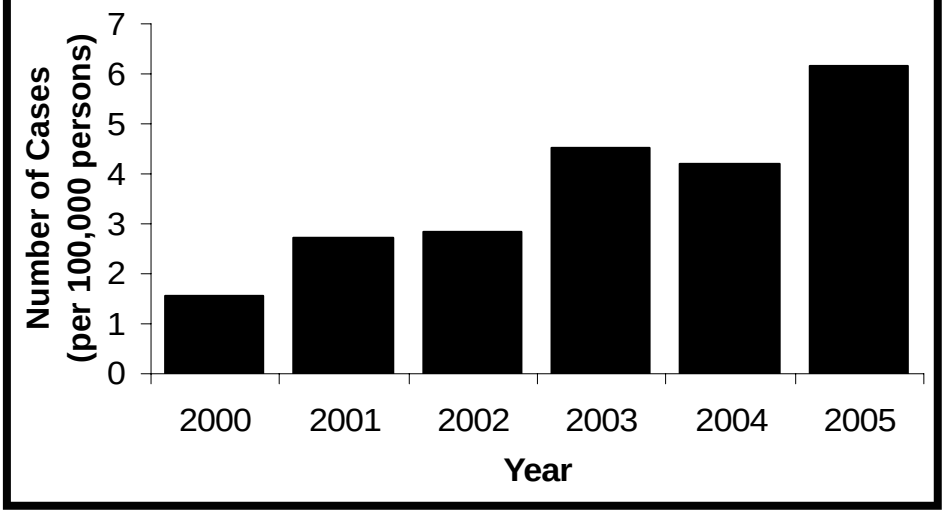
Worldwide, rates of GAS invasive disease, STSS and NF increased from the mid-1980s to early 1990s. Rates of invasive disease have been stable over the last 5 years throughout the United States. Increases in the rate and severity of GAS invasive disease are associated with increases in the prevalence 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 post-surgical 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 2004 and 2005, 247 and 368 were reported, for rates of 4.2 and 6.2 per 100,000 population, respectively **(Figure 1)**.

Figure 1. Incidence Rates of Group B Streptococcal Infection, Tennessee, 2004-2005.



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 and/or liver disease. Rates of disease in Tennessee are highest for those infants (<1 year old) (61.2 and 93.6 cases per 100,000 persons, in 2004 and 2005, respectively), followed by those age 65 years or older (12.3 and 16.4 cases per 100,000 persons, in 2004 and 2005) **(Figure 2)**.

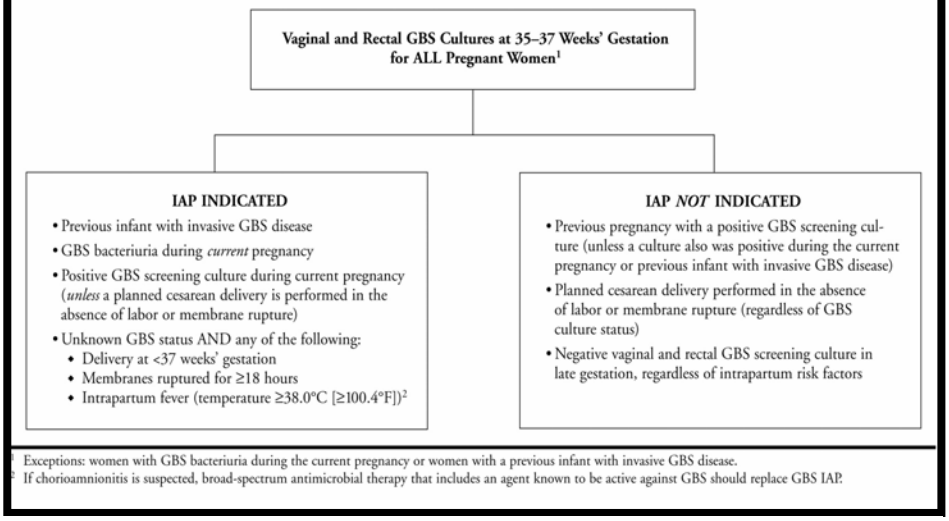
Infection in newborns is classified into two distinct categories: early-onset disease (0-6 days old) and late-onset disease (7-89 days old). Early-onset disease is characterized by sepsis, respiratory distress, apnea, shock and pneumonia. Early-onset infection is either acquired *in utero* or during delivery. Newborns delivered at less than 37 weeks gestation 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 123 GBS cases under the age of one year were reported in Tennessee in 2004-2005. Early-onset cases accounted for 13 (11%) of 123 cases under one year of age and late-onset disease accounted for 102 (83%) of 123 cases.

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.[1] Colonized women are then offered antibiotics at the time of labor (**Figure 3**). Increased surveillance and awareness may be partly responsible for the upsurge in incidence in 2005. Efforts have been made over the past year to improve physician awareness of the new guidelines statewide and to target areas with a history of lower screening rates. A follow up study of compliance with screening in pregnancy is currently underway in the four largest metropolitan areas of the state.[2] This effort to decrease GBS disease in infants complements the Department of Health campaign to lower infant mortality.

Figure 2. Incidence of Invasive Group B Streptococcal Infection, by Age Group, Tennessee, 2004-2005.

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.



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.

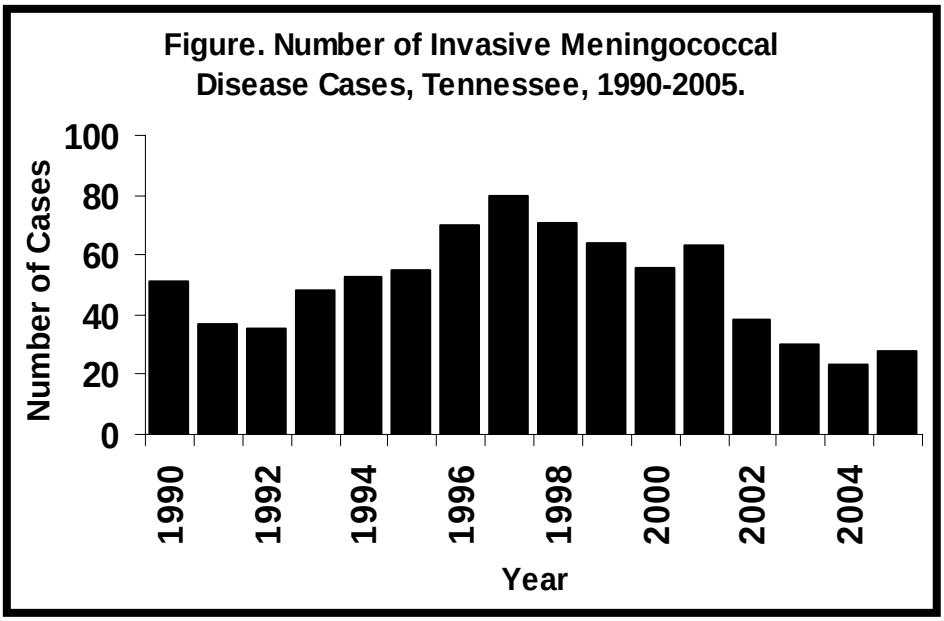
Transmission generally occurs through direct contact with respiratory secretions from a nasopharyngeal carrier. Risk groups include infants and young children (for endemic disease), refu-

[1]The Prevention of Invasive Group A Streptococcal Infections Workshop Participants. Prevention of invasive group A streptococcal disease among household contacts of case patients and among postpartum and post surgical patients: recommendations from the Centers for Disease Control and Prevention. *Clin Infect* Dis 2002; 35:950-959.

[2]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.

gees, 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 since 1990 has ranged from a low in 1992 of 36 cases to high in 1997 of 81 cases. Twenty-three cases (0.4 cases per 100,000 persons) were reported in 2004 and 28 (0.5 cases per 100,000 persons) in 2005 (**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. Eighteen and 25 isolates were sent to the Tennessee Department of Health Laboratory in 2004 and 2005 respectively. Of thirty-three isolates that were able to be serogrouped, serogroup B with 15 (46%) was most frequently identified. Nine (27%) were serogroup C, seven (21%) were serogroup Y and two (6%) were serogroup W135.

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.

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 (33 cases per 100,000 persons).

For statewide reporting (passive surveillance), 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.

The ABCs program has been conducting active surveillance for invasive MRSA in Davidson county hospitals for Davidson county residents since October 2004. ABC data for 2005

reveal that 25% of invasive MRSA occurred >48 hours following hospital admission. Most patients had healthcare related risk-factors (i.e., hospitalized in past year [70%], presence of an invasive device [48%], surgical procedure in past year [47%], resident of a long-term care facility in past year [33%], previous MRSA [14%], dialysis in past year [13%]. Only 13% had community-onset MRSA with no healthcare related risk-factors.

The incidence of MRSA increases dramatically with age (**Figure 1**). The incidence higher among blacks than whites (**Figure 1**), is highest in West and lowest in East Tennessee (**Figure 2**).

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.

Figure 1. Incidence of Invasive MRSA, by Race and Age, Tennessee, 2005.

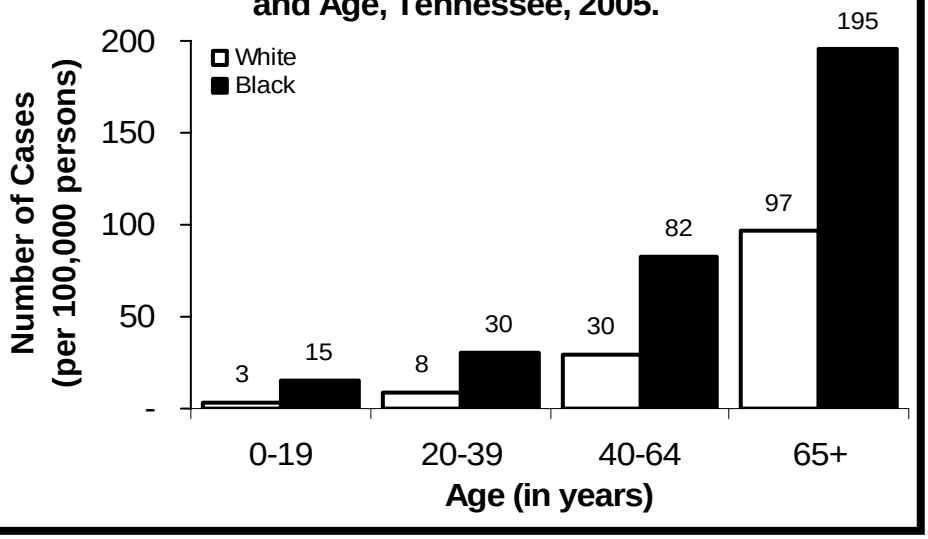
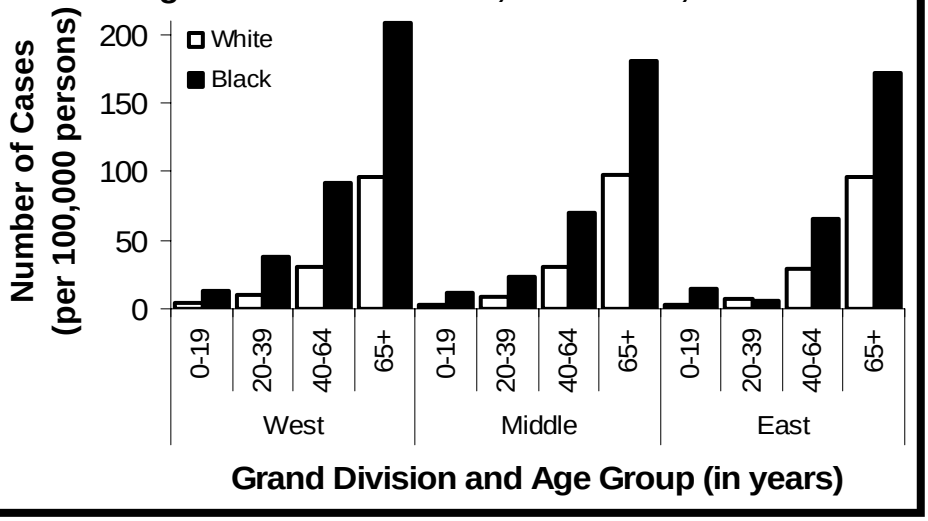


Figure 2. Incidence of Invasive MRSA by Race, Age and Grand Division, Tennessee, 2005.



Rabies

In 2004-2005, Tennessee had no human rabies cases and substantially fewer cases of animal rabies than in previous years. Although wildlife rabies occurs most commonly in Tennessee, domestic animal submissions account for the majority of brains tested by state laboratories. The recent emergence of raccoon variant rabies in northeast and southeast Tennessee is of great concern. The Tennessee Department of Health is continuing to work collaboratively with state and federal agencies to slow the westward 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.

Animal rabies cases (**Table**) declined more than 50% from 2003 (n=103) to 2004 (n=49), and remained low in 2005 (n=48). Historically, Tennessee has had sporadic cases of bat rabies, terrestrial rabies in skunks, and as of April 2003 raccoon variant rabies. Bat rabies cases are reported sporadically from various counties throughout the state and occur most commonly in the

Table. Animals Testing Positive for Rabies by Species, Tennessee, 1995-2005.

Species	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Skunk	82	80	135	127	79	88	98	76	74	27	23
Bat	7	12	8	5	10	15	11	27	15	11	16
Dog	3	6	3	6	5	3	2	2	3	1	1
Raccoon	0	0	0	0	0	0	0	1	4	8	4
Fox	4	1	1	1	1	0	0	1	2	1	3
Horse	1	1	2	1	0	0	0	0	4	0	1
Cattle	3	0	0	1	0	0	0	1	0	0	0
Cat	0	0	0	0	0	1	0	0	1	0	0
Goat	0	0	0	1	0	0	0	0	0	0	0
Opossum	0	0	0	0	0	0	0	0	0	1	0
Total	**100**	**100**	**149**	**142**	**95**	**107**	**111**	**108**	**103**	**49**	**48**

summer months. In 2004 and 2005, there were eleven and sixteen rabies-positive bats, respectively. Various rabies-positive bat species were reported. Skunk rabies is the predominate type of animal rabies in Tennessee. The striped skunk, *Mephitis mephitis*, transmits north-central skunk variant rabies in middle and northeastern Tennessee. The number of skunk rabies cases fluctuates from year-to-year possibly due to variation in skunk population density. In 2004 and 2005 combined, only fifty skunks were confirmed as being infected with rabies. This number is substantially less than in the previous nine years when the average number of rabid skunks exceeded ninety-three per year. Three cases of animal rabies occurred among domestic animals in 2004-2005. A rabid dog from Lincoln County was infected with north central skunk variant rabies in 2004. In 2005, a horse from Rutherford County and a dog from Greene County were also infected with north central skunk variant rabies.

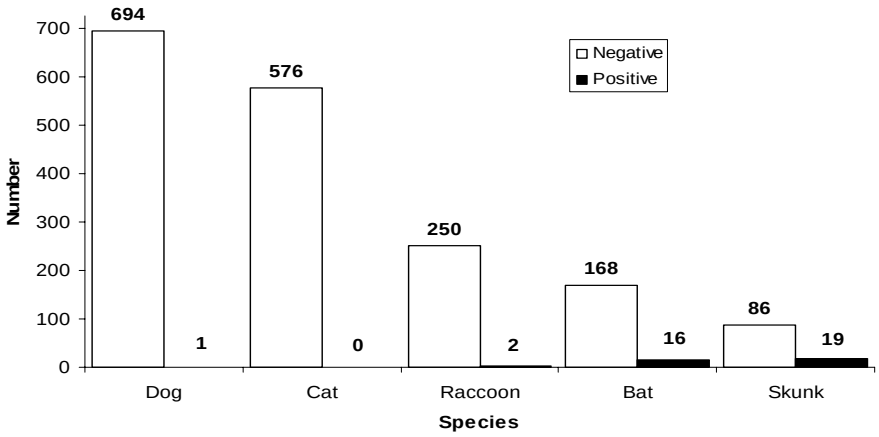
Following the first raccoon variant animal rabies cases in Carter and Johnson Counties in 2003, raccoon variant rabies emerged in Hamilton County in 2004. Animals infected with raccoon variant rabies in Hamilton County included seven raccoons, one skunk, one opossum, and one fox. No raccoon variant rabies cases were reported from northeast Tennessee in 2004. In 2005, only one raccoon variant rabies infected skunk was reported in Hamilton County. Seven raccoon variant rabies cases from 5 counties were reported in northeast Tennessee in 2005. Counties reporting a raccoon variant rabies infected animal included Johnson (one skunk), Carter (two raccoons), Washington (one raccoon), Unicoi (one fox, one cat), and Knox (1 fox). The rabid fox in Knox County was a substantial distance to the west from any previous raccoon variant rabies activity in Tennessee; it remains unclear if the animal was translocated or moved on its own from enzootic areas to the east. Since 2003, raccoon variant rabies cases have been confirmed in six Tennessee counties.

The Tennessee Department of Health completed a review of all animals submitted for rabies testing in 2005. Animals were submitted for testing to one of three public health laboratories in the state: Knoxville, Nashville, or Jackson. In 2005, there were 2,010 animals tested in state laboratories. Direct fluorescent antibody tests for rabies were negative on 1,937 (96%), forty-one (2%) were positive (USDA-WS enhanced surveillance ascertained seven additional positive animals for a total of forty-eight), and thirty-two (2%) animal submissions were unsatisfactory because the animal was decomposed or its brain parts were unidentifiable for testing. Although animal rabies in Tennessee is found mainly among wildlife, the vast majority of animal submissions were of domestic animals, especially dogs and cats (**Figure**). Most submissions came from larger metropolitan areas.

As mentioned, to slow the westward spread of raccoon rabies in Tennessee, the Tennessee Department of Health, along with USDA-WS and the Centers for Disease Control and Prevention (CDC) and other partners conduct a cooperative program that includes enhanced surveillance and an ORV program. In response to the emergence of raccoon variant rabies in Hamilton County, ORV campaigns were conducted in April and November 2004. Greater than 320,000 baits were dis-

tributed by ground and aerial crews in Hamilton County and seven surrounding counties. In August 2004, as part of the larger Appalachian Ridge ORV campaign, > 160,000 baits were distributed in seven northeastern Tennessee counties. In 2005, ORV campaigns were conducted in southeastern Tennessee in April and October (> 280,000 baits) and in northeastern Tennessee in August (>260,000 baits). Continued support from USDA-WS and other partners is needed to control the spread of raccoon rabies in Tennessee.

Figure. Animal Species and Rabies Testing Results, Top Five Species Submitted to TDH Laboratories, 2005



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 2004, there were 696 cases (12 cases per 100,000 persons) of pneumococcal disease seen across the state. In 2005, that number increased to 976 cases (16 cases per 100,000 persons).

As seen in **Figure 1,** the rate of invasive pneumococcal disease in young children has dropped significantly since the introduction of the pneumococcal conjugate vaccine (Prevnar®). Rates of invasive pneumococcal disease in the elderly have also decreased, but appear to be leveling off. (**Figure 1**).

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

Figure 1. Incidence of Invasive Pneumococcal Disease, by Year, Tennessee, 1995-2005.

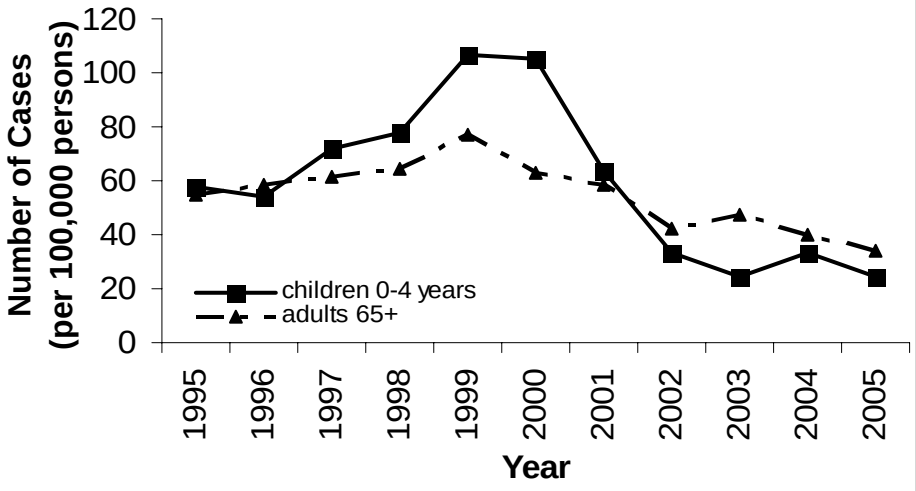
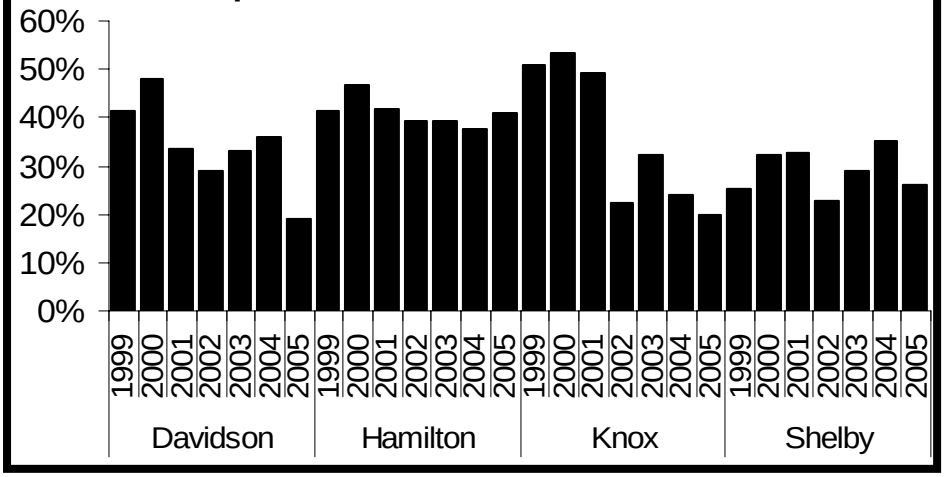


Figure 3. Appropriate Antibiotic Use Billboard Campaign.

Because of alarming rates of drug resistance in the late 1990's (**Figure 2**), the Tennessee Department of Health formed appropriate antibiotic use coalitions in Davidson and Knox counties with the aim to reduce inappropriate 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. During the 2004-5 influenza season, a billboard campaign (**Figure 3**) was conducted in Davidson and Knox counties. In addition, statewide messages on respiratory hygiene and appropriate antibiotic use were disseminated via radio.

Figure 2. Proportion of Invasive Pneumococcal Isolates Not Susceptible to Penicillin in Major Metropolitan Areas, Tennessee, 1999-2005.



D. Sexually Transmitted Diseases

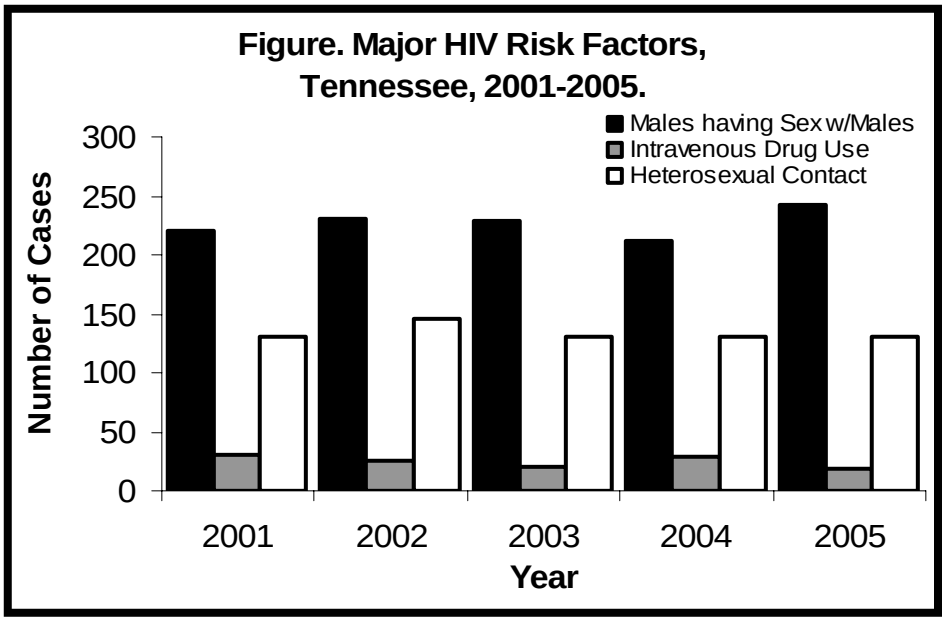
Staff from the Metropolitan Nashville/Davidson County Health Department volunteer their time to offer free STD and HIV testing to county residents at a local area park.

Source: Tennessee Department of Health

Human Immunodeficiency Virus (HIV)

Human Immunodeficiency Virus (HIV) has been a reportable disease in Tennessee since 1992. As of December 31, 2005, there have been 7,479 HIV cases reported to the State of Tennessee's HIV/AIDS/STD Section. The number of reported HIV/AIDS cases through 2005 was 19,372.

Since the beginning of HIV reporting in Tennessee, approximately 58% of all cases were among blacks and two-thirds were among males. The **figure** shows that the highest risk of HIV infection is among men having sex with men (MSM). The next most common risk factor occurs among people engaging in heterosexual activities with people infected with HIV/AIDS. Over the last five years, these three risk factors remain the most common way of spreading of HIV from person-to-person.

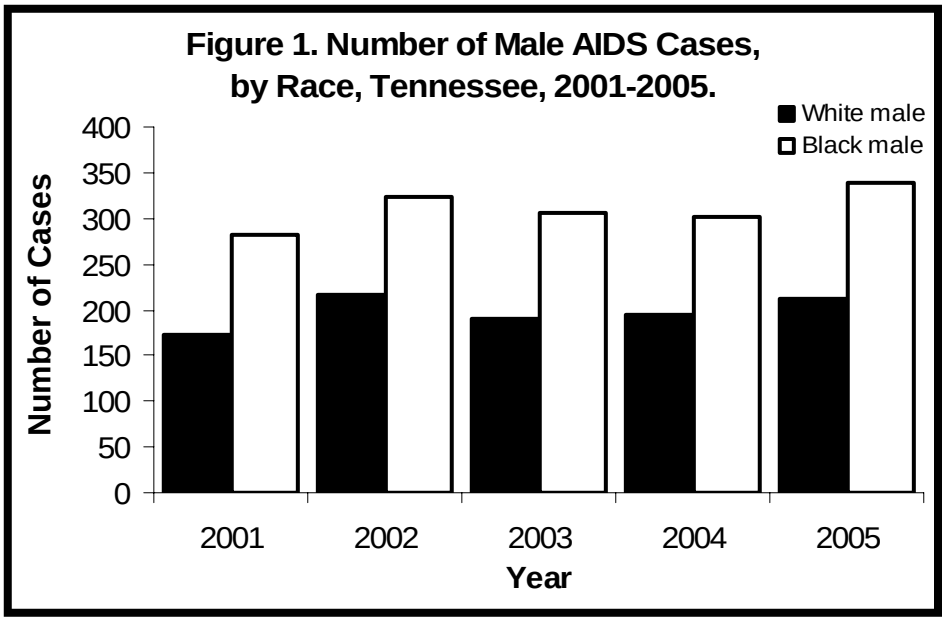


HIV rates per 100,000 persons within Tennessee's public health centers are: Northeast, 6.6; East, 5.4; Southeast, 6.4; Upper Cumberland, 3.1; Mid Cumberland, 6.8; South Central, 5.1; and West, 8.7. The Metropolitan rates are: Davidson, 34.3; Hamilton, 16.0 Knox, 13.1, Madison, 8.4; Shelby, 47.6 and Sullivan, 3.2. The overall state HIV incidence rate was 16.5.

Acquired Immunodeficiency Syndrome (AIDS)

The total number of AIDS cases reported from 1982 (the year AIDS data was first collected) through 2005 was 11,900. Since reporting began, the number of new cases of AIDS has decreased most significantly among whites. Overall, the number of reported cases of AIDS has remained stable since 2001.

Historically, males have had higher rates of AIDS than females. The number of AIDS cases among whites and blacks has remained consistent from 2001 through 2005. **Figures 1** and **2** depict the changes in the number of cases among males by race and among females by race, respectively.



In 2005, 809 new AIDS cases were reported in Tennessee. AIDS rates per 100,000 persons within Tennessee's public health regions are: East, 5.0; Southeast, 6.8; Middle, 4.3; and West, 7.8. The Metropolitan rates are:

Davidson, 30.0; Hamilton, 13.4 Knox, 9.3 Madison, 8.4; Shelby, 37.0 and Sullivan, 4.5. The overall state AIDS incidence rate per 100,000 persons in 2005 was 13.4.

Reported AIDS deaths among Tennessee residents totaled 94 persons. **Figure 3** includes individuals who had AIDS but may have died from other causes, such as, motor vehicle crashes, etc. Since reporting began, the total number of deaths among Tennessee residents reported as having AIDS is 5,940. Highly effective anti-retroviral therapy, as well as other advances in medical treatments, has greatly improved the quality of life among persons living with AIDS.

Figure 2. Number of Female AIDS Cases, by Race, Tennessee 2001-2005.

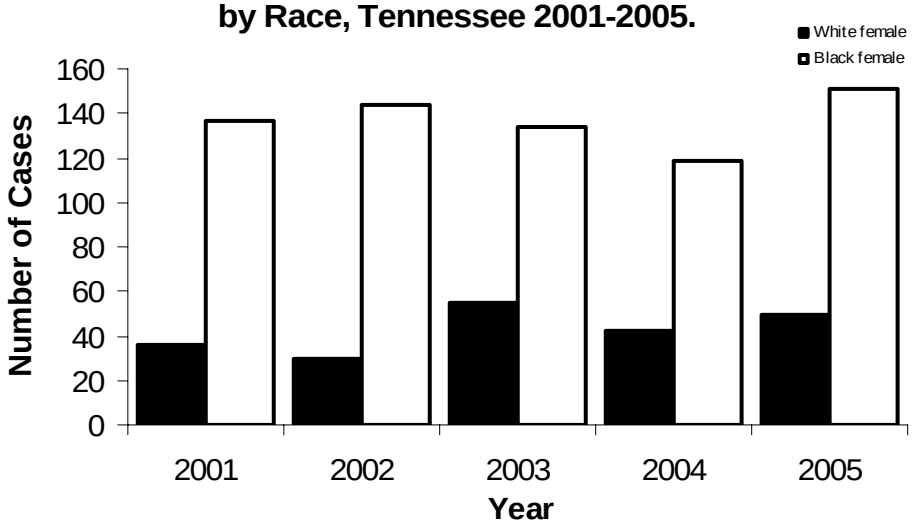
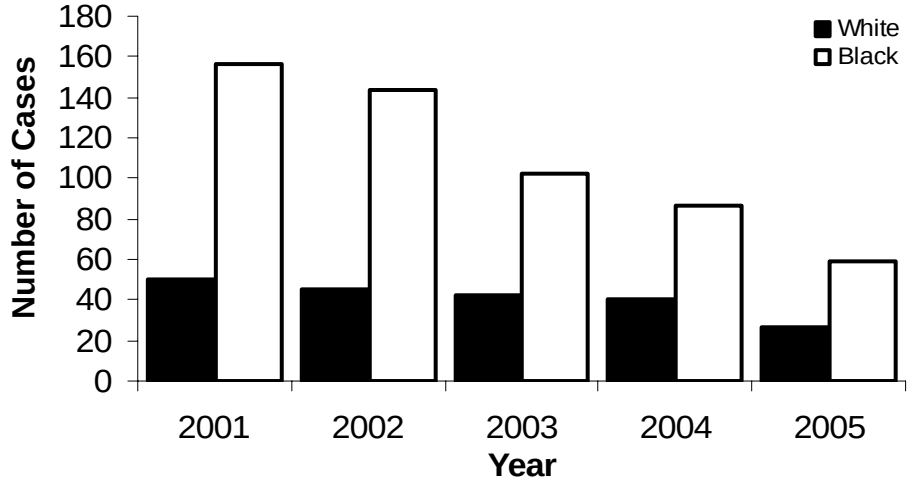


Figure 3. Number of AIDS Deaths, by Race, Tennessee, 2001-2005.



Pediatric HIV/AIDS Due to Perinatal Risk

Since 1992, 1,297 HIV perinatally exposed infants have been reported. As of 12/31/05, 127 infants were ultimately diagnosed with pediatric HIV, 77 were diagnosed with pediatric AIDS, and 749 infants initially born to HIV/AIDS infected mothers were found to be uninfected by the virus. Additional infants who were perinatally exposed to the AIDS or HIV virus may have gone uncounted due to reporting delays of these cases. Improved interventions, including anti-retroviral agents used during pregnancy and labor and medical care for women and their newborns has greatly decreased the chances of exposed infants developing HIV or AIDS.

Chlamydia

Infections due to *Chlamydia trachomatis* are among the most prevalent of all sexually transmitted diseases (STD). In women, these infections, if left untreated, often result in pelvic inflammatory disease, which can cause infertility, ectopic pregnancy and chronic pain. In addition, pregnant women may also pass on infection to their babies during vaginal delivery. *Chlamydia* became reportable in Tennessee in July 1987. 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 2005 increased to 23,041.

Figure 1. Incidence of *Chlamydia trachomatis*, by Gender and Race, Tennessee, 2005.

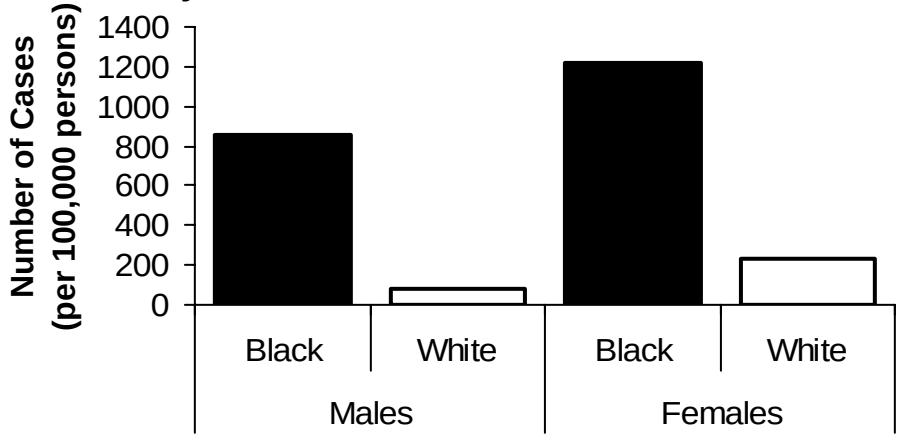
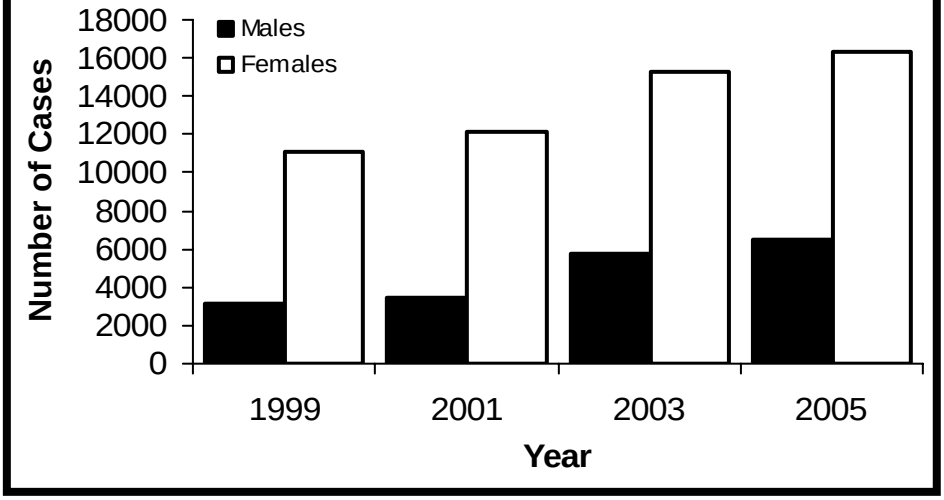


Figure 2. Number of Cases of *Chlamydia trachomatis*, by Gender, Tennessee, 1999-2005.



In 2005, 87% of *Chlamydia* morbidity occurred among patients aged 15-19 years (8,375) and 20-29 years (11,699). Females comprised 71% 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, 40% percent of female morbidity was reported among blacks and 35% among whites, while 23% had no race category identified. There were 856 cases per 100,000 persons among black males and 80 cases per 100,000 persons among white males with *Chlamydia* in 2005. There were also 1217 cases per 100,000 population among black females and 230 cases per 100,000 persons among white females with *Chlamydia* (**Figure 2**). Black females aged 20-29 years have the highest rate of infection with 3,453 cases per 100,000 persons. Moreover, screenings of just over 95,694 patients for *Chlamydia* in health department STD, prenatal and family planning clinics, in 2005, resulted in a range of 9% to 17% positivity rates in metropolitan areas and 6% to 11% positivity rates in rural areas. The overall statewide screening positivity rate for *Chlamydia* increased from 7% in 2002 to 11% in 2005. The increase can be attributed to more sensitive laboratory testing methods implemented in February 2003.

Gonorrhea

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

Figure 1. Number of Cases of *Neisseria gonorrhoeae* , by Gender, Tennessee, 1999-2005.

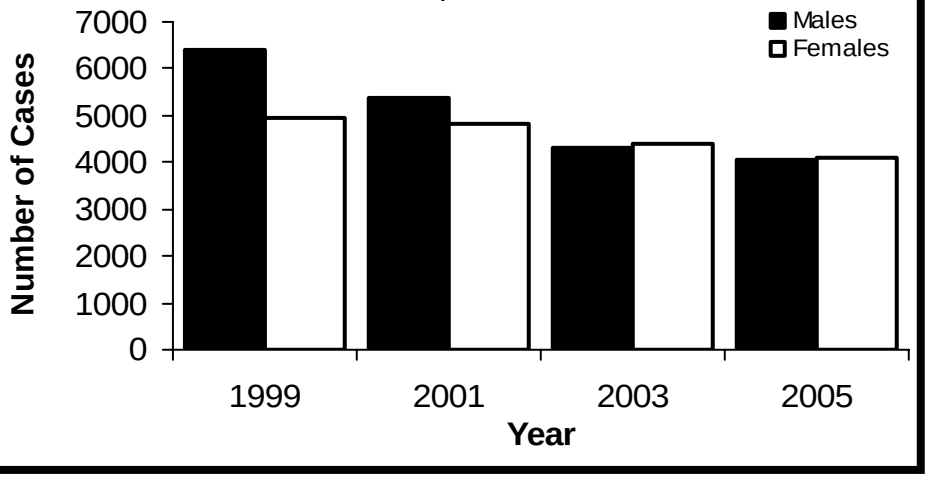
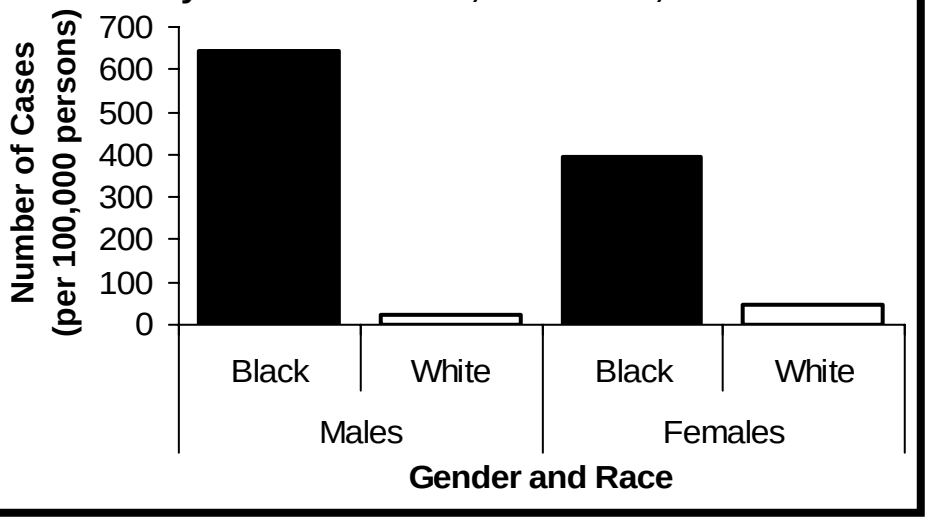


Figure 2. Incidence of *Neisseria gonorrhoeae* , by Gender and Race, Tennessee, 2005.



Following a record high of 35,362 Gonorrhea cases reported in 1976 (rate=817 cases per 100,000 persons), the number decreased by 76% to 8,619 cases in 2005 (rate=145 cases per 100,000 persons). In 2005, there were 4,038 reported cases of Gonorrhea among males and 4,089 reported cases among females (**Figure 1**). The metropolitan regions of the state have consistently accounted for 75% of the state's morbidity during this time period. In 2005, 60% of all reported cases of Gonorrhea in Tennessee were among blacks. Additionally, there were 643 cases per 100,000 persons among black males and 25 cases per 100,000 persons among white males with Gonorrhea in 2005. There were also 394 cases per 100,000 persons among black females and 46 cases per 100,000 perspns among white females with Gonorrhea (**Figure 2**). 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 145 per 100,000 persons was well above the *Healthy People 2010* national goal of 19.

In 2005, women aged 15-19 had higher rates of Gonorrhea (732 cases per 100,000 persons) than women aged 20-29 (475 cases per 100,000 persons). The rate of Gonorrhea in men aged 20-29 was 469 cases per 100,000 persons in 2005. Additionally, screening approximately 95,805 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.

Figure 1. Number of Cases of Early Syphilis, Tennessee, 1999-2005.

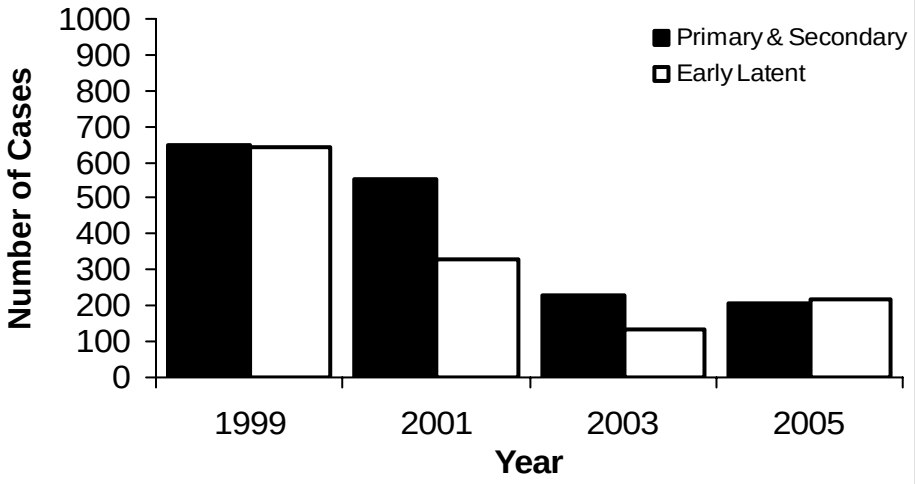
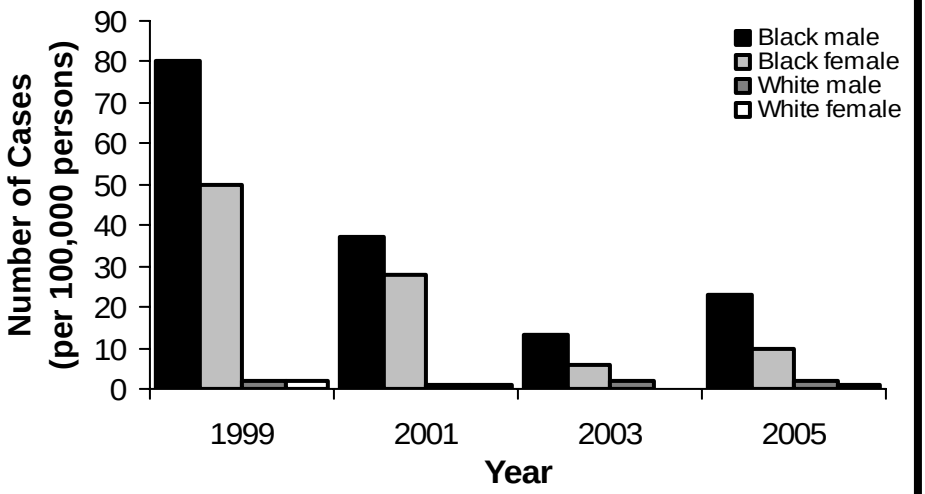


Figure 2. Incidence of Primary and Secondary Syphilis, Tennessee, 1999-2005.



Historically, most Syphilis cases in Tennessee occur in the large metropolitan areas. The six Tennessee metropolitan regions collectively represent 42% of the state's population; however, they account for 88% of 422 cases of early Syphilis (primary, secondary and early latent) cases in 2005 **(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 2005, two metropolitan areas, Shelby County and Davidson County, reported 287 and 43 cases, respectively, or 78% of the state's total Syphilis cases. The seven remaining rural regions comprise 58% of the state's population but accounted for only 12% of the early Syphilis cases in 2005.

Early Syphilis cases are slightly 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 76% of reported early Syphilis cases. In 2005, the rate for early Syphilis within Tennessee was 7 cases per 100,000 persons; the rate for blacks was 33. When looking at primary and secondary Syphilis, the rate among white males was 2 cases per 100,000 persons, and the rate among white females was 1 case per 100,000 persons. Furthermore, the rate was 23 cases per 100,000 persons among black males and 10 cases per 100,000 perdn among black females **(Figure 2)**. In 2000, the overall Syphi-

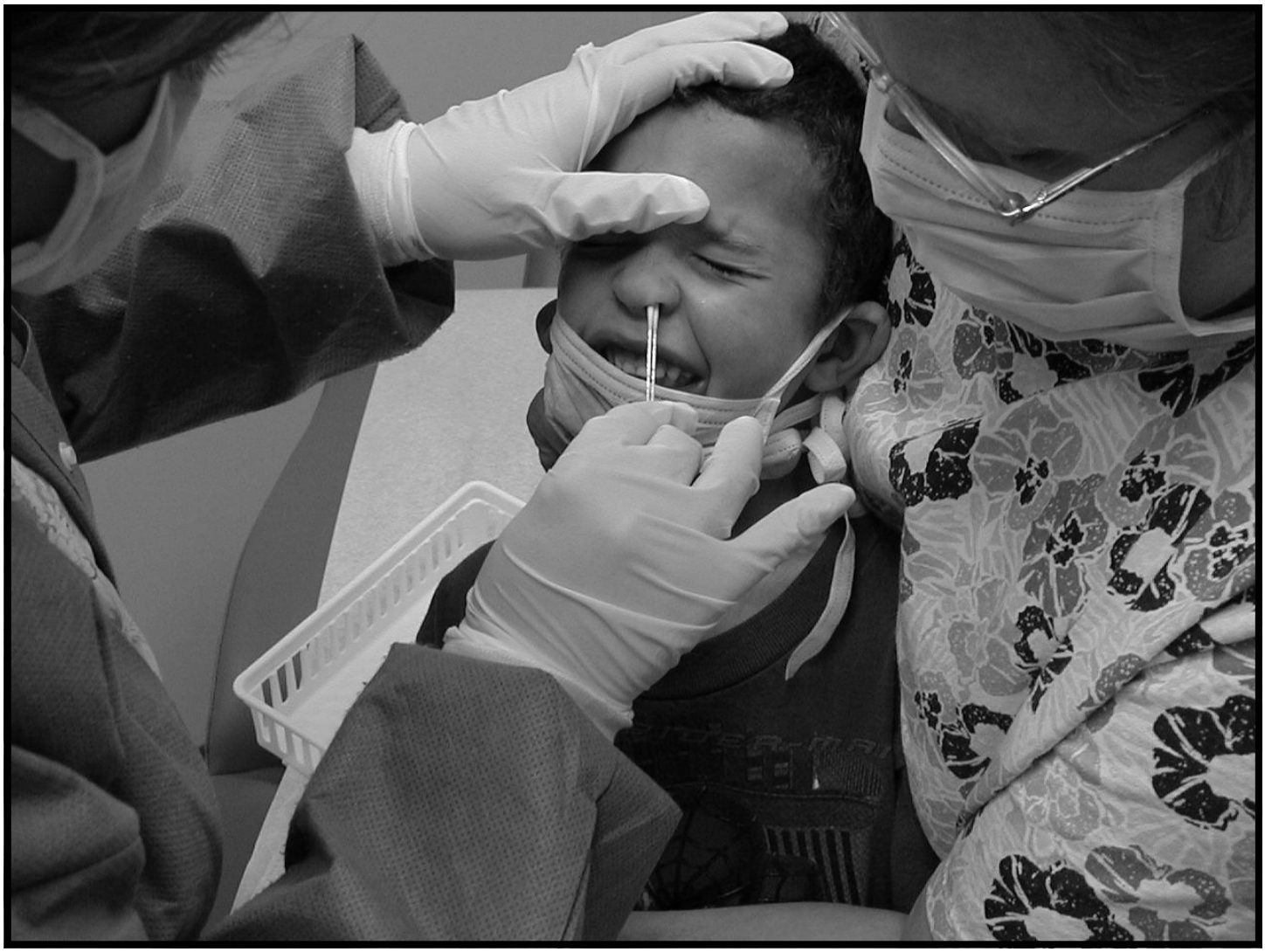
lis rate was 30 cases per 100,000 persons. However, in 2005, the overall Syphilis rate was 16 cases per 100,000 persons. This represents a 46.6% decrease during this time frame. Among blacks, the overall Syphilis rate was 152 cases per 100,000 persons in 2000, and 70 cases per 100,000 persons in 2005. This represents a 54% decrease for blacks during this time. In 2000, blacks aged 20-29 years and 30-39 years had rates of 45 and 48 cases per 100,000 persons, respectively. By 2005, the rate for the age group of 20-29 years had fallen to 29 cases per 100,000 persons, representing a 36% decrease. Additionally, the rate for the age group of 30-39 years had fallen to 32 cases per 100,000 persons, representing a 33% decrease in 2005.

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 2005, 217 cases were diagnosed with primary or secondary Syphilis, 205 with early latent (less than one year) Syphilis, 359 were late or latent cases and 19 were congenital cases. Statewide, the 217 primary and secondary cases combined represent a rate of 3.6 cases per 100,000 persons. This is greater than, but within reach of, the Healthy People 2010 national objective of 0.2 cases per 100,000 persons.

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

E. Vaccine-Preventable Diseases



June 2004 — During an outbreak of pertussis, staff from the Robertson County Health Department and Mid-Cumberland Regional office help collect nasopharyngeal swabs from suspect cases and their contacts.

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 2005.

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 since 2000 and more detailed results of the 2005 surveys are presented below (**Figures 1-3**).

Table 1. Vaccine-Preventable Disease Morbidity, Tennessee, 2003-2005.

Disease	Pertussis	Diphtheria	Tetanus	Polio	Measles	Mumps	Rubella	Hepatitis B	*H. influenza* type b <5 yo
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

Table 2. Immunization Survey Results, Tennessee, 2005.

Survey	Immunization Level
24-Month-Old Children*	81.20%
Day Care Center Enrollees**	90.80%
Public Kindergarten Survey**	97.50%
Private Kindergarten Survey**	98.30%

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

** Compliance with State Legal Immunization Requirements

Figure 1. 2005 Tennessee Immunization Survey of 24-Month-Old Children: Percent with Age-Appropriate Immunization Levels by Vaccine.

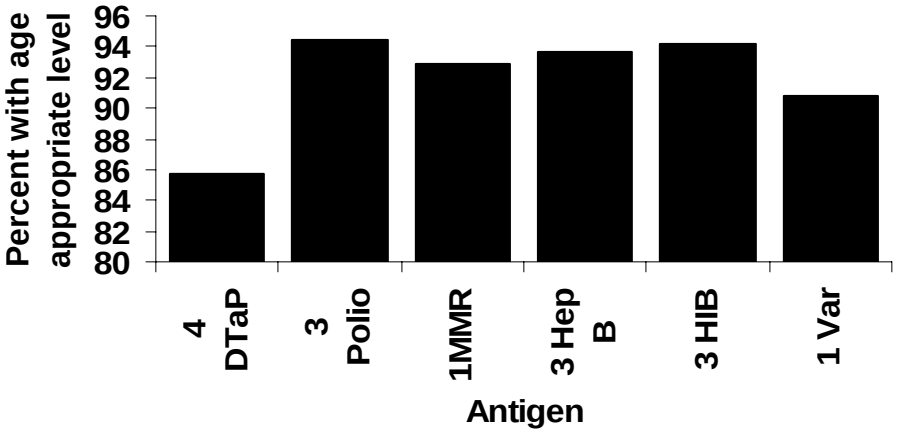


Figure 2. 2005 Tennessee Immunization Survey of 24-Month-Old Children: "4:3:1" & "4:3:1:3:3:1" Percent Immunized on Time: 2000-2005.

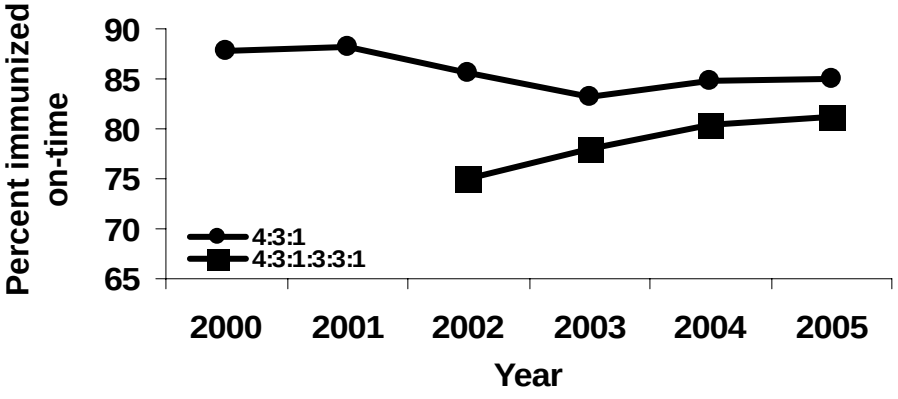
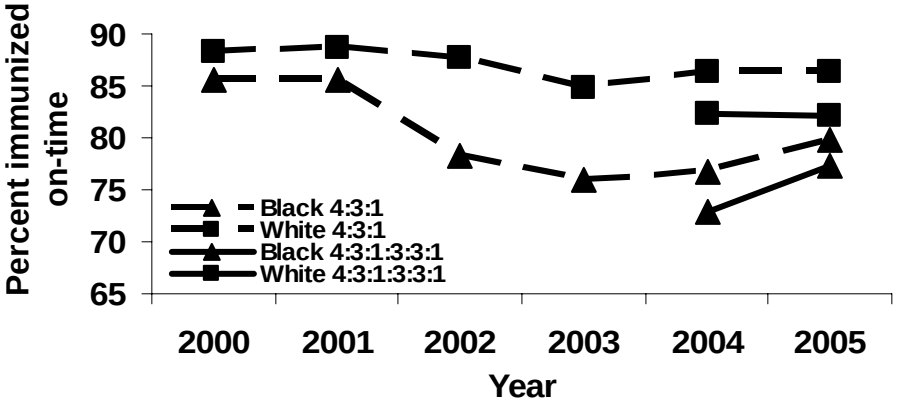


Figure 3. 2005 Tennessee Immunization Survey of 24-Month-Old Children: Trends in on-time immunization disparities (Black vs. White): 2000-2005.



Inferences from the 2005 Survey:

The 2005 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 2005 survey include:

a. The 4:3:1:3:3:1 on-time level has increased 0.7 percentage points from 2004 to 81.2%.

b. Assessed individually, all antigens are in excess of 90% on-time coverage, except DTaP 4. The DTaP 4 level is the sole barrier to achieving the statewide goal of 90% on-time coverage for each vaccine in the 4:3:1:3:3:1 series.

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: 35.0% compared to 22.3% in private practices.

d. Series complete levels for TennCare enrollees have improved and were essentially equivalent to non-TennCare enrollees, with a point estimate less than 1 percentage point lower.

e. On-time immunization rates of WIC-enrolled children were equivalent to 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 4.8 percentage points, which is comparable to pre-2002 gaps.

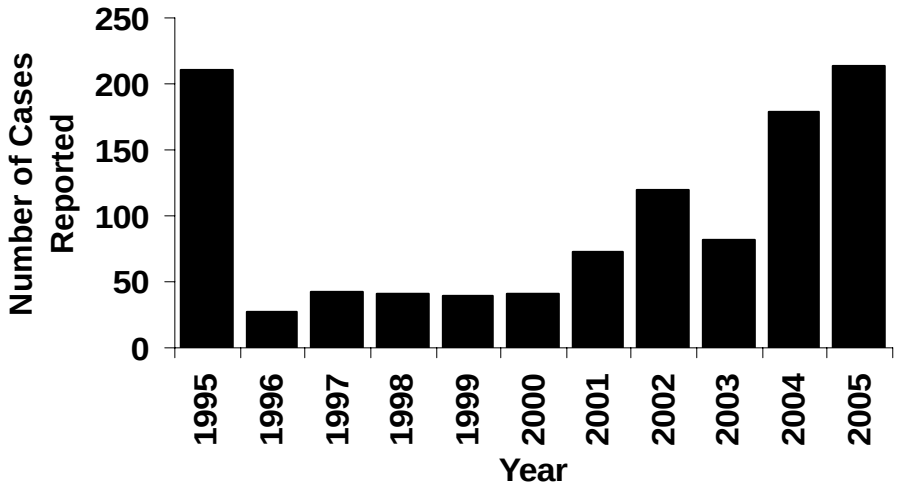
g. The proportion of children receiving all immunizations in private practice clinics continues to grow.

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.

Figure. Number of Cases of Pertussis Reported in Tennessee, 1995-2005.



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 1995 to 2003 in Tennessee.

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, "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.

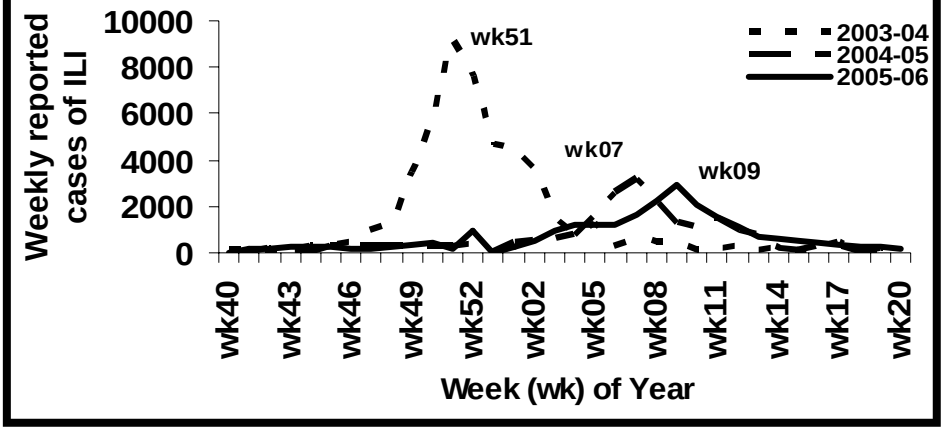
Complications of tetanus include the following: laryngospasms; fractures of the long bones; hyperactivity of the autonomic nervous system; secondary infections, such as sepsis, pneumonia, decubitus ulcers (due to long hospitalizations, in-dwelling catheters, etc.) and aspiration pneumonias. The fatality 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 3 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 2002-3, 2003-4, and 2004-5 influenza seasons. 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.

Recommended Childhood and Adolescent Immunization Schedule UNITED STATES • 2005

Age ▶ / Vaccine ▼	Birth	1 month	2 months	4 months	6 months	12 months	15 months	18 months	24 months	4–6 years	11–12 years	13–18 years
Hepatitis B[1]	HepB #1	HepB #2			HepB #3				HepB Series			
Diphtheria, Tetanus, Pertussis[2]			DTaP	DTaP	DTaP		DTaP			DTaP	Td	Td
Haemophilus influenzae type b[3]			Hib	Hib	Hib	Hib						
Inactivated Poliovirus			IPV	IPV	IPV					IPV		
Measles, Mumps, Rubella[4]						MMR #1				MMR #2	MMR #2	
Varicella[5]						Varicella			Varicella			
Pneumococcal[6]			PCV	PCV	PCV	PCV			PCV	PPV		
Influenza[7]					Influenza (Yearly)				Influenza (Yearly)			
Vaccines below red line are for selected populations												
Hepatitis A[8]									Hepatitis A Series			

This schedule indicates the recommended ages for routine administration of currently licensed childhood vaccines, as of December 1, 2004, 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.

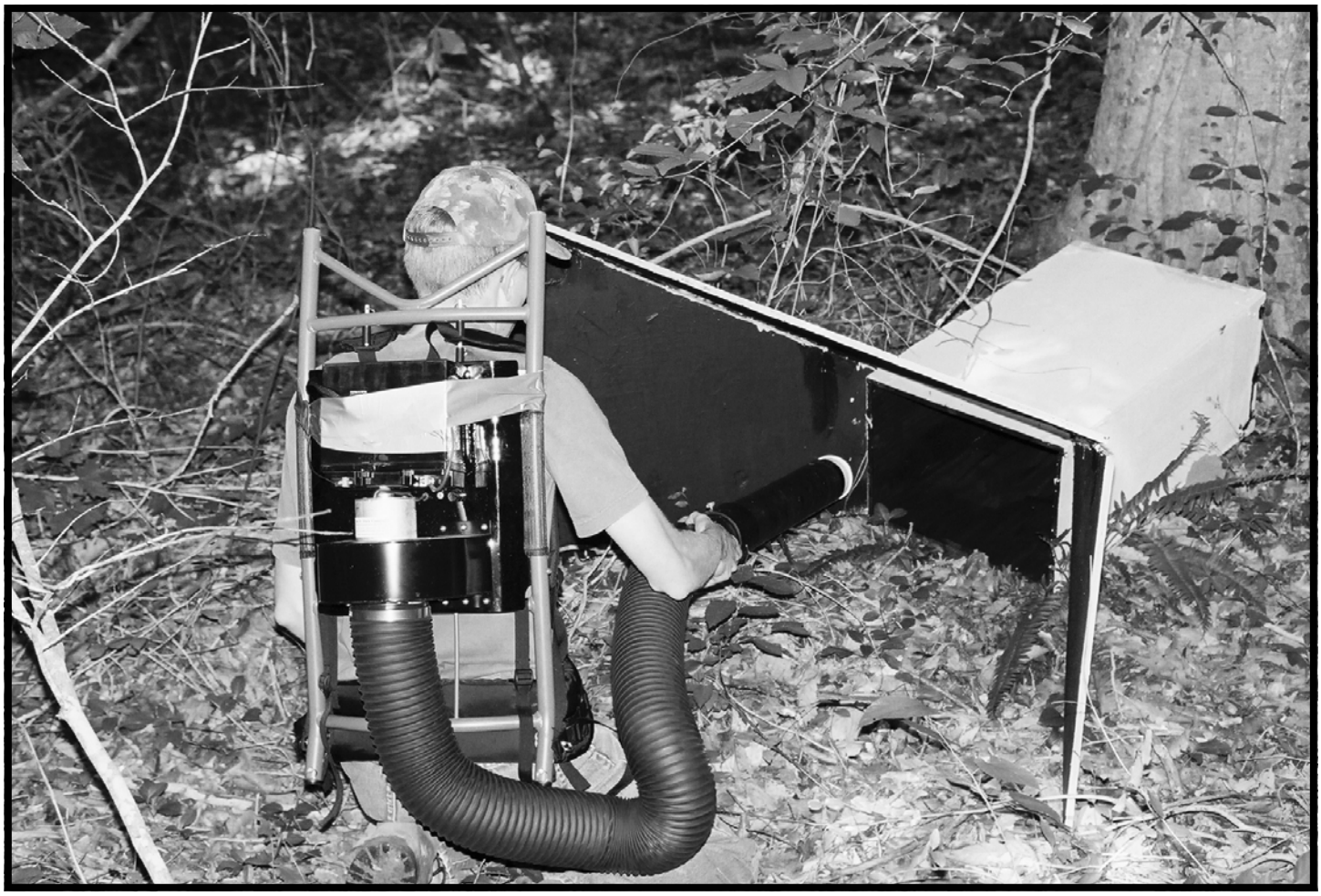
Indicates age groups that warrant special effort to administer those vaccines not previously administered. Additional vaccines may be licensed and recommended during the year. Licensed combination vaccines may be used whenever any components of the combination are indicated and other components of the vaccine are not contraindicated. Providers should consult the manufacturers' package inserts for detailed recommendations. Clinically significant adverse events that follow immunization should be reported to the Vaccine Adverse Event Reporting System (VAERS). Guidance about how to obtain and complete a VAERS form are available at www.vaers.org or by telephone, 800-822-7967.

Range of recommended ages
Only if mother HBsAg(–)
Preadolescent assessment
Catch-up immunization

DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

The Childhood and Adolescent Immunization Schedule is approved by:
Advisory Committee on Immunization Practices www.cdc.gov/nip/acip
American Academy of Pediatrics www.aap.org
American Academy of Family Physicians www.aafp.org

F. Vectorborne Diseases



In response to a 2005 outbreak of eastern equine encephalitis in West Tennessee, Tennessee Department of Health staff and student interns from Union University in Jackson, Tennessee, used a variety of mosquito traps including mosquito resting boxes to catch mosquitoes for virus and host blood meal identification.

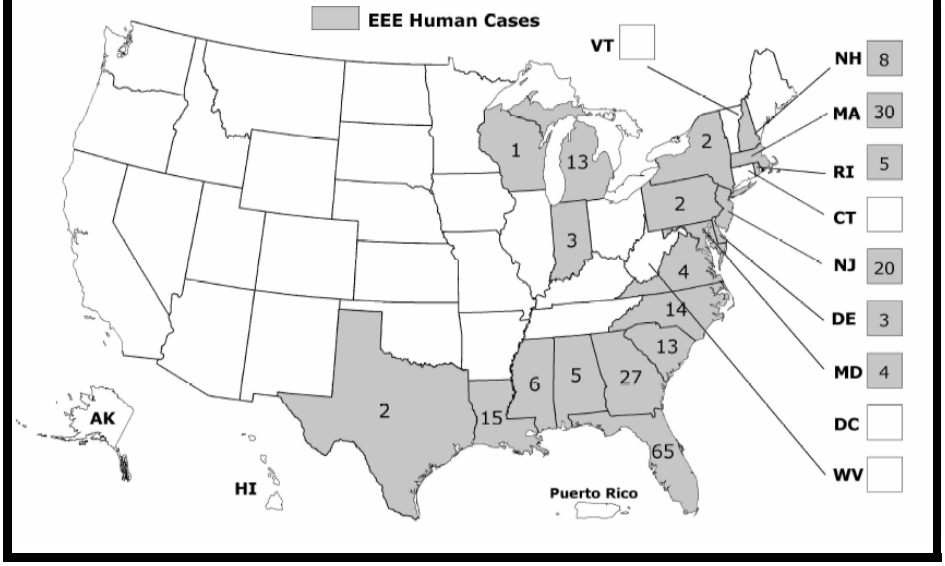
Source: Tennessee Department of Health

Arboviral Diseases

Eastern Equine Encephalitis (EEE)

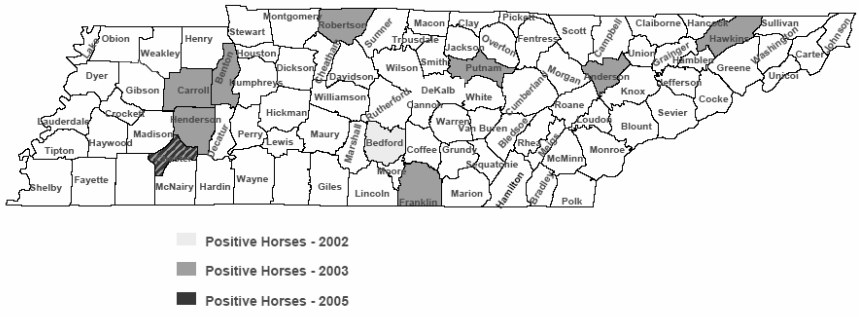
Eastern equine encephalitis (EEE) is caused by EEE virus which is transmitted by mosquitoes throughout the Americas. In North America, the distribution of EEE virus coincides with its enzootic vector, *Culiseta melanura*, principally along the Atlantic and Gulf coasts. EEE virus circulates in swampy coastal areas where *Culiseta melanura* feeds on wild birds. Inland foci have also been documented in New York, Wisconsin, Michigan, South Dakota, Minnesota, Ohio, Mississippi, Alabama and Tennessee (**Figure 1**). Humans and horses are affected when EEE "spills over" from swamp habitats through bridge vectors that feed on both birds and mammals.

Figure 1. Human Eastern Equine Encephalitis Cases, by State, 1964-2005.



Outbreaks of human disease in the United States are usually small, but have severe consequences including seizures, coma and death. The case-fatality rate ranges from 35-90% and survivors often have persistent neurological deficits. Equine epizootics, with case-fatality rates approaching 90%, serve as sentinels for increased risk to humans from EEE virus. In Tennessee, equine epizootics occur periodically across the state. Figure 2 shows the distribution of EEE horse cases from 2002-2005.

Figure 2. Distribution of EEE horse cases in Tennessee from 2002 to 2005.



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.

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

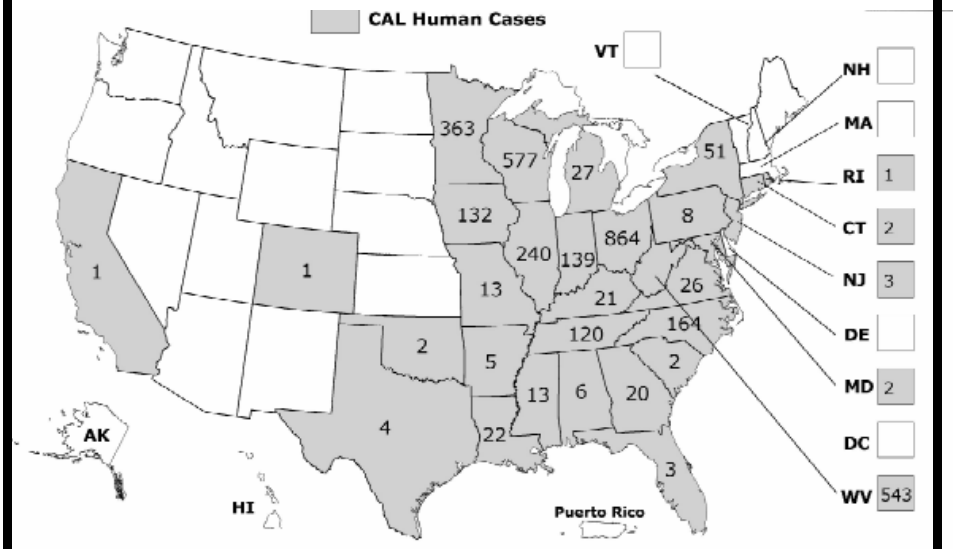
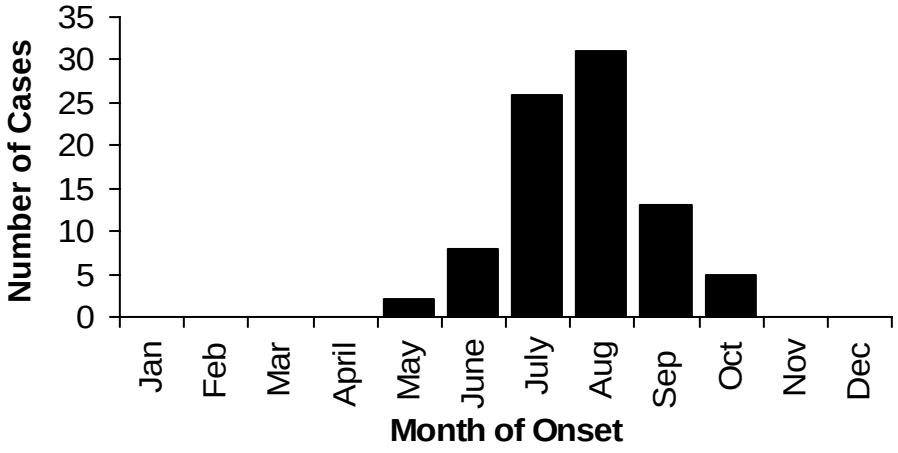


Figure 2. Distribution of La Crosse Encephalitis Cases, by Month of Onset, Tennessee, 1998-2003.



In 2002, 164 cases of La Crosse encephalitis were reported from 16 states in the United States, representing the most reported to CDC in any year since 1964. Due to the similarity of symptoms between LAC and West Nile virus, 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**).

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of La Crosse Encephalitis, by Year, Tennessee and the United States, 1995-2005.

	1995		1996		1997		1998		1999		2000		2001		2002		2003		2004		2005	
	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR
TN	-	0.00	1	0.02	8	0.15	9	0.17	6	0.11	19	0.33	17	0.30	15	0.26	14	0.24	13	0.22	2	0.03
US	11	#	123	#	129	#	97	0.04	70	0.03	114	0.04	128	0.05	164	0.06	NA	NA	112	0.04	73	0.02

NA= Notifiable Diseases is not compiled # Not nationally notifiable

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 *Ae. albopictus* mosquito. In 2004, a case in Cocke county also emerged, suggesting that transmission TN is possible in the northeast region of the state as well.

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 (**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 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.

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 (2004)	0	0.00	3	0.96	9	1.12	1	0.12	0	0.00	0	0.00	0	0.00
TN (2005)	0	0.00	0	0.00	2	0.25	0	0.00	0	0.00	0	0.00	0	0.00
US (2004)	1	-	17	-	78	-	7	-	4	-	3	-	2	-
US (2005)	0	-	16	-	44	-	4	-	1	-	2	-	6	-

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 125 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**) and all are susceptible when traveling since, without much exposure in the U.S., we have a very susceptible population. 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 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.

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of Malaria, by Year, Tennessee and the United States, 1996-2005.

Year		TN	US	Year		TN	US
1996	No.	14	1392	2001	No.	14	1383
	IR	0.02	0.52		IR	0.30	0.49
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

NA= Notifiable Diseases is not compiled

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of Malaria, by Age Group in Tennessee, 2004 and 2005.

	<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	10	0.00	14	0.02	11	0.15	16	0.17	9	0.11	13	0.33	14	0.30
US	1167	0.44	1392	0.52	1544	0.58	1227	0.45	1540	0.56	1402	0.50	1383	0.49

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.

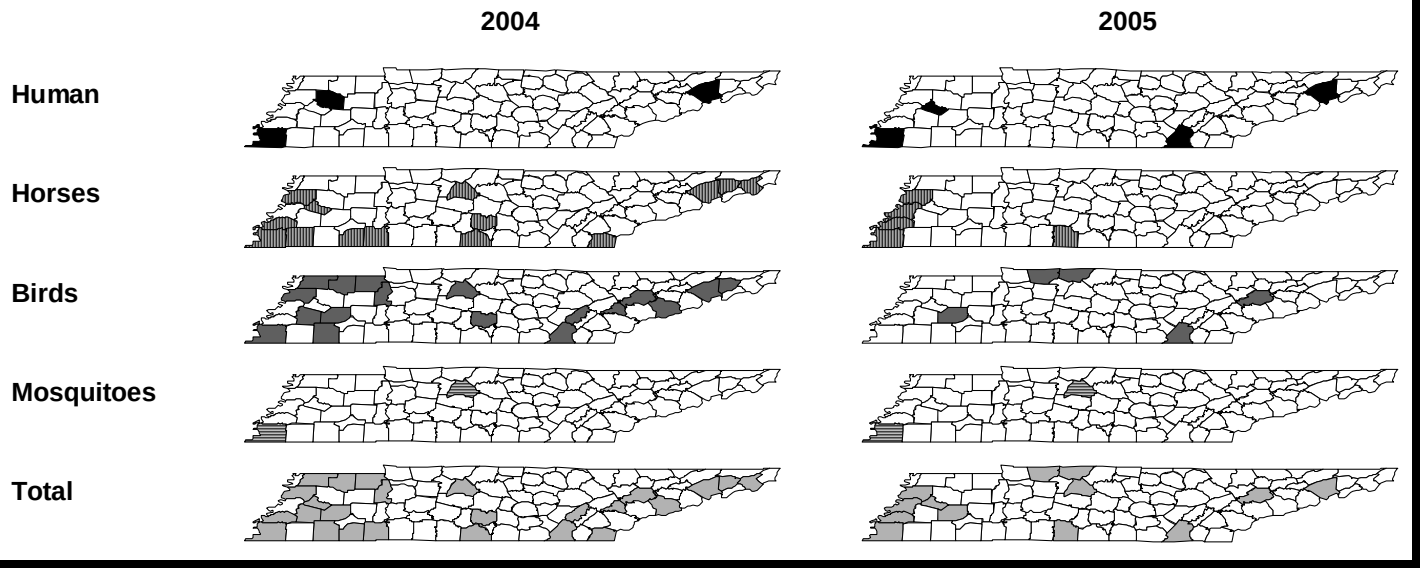
West Nile Fever/Encephalitis

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 and 18 cases in 2005 (**Figure 1**). This is a reduction compared to 2002 (56 cases) and 2003 (26 cases). 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 reported 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 2**). In 2005, human cases occurred later and ended later than in 2004.

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

Figure 1. Geographic Distribution of West Nile Virus Indicators, Tennessee, 2004-2005.



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. Forty seven percent of the cases in 2004-5 were in people over the age of 65. Eighty-one percent of cases were in people over 40. In cases from 2004-5, 38% 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' 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.

Figure 2. Distribution of West Nile Human Cases, by month, Tennessee, 2002-2005.

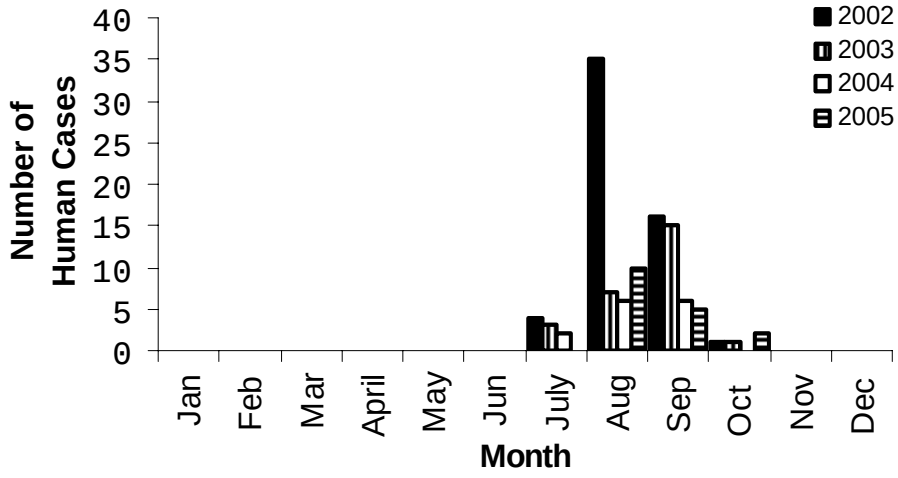


Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of West Nile Virus, Tennessee and the United States, 2001-2005.

	2001		2002		2003		2004		2005	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
TN*	0	0.00	56	0.97	26	0.44	14	0.24	18	0.30
US Total	NA	NA	3106	1.06	9690	3.30	2411	0.82	2901	0.98

*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 (2003)*	0	0.00	0	0.00	0	0.00	1	0.12	3	0.24	8	0.43	14	1.93
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
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 2003 and 2005.

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 males and 45% for females. 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' distributions in that approximately 76% of the cases reported since 1996 have been reported from those regions.

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

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.

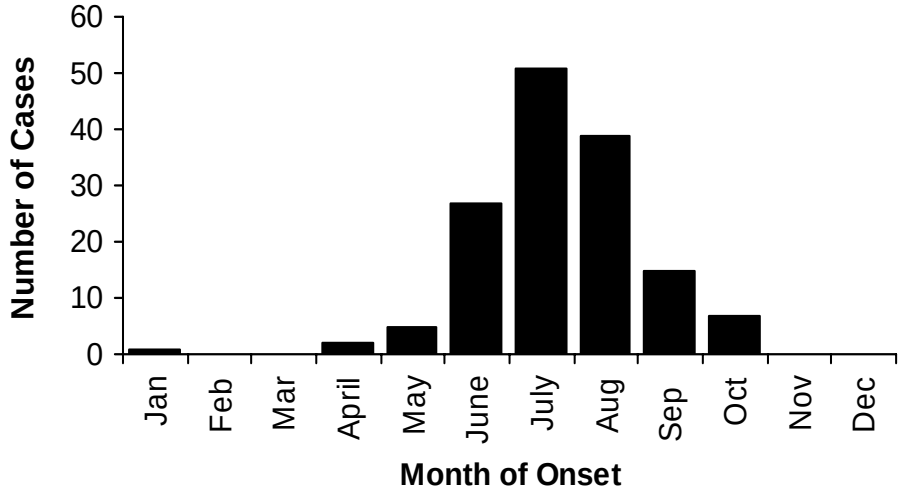


Table 3. Reported Cases and Incidence Rates (per 100,000 persons) of Human Monocytic Ehrlichiosis, by Year, Tennessee and the United States, 2000-2005.

	2000		2001		2002		2003		2004		2005	
	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
US	200	0.09	142	0.05	216	0.08	321	0.11	NA	NA	NA	NA

NA= Notifiable Diseases is not compiled

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.

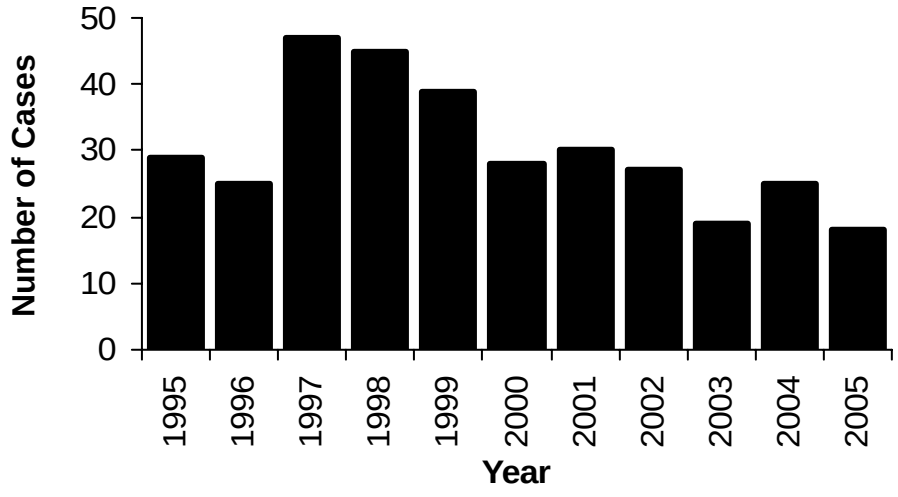
The **figure** depicts the number of reported cases of Lyme disease in Tennessee since 1995. In contrast to Tennessee's incidence rate of 0.3 per 100,000 population in 2003, the national incidence rate in 2002 was 8.2 cases per 100,000 population.

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 general-

ized 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.

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



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 an infection of *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 host. 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 transovarial transmitted from the female tick to the offspring as well as transtadial transmission from

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of Rocky Mountain Spotted Fever, by Year, Tennessee and the United States, 1996-2005.

Year		TN	US	Year		TN	US
1996	No.	47	831	2001	No.	85	695
	IR	0.88	0.32		IR	1.50	0.25
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

NA= Notifiable Diseases is not compiled

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

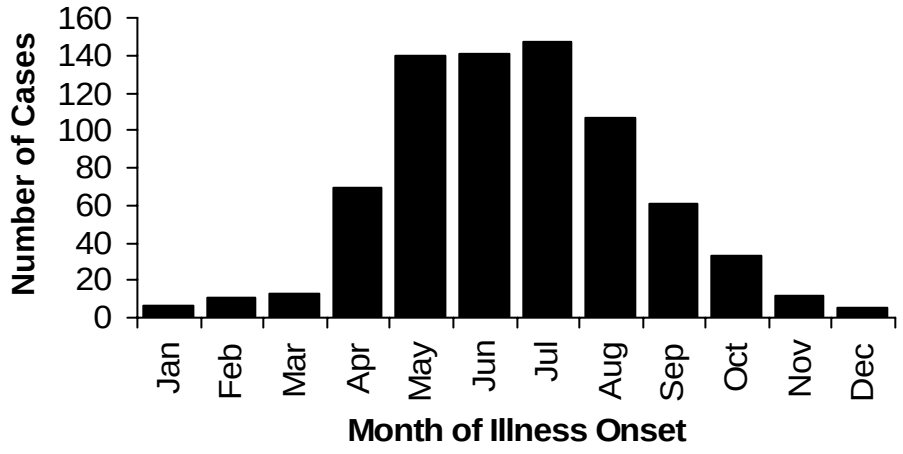
	<1 year		1-4 years		5-14 years		15-24 years		25-39 years		40-64 years		>65 years	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
TN (2003)	0	0.00	3	0.97	6	0.75	3	0.37	15	1.21	37	1.97	9	1.41
TN (2004)	0	0.00	3	0.96	10	1.24	6	0.74	24	1.93	40	2.08	15	2.07
TN (2005)	0	0.00	1	0.33	21	2.59	17	2.08	24	1.95	56	2.85	19	2.56
US (2003)	4	0.11	43	0.28	137	0.33	100	0.26	227	0.36	437	0.52	148	0.42

one developmental stage of the tick to the next (e.g. if an immature tick becomes infected with *R. rickettsia*, the infection continues to the adult tick, thereby infected for life).

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 reported. 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 the 3-5 day 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 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.

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



Community supported prevention measures to reduce tick populations is 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

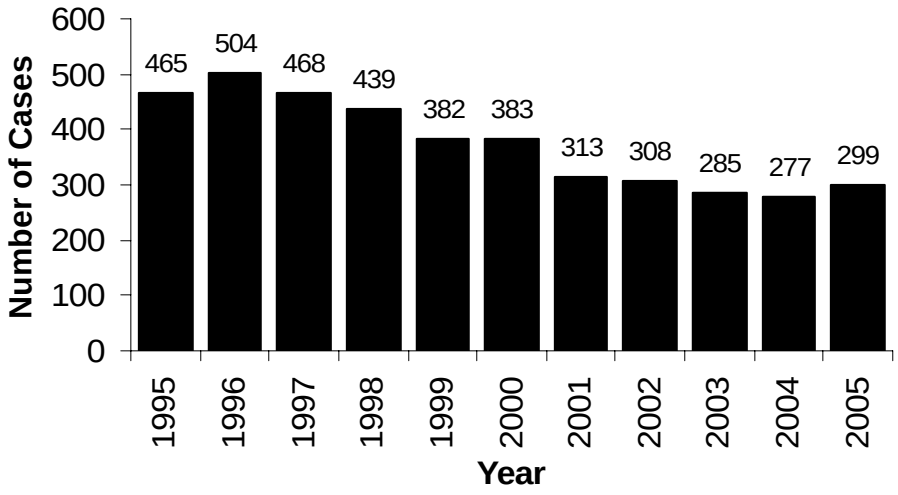
Staff from the Memphis/Shelby County metropolitan health department prepare for the grand opening of their new Tuberculosis Fast Track Clinic. The clinic will be a quick way for patients only needing Tuberculin Skin Test (TST) placements, TST readings, chest x-rays and phlebotomy services to be seen.

Source: Tennessee Department of Health

Tuberculosis Elimination Program

Tennessee reported 277 cases of tuberculosis (TB) in 2004, which represented a decrease of 2.8% compared with the 308 TB cases reported in 2003. The 2004 TB case rate of 4.7 cases per 100,000 population was the lowest ever recorded in Tennessee. However, in 2005 there were 299 TB cases reported in Tennessee, an increase of 7.4% above the total for 2004. Corresponding to the increase in cases was an increase in Tennessee's 2005 TB case rate to 5.0 per 100,000 population, rising above the national case rate of 4.8 per 100,000. During both 2004 and 2005, Tennessee's two largest metropolitan areas had the highest incidence of TB disease in the state: Memphis/Shelby County reported 85 TB cases in 2004 and 90 cases in 2005 (case rates of 9.4 and 9.9 per 100,000 population for each year, respectively); Nashville/Davidson County reported 53 TB cases in 2004 and 66 cases in 2005 (case rates of 10.9 and 11.5 per 100,000 population for those years, respectively). 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. However, during 2005 there were identified TB outbreaks in one community in Memphis and two correctional facilities in the West Tennessee Region. These outbreaks suggest ongoing TB transmission in some localities and facilities, and represent a significant public health concern.

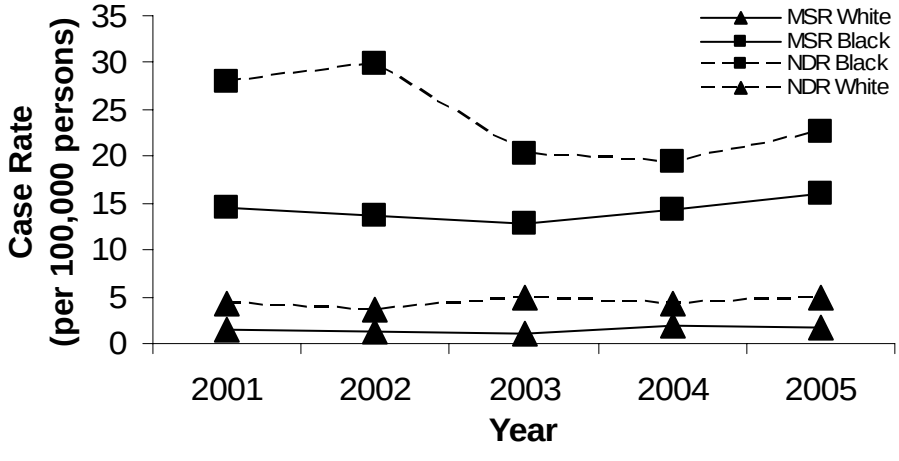
Figure 1. Number of Tuberculosis Cases, Tennessee, 1995-2005.



Racial and Ethnic Distribution

During the period from 2004 through 2005, the racial and ethnic distribution of TB cases in Tennessee changed very little. In 2004, Tennessee reported 44% of TB cases as black non-Hispanic, 39% as white non-Hispanic, and 10% as Hispanic of any race; in 2005, the racial and ethnic distribution was 46%, 37% and 12% for the same categories, respectively. Of black non-Hispanic cases in 2004 and 2005, 54% were from Memphis/Shelby County (total of 140 cases) and 25% were from Nashville/Davidson County (total of 65 cases). In 2005, Memphis/Shelby County had a black non-Hispanic case rate of 15.9 cases per 100,000 population compared to

Figure 2. Non-Hispanic White & Non-Hispanic Black TB Case Rates, Memphis/Shelby & Nashville/Davidson Counties, 2001-2005.



- Population estimates are from the US Census Data and represent estimates at midpoint of each year.
- 2005 estimates are using 2004 population estimates and are preliminary.

1.8 for white non-Hispanics. Also during 2005, Nashville/Davidson County had a case rate of 21.3 cases per 100,000 population compared to 5.0 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-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. Clustering percentages for reported TB cases in Tennessee in 2004 and 2005 can be found in **Figure 3**.

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.

Figure 3. TB Clustering Percentages Tennessee & the United States, 2004-2005.

Categories	Case Counts		Total
	2005	2004	2004 + 2005
Clustering Percentage**	47.60%	52.90%	50.10%
# of US born Submissions*	169	154	323
# of US born Clustered isolates	92	97	189
US Born Clustering Percentage	54.40%	62.90%	58.50%
# of Foreign Born Submissions*	48	30	78
# of Foreign Born Clustered Isolates	8	4	12
Foreign-born Clustering Percentage	16.70%	13.30%	15.40%

* Submissions = number of culture positive isolates submitted to the CDC contracted genotyping laboratory
** Clustering Percentage = (# clustered isolates / # submissions) X 100

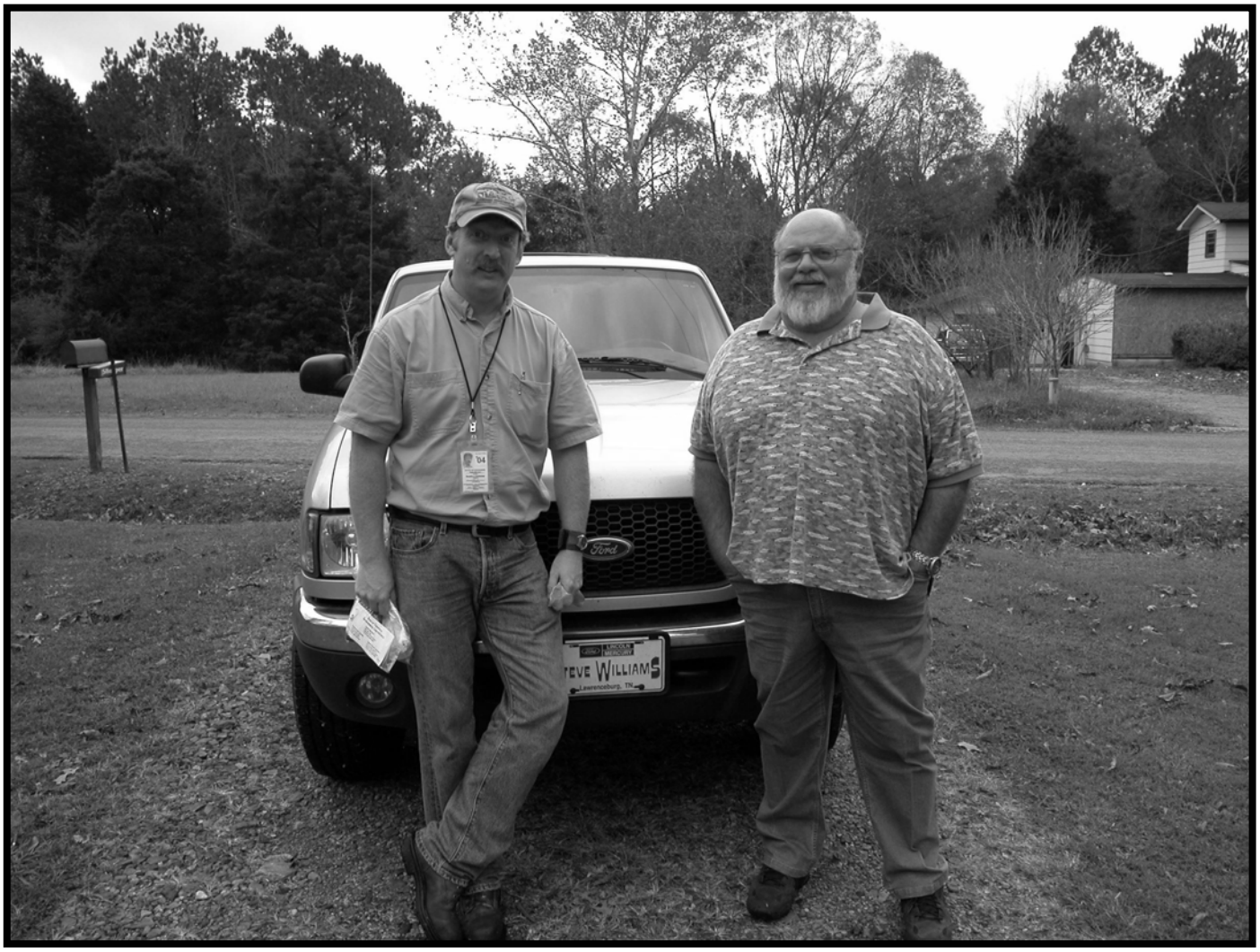
TB Treatment

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. Tennessee reported no cases in 2004 having either initial MDR or acquired MDR. In 2005, Tennessee reported two initial MDR cases, with no reported case of acquired MDR-TB. 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 one case of acquired MDR-TB 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. It should be noted that data for final drug susceptibilities for 2005 cases are preliminary at the time of this report's publication.

Section IV.

Environmental Health



Ron Clendening, Environmental Epidemiology (EEP), and Newt Gibbs, Department of Environment and Conservation (TDEC). Newt worked in the Columbia office of TDEC and helped EEP with several sites. Newt died on June 5, 2005. He will be missed.

Source: Tennessee Department of Health

CEDS' Greener Grass: Environmental Epidemiology

Within the Tennessee Department of Health, there are two sections of the Bureau of Health Services involved in environmental issues. General Environmental Health is charged with maintaining healthful standards for potentially harmful environments, such as swimming pools, as well as ensuring that food service establishments meet appropriate standards. Within the CEDS section, the Environmental Epidemiology Program (EEP) is responsible for environmental public health activities that relate to chemical exposures and pollution with a focus on site specific investigations. EEP also investigates disease clusters that may be environmentally related.

EEP is funded through a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is the federal public health agency within the Centers for Disease Control and Prevention (CDC) whose mission is to prevent exposure to hazardous substances that may result in adverse human health effects and diminished quality of life. Many of these exposures are associated with waste sites, unplanned releases of chemicals and other sources of pollution. Most of EEPs' investigations are related to hazardous waste sites, but cases do arise from emergencies and public complaint. EEP frequently collaborates with TDEC, local health departments, the U.S. Environmental Protection Agency (EPA), CDC, and other state and local agencies.

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

Environmental public health questions commonly answered include:

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

EEP worked in the following areas around the state, publishing certified public health assessments and health consultations, with associated site visits, public meetings and educational materials development. These assessments and consultations may be viewed on the TDH Website at http://tennessee.gov/health. Click on Programs, then Communicable and Environmental Disease Services, then Environmental Epidemiology.

Public Health Assessments

Loudon County

Responding to concerns of Loudon County residents, the TDEC Division of Air Pollution Control (APC) designed a Hazardous Air Pollutants (HAPs) study to look at emissions in the Town of Loudon, Loudon County. One monitoring location was selected based on air modeling results. In March 2004, APC asked EEP to identify possible health risks from exposure to the HAPS, using the monitoring data collected in the industrial corridor. EEP then initiated the PHA process in Loudon County, Tennessee. The draft version of the report was available to the public for comment in May 2005.

Of the 41 HAPs sampled, four were identified as chemicals of concern: benzene, carbon tetrachloride, acetaldehyde, and formaldehyde. Carbon disulfide, ozone, and particulate matter were considered carefully because of community concern.

From the data, the following conclusions were made:

- Formaldehyde monitored between

November 15, 2003, and April 9, 2004, presented an indeterminate health hazard. Monitoring for formaldehyde was not reliable during this period. There was no apparent public health hazard identified from exposure to formaldehyde monitored April 21, 2004, to December 24, 2005.

- No apparent health hazard was identified throughout the sampling period for benzene, carbon tetrachloride, and acetaldehyde.
- An indeterminate health hazard was identified for ozone and particulate matter.
- An indeterminate health hazard was identified for the mixtures of HAPs, especially aldehydes.

As part of the health assessment process, EEP needed to assess the health of the community. The community had several health concerns about respiratory and heart diseases. In order to more thoroughly understand disease trends about respiratory and heart-related illnesses, analyses were performed for 40 specific diseases. Data available about these diseases included:

- Death certificate information from 1990 through 2003;
- Inpatient hospital discharge data from 1997 through 2003;
- Outpatient hospital discharge data from 1998 through 2001; and
- Tennessee Cancer Registry (TCR) incidence case data from 1991 through 2000. Loudon County was compared to Franklin County and to the entirety of Tennessee. Franklin County was chosen as a comparison because it matched Loudon County closely in demographic measures.

Two findings of significance from the health outcome data analysis were observed:

- A significantly increased rate of chronic rhinitis and sinusitis for Loudon County compared to Franklin County and Tennessee using in-patient and out-patient hospital records; and
- Of all counties in Tennessee, Loudon County had the highest mean incidence rate for all cancers combined, based on data from the Tennessee Cancer Registry. (It was later determined that data collection inefficiencies in other counties may have contributed to this finding.)

The draft results of this health assessment were presented to community members in Loudon for their comment. The final report was published in 2006.

Collierville, Shelby County

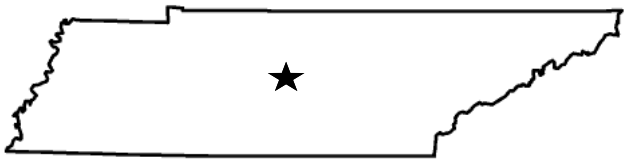
Smalley-Piper became a new, proposed Superfund National Priorities List (NPL) site in November 2004, following EEP's health consultation published on November 6, 2003. At that point, federal law required this public health assessment to be completed. Smalley-Piper became a final NPL site on April 27, 2005. EEP began the PHA process in 2005 at the Smalley Piper site in Collierville, Tennessee. About twenty years ago, there was release of chromium that has since led to contaminated groundwater in Collierville, Tennessee. The chromium likely came from past magnesium battery casing manufacturing at the Smalley-Piper site. Chromium was detected in the raw groundwater drawn by the Town of Collierville's Water Plant #2. Traditional water treatment was unable to remove all of the chromium contamination from the water. The finished public drinking water leaving the plant contained very small amounts of chromium. The drinking water never exceeded any regulatory drinking water standards at any point of the process; however the Town of Collierville wanted to maintain the highest water quality and so the chromium contamination eventually resulted in a shutdown of Water Plant #2. The results from this health assessment were presented to community members in Collierville for their comment. The final report was published in 2006 and therefore will be summarized in that annual report.

EEP's Health Consultations

The most common environmental health investigation takes the form of a *health consultation*. Consultations are similar to PHAs, but usually discuss one specific, site-related public health question. HCs can determine whether

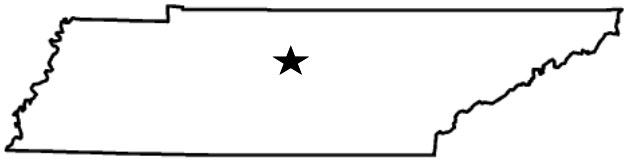
cleanup actions are necessary to protect public health or respond to EPA requests, such as reviewing sampling plans and feasibility studies. If site conditions change or new data becomes available, a series of HCs may be written for one site. These investigations are intended to prevent or mitigate environmental exposure by recommending a public health action plan. Recommendations might include restricting land use, changing a drinking water source, conducting additional environmental sampling, restricting site access, implementing health education campaigns or removing contaminated material. In 2004, EEP published 10 certified HCs. In 2005, EEP published 7 certified HCs.

College Grove, Williamson County



In 1999, TDEC discovered high levels of lead in soil in many areas of College Grove. The lead originated with contaminated battery casings that were chipped by a secondary lead smelter and given to area residents and businesses for use as paving material or fill. The US EPA mobilized their emergency response team to identify areas with battery chips and to remove the chips and contaminated soil from residential property. In 2003, a resident who had recently purchased a home in College Grove discovered battery chips in the yard and asked for assistance. EEP worked with TDEC to have the soil tested and with the parents to have the child's blood tested for lead. No apparent health risk was evident since the child's blood lead levels were within the normal range. However, EEP recommended that the residents take off their shoes and wash their hands before entering the house to minimize any exposure to lead. TDEC worked with the homeowner to remediate the area of lead contamination and did further testing at the residence to ensure no further areas of contamination existed. The family was given educational material regarding lead exposure. This investigation resulted in a certified public health consultation in 2004, the creation of education materials about lead, and a site visit to the parents.

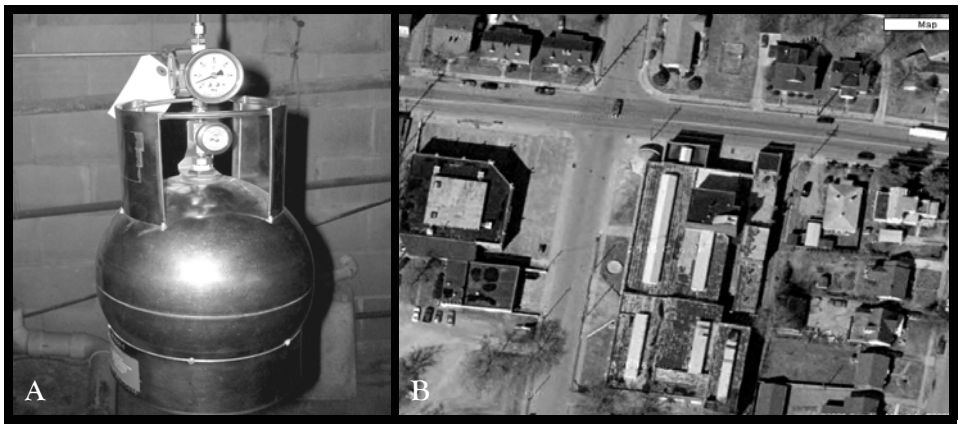
White Way Cleaners, Davidson County



One of Nashville's largest drycleaning facilities was being redeveloped into a new multiple use buildings. The facility had many drycleaning machines operating for decades. Shallow groundwater and some soil near the site were known to be contaminated. The site is within the historic Edgefield community of Nashville not far from the famous Music Row. Drycleaner solvents were discovered to have migrated off site, mainly via an old brick sewer. Six nearby homes were sampled by the TDEC Drycleaner Environmental Response Program. EEP assisted by reviewing data collected with summa canisters in the homes' basements or crawlspaces. A summa canister is a stainless steel a vacuum bottle used to collect an air sample. Only one basement had a tiny amount of solvent vapor detected. No apparent public health hazard was found. A public availability session was held at a nearby church. EEP distributed a question and answer

Former White Way Cleaners, 1200 Villa Place. Nashville, Davidson County, Tennessee. *Source: David Borowski, Tennessee Department of Health.*

sheet to residents. Two of Nashville's major television stations reported the situation accurately and positively. This helped the community understand the on-going environmental work being performed by TDEC, EEP, and the redevelopment contractors. Additional meetings were held with concerned stakeholders and residents. A second and third health consultation were later produced to identify specific concerns in an individual's yard.



A: Summa Canister; B: Aerial photo of former White Way Cleaners. Nashville, Davidson County, Tennessee. *Source: (A) Tennessee Department of Health, (B) Google.*

Copper Basin Mining District, Polk County

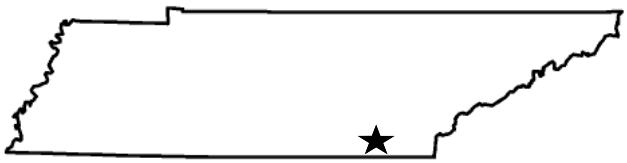
TDEC asked EEP to provide guidance on the possibility of adverse health effects from manganese in soil in an area where children play. EEP concluded that no apparent health hazard exists from the manganese in soil.

Chromasco, Shelby County

A former industrial site was being sold at the same time it was under environmental investigation. The large site has both surface and subsurface pollution. Groundwater seeping to the surface was noticeably green from chromium contamination. Redevelopment of the site was of concern to the local community and nearby businesses. The redevelopment plan was to dig out several cells so that landfilling could occur. The digging might result in fugitive dusts being created and blown off-site. Several attorneys requested the draft HC document for their review. The dialogue created by EEP's involvement in the health consultation process effectively ended the debate on re-use of the site before ATSDR finished certifying the document for publication.

Abandoned building and nearby paved areas. Chromasco, Memphis, Shelby County, Tennessee. *Source: David Borowski, Tennessee Department of Health.*

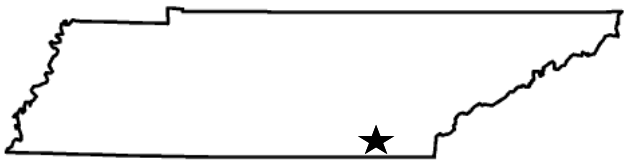
Chattanooga Creek, Hamilton County



TDEC contacted EEP concerning a proposal for the creation of a greenway along Chattanooga Creek, an area with much industrial pollution. During 2003, EEP began review of data, meeting with various stakeholders, and planning how to best address the issues of the proposal. No federal brownfields funding was available at the time, so the greenway

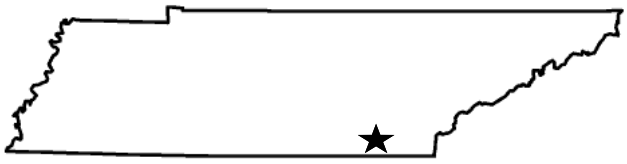
plan was put on the back burner. EPP expects the idea will come back around in a few years when funding is available. The site work led to an HC for Glover property which is discussed below.

Glover Site, Hamilton 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 and public health findings. Site work is still not complete. Polycyclic aromatic hydrocarbons (PAHs) are definitely present, but in many areas below health screening levels. Still, new warning signs were recommended.

Big Bone Cave, Van Buren County

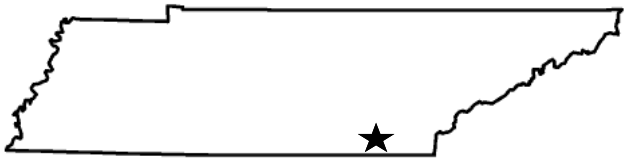


The Tennessee State Parks requested that EEP consider radon issues in a popular tourist cave. Big Bone Cave is a natural wonder that is frequented by visitors, including overnight scouting trips. Tennessee geology is well known as a source of radon gas emissions. Whether or not visitors to the park or park rangers were at risk needed to be answered. EPP completed a health consultation to determine the risk posed by radon. EEP happily reported that there was no apparent health hazard.

Indian Mound Home Pesticide Contamination, Stewart County

A "professional" pesticide application led to an investigation in Indian Mound. The Tennessee Department of Agriculture provided indoor wipe sampling results to EEP. EEP then analyzed the data and helped to prepare a public health action plan to assure the safety of the homeowners. EEP recommended that contaminated materials be removed from the home or cleaned. EEP also recommended that an infant be evaluated by a clinical toxicologist.

Howard School, Hamilton County



The Howard School site in Chattanooga has long been under environmental investigation. Years ago contaminated soil was removed from the area around the on-site daycare building. Construction of a new gymnasium stirred up once buried soil in an area where children can play. EEP was provided petroleum hydrocarbon data from some of the excavated soil to review. EEP did a site visit and consultation to ensure the safety of the sensitive population.

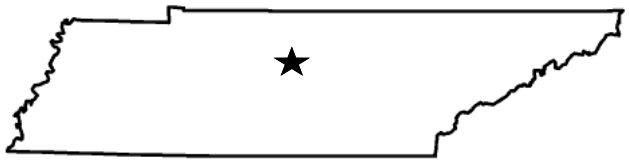
Duracell, Bradley County

Anonymous citizen complaints were made to the US EPA concerning potentially high levels of mercury contamination present within the Duracell manufacturing facility in Cleveland, Tennessee. EPA and TDEC asked EEP to assist in the investigation of the mercury levels within the facility. EEP contacted ATSDR for additional support. With the full cooperation of the Duracell company officials, a site visit was quickly scheduled. An EPA representa-

tive brought a mercury vapor monitor and readings were taken throughout the facility, including the areas mentioned by the anonymous complainants. Since mercury had been used in the manufacturing process in previous years, the monitor confirmed the presence of mercury vapors inside the facility. However, the overall mercury vapor levels within the facility were found to be below occupational regulatory standards, including in the areas identified by the complainants.

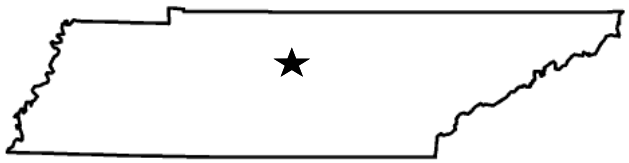
EPA staff using the Ohio Lumex RA-915 Light (Lumex) to analyze real-time air samples from the floor drain in the nail room. Duracell, Cleveland, Bradley County, Tennessee. *Source: Bob Safay, Agency for Toxic Substances and Disease Registry.*

Concord Cleaners, Davidson County



The TDEC Drycleaner Environmental Response Program (DCERP) asked EEP to review the air monitoring data from a commercial building that was a former drycleaner facility in Nashville. The groundwater under the building was contaminated with the drycleaner solvent, tetrachloroethylene (PCE) and its associated breakdown products. The building now houses a popular coffee shop. DCERP had concerns that drycleaner solvent vapor levels could be a potential health hazard for the employees and customers. An open sump pit, filled with groundwater, is present in the basement of the building. Air monitoring was conducted in this basement space and analyzed for drycleaner related volatile organic compounds (VOCs). The potential for human exposure to drycleaner related VOC vapors at this site were found to be minimal. EEP will continue to work with DCERP on this site as needed to review additional data and to respond to environmental public health questions.

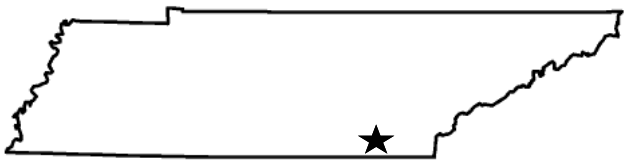
Town and Country Cleaners, Davidson County



The TDEC DCERP asked EEP to review the air monitoring data from a commercial building that is adjacent to an active drycleaner facility in Nashville. The commercial building adjacent to the drycleaner facility contains several businesses, one of which is in the basement. The groundwater under the commercial building is contaminated with the drycleaner solvent, tetrachloroethylene (PCE) and its associated breakdown products. The basement has a system of sumps to collect and remove groundwater before it can enter the building. DCERP had concerns that drycleaner solvent vapor levels could be a potential health hazard for employees and customers. Air monitoring was conducted in a retail portion of the basement. VOC concentrations were below any levels of health concern.

An environmental consultant collects indoor air samples utilizing standard summa canisters.

Walden's Ridge Utility District, Hamilton County



The Chattanooga-Hamilton County Health Department (CHCHD) contacted EEP to assist them in an investigation of some alleged drinking water quality issues in Walden, Ten-

nessee. Residents of Timesville, a small community just outside of the town limits of Walden, had complained to the CHCHD that their drinking water supply and other water pollution problems were causing illnesses in their community. EEP personnel traveled to Chattanooga to meet with TDEC personnel that had conducted investigations of the utility and water pollution complaints in the Timesville community. A tour of the Walden area, including Timesville, was made as well as a tour of the Walden's Ridge Utility District drinking water treatment facility. EEP and CHCHD personnel met with and interviewed several of the Timesville residents to gather information concerning illnesses in the community. The investigation revealed that people thought the water supply has been affected by contamination from tetrachloroethylene (PCE). PCE is a manufactured chemical used for drycleaning and metal degreasing. The levels at the water plant have generally been below the EPA Maximum Contaminant Level (MCL), although there have been some exceedances. EEP's calculations of the possible doses of PCE that the customers of the utility could have received show them to be below any levels that could lead to adverse health effects. The water supply was found to be safe and the other community concerns were put to rest after EEP shared the results during an autumn public meeting. One citizen stood and publicly thanked EEP staff for doing this investigation and going the extra mile in addressing concerns rather than just the chemical in the water.

Environmental Epidemiologists

The Environmental Epidemiologists located at the 13 regional health offices are an invaluable resource to our state. From creating the Cancer Cluster Investigation Protocol to following up with community members regarding environmentally related health concerns, these highly skilled professionals have demonstrated compassion and technical expertise in their field. They provide EEP and others within CEDS, a community perspective on local issues and their involvement promotes successful public meetings. An example of their work is readily available on the TDH Website, http://tennessee.gov/health (Click on Programs, then click on Communicable and Environmental Disease Services), where they contributed vital educational materials in an easily understandable format. EEP will continue to develop this collaboration as we continue to serve the citizens of Tennessee.

Clandestine Methamphetamine Laboratories

TDEC asked EEP to help them determine clean-up methods for meth labs found in homes and apartments. EEP did this, resulting in TDEC's promulgation of rates to determine when a property is safe for human use.

SECTION V.

Investigations and Outbreaks

August 2005 — Tennessee's EIS officer Dr. Rand Carpenter led an investigation into the outbreak of *E. coli* O157:H7 among members of a recreational club. Above are various pictures taken during that investigation.

Source: Tennessee Department of Health

Highlighted Investigations and Outbreaks in Tennessee in 2004-2005

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 2004-2005. 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.

Outbreak of *E. coli* O157:H7 among Members of a Recreational Club

In August, 2005, the Department of Health learned of two hospitalized pediatric cases of *E. coli* O157:H7 infection. Bacterial isolates from these cases matched by pulsed field gel electrophoresis (PFGE). Interviews with the patients' families, notification from other states, and in-state hospital and laboratory surveillance led to the identification of a total of 14 epidemiologically-linked cases, including 4 that occurred secondary to another case in the same household. There were 5 patients hospitalized with hemolytic uremic syndrome, and no deaths. Of the 14 total cases, eight matched by two enzymes on PFGE, four were from households with another confirmed PFGE-matched case, and 2 had serologic evidence of recent infection with *E. coli* O157:H7.

A case-control study including 10 patients and 59 age-matched controls from area pediatric practices identified visiting a community recreational club (Facility A) as a risk factor for *E. coli* O157 infection (OR 29.7, CI 4.3 - 313.4). A second survey focusing on Facility A was administered to 13 cases and 39 controls (age-matched, non-ill club members). Illness was associated with visiting Facility A on August 1 (OR 10.0, CI 1.8 - 54.6) and August 2 (OR 5.3, CI 1.2 – 23.2). Swimming in any outdoor pool was associated with illness (OR undefined), although no particular pool or pool activity was significantly associated. Dining at the pool picnic tables with food from home was also associated with illness (OR 18.3, CI 1.9 – 179.9), as was attendance at a tennis camp at Facility A (OR 5.3, CI 1.2 – 24.4).

An environmental inspection of Facility A identified no problems with the outdoor pools' chlorine and filtration system. Sampling demonstrated fecal coliform contamination of a well water system used for irrigating outdoor clay tennis courts but *E. coli* O157:H7 was not cultured. Recommendations were made to Facility A to prevent future outbreaks, including discontinuation of irrigation from a potentially contaminated water source.

Use of Molecular Epidemiology to Identify a Multistate Outbreak of Hepatitis A Caused by Consumption of Raw Oysters

Background: No shellfish-related hepatitis A outbreaks have been documented in the U.S. since 1988. In August 2005, persons with hepatitis A whose only risk factor was raw oyster consumption were identified in several states.

Methods: A case was defined as a person with symptoms and laboratory confirmation of hepatitis A virus (HAV) infection during August-September 2005. State health departments were encouraged to ask hepatitis A cases about oyster consumption. A case-control study of food eaten 2-6 weeks before illness was conducted among AL cases and community controls. Shellfish tags were used to trace implicated oysters to the harvest area. Frozen oysters from the same harvest area and date were retrieved. A 315-nucleotide fragment of the VP1-2a region of the HAV genome was used to compare viral sequences isolated from case-patients with those amplified from oyster meat and from 132 other hepatitis A cases reported to CDC over the previous year.

Results: Forty cases that ate raw oysters 2-6 weeks prior to illness were identified. Among AL cases, 16 (94%) ate raw oysters, compared to 2 (7%) controls (odds ratio 217, 95% confidence interval 18-2597). The estimated attack rate at one restaurant where 9 cases had eaten was 1.1 cases/10 dozen raw oysters served. Cases ate raw oysters in 1 of 12 restaurants in Flor-

ida, Alabama, Tennessee and South Carolina. All restaurants used the same oyster supplier and served oysters harvested from the same area in the Gulf of Mexico during July 25-August 9, 2005. Viral sequences obtained from 28 oyster-related cases were identical to each other and to the isolate from oyster meat, and different from all sequences obtained from other reported hepatitis A cases.

Conclusions: Raw oysters contaminated with HAV prior to distribution were the source of the first oyster-related hepatitis A outbreak in the U.S. since 1988. Contamination likely occurred before or during harvesting. Newly developed molecular epidemiologic techniques provided additional evidence that cases in this multi-state outbreak were linked and supported traceback findings. This investigation is the first to obtain a single identical HAV sequence from case patients and an implicated food item.

Staphylococcus aureus Outbreak Associated with Tres-Leches Cake

In August 2004, 20 of 44 attendees at a family birthday party reported the acute onset of nausea, vomiting, cramps, diarrhea, chills and myalgias, with a mean onset of 6 hours after the party. An epidemiologic investigation identified the consumption of a traditional Mexican "Tres Leches" cake as significantly associated with illness (RR=2.4, $p<0.0001$). Stool specimens from four ill persons grew *S. aureus*. An environmental investigation of the bakery where the cake was prepared identified numerous violations including poor hygiene practices and improper foodhandling temperatures. No foodhandlers reported recent illness and none had visible skin lesions. A sample of cake from the party grew *S. aureus*, with a PFGE pattern indistinguishable from the isolates from 3 of the affected cases. Specific recommendations for preventing food contamination were made, and food safety training was held at the bakery for all employees.

Staphylococcus aureus Outbreak Associated with Pork at a Benefit Luncheon

Shortly after eating at a benefit luncheon at a community event in July, 2005, several attendees presented to on-site fire department paramedics with the acute onset of nausea and vomiting. Ultimately over 50 ill persons were identified, with a mean incubation period of 3.7 hours. A prompt case-control study by the local health department identified pulled-pork barbeque as the likely vehicle (OR=19.1, 95% CI 1.1-340). Investigation revealed that 64 pork butts totaling over 500 lbs. were prepared the day prior to the event, and stored overnight in a refrigerator that did not maintain adequate cooling temperatures. Eight of 9 stool specimens from ill persons grew *S. aureus*. Samples of barbecued pork grew *S. aureus* at concentrations up to 10^7 cfu/gram. Subsequently reports were received from an out-of-state family who purchased barbecued pork from the same establishment while traveling in the area 3 days after the initial outbreak, and developed acute gastroenteritis. Leftover samples from that family's pork also tested positive for *Staphylococcus aureus*. The establishment closed and underwent remediation prior to reopening.

SECTION VI.

Public Health Emergency Preparedness Program

Public health personnel from Memphis Shelby County and West Region, Public Health Emergency Preparedness Program staff conducted a Strategic National Stockpile (SNS) warehouse training. This training focused on the essential components to receiving mass quantities of medical assets in our state from the Centers of Disease Control and Prevention (CDC). 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 bioterrorism, 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). Mental health needs of the public and of emergency response personnel have 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 plans concerning the receipt, staging, storing and distribution of assets from the SNS. Also, in order to better coordinate the mobilization of over 25,000 community volunteers recruited to interface with hospitals and medical care providers in a public health emergency, 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 survey was recently completed in which hospital and clinical labs detailed their diagnostic capabilities and indicated their capacity to assist TDH in an emergency situation. Training was also provided to hospital laboratories across the state in isolation and diagnosis of potential bioterrorist agents. Additionally, a new emphasis on chemical terrorism laboratory response was placed in this year's CDC funding. Renovations are currently underway at the TDH Laboratory to develop testing clinical specimens for chemical terrorist agents. Laboratory Services has utilized grant funds to develop and equip four 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 purchased. 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 is ready 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 to anyone 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 2004, the Preparedness Program staff developed a 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 was conducted over a three-year period in the 11 Tennessee Office of Homeland Security Jurisdictional Districts. It was 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

July 2005 — Dr. Rand Carpenter wasn't afraid to roll up his sleeves and dive right on in when he joined the Tennessee Department of Health as its newest Epidemic Intelligence Service Officer.

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:

- Investigation of a case of diphtheria due to C. *ulcerans*
- Community-wide outbreak of Hepatitis A
- Outbreak of *E. coli* O157 associated with a community club
- Surveillance for illness among persons displaced by hurricane Katrina
- Evaluation of a school-based influenza vaccination campaign
- Cluster of *Salmonella* Tallahassee diarrhea
- Outbreak of *Fusarium* keratitis associated with contact lens solution

Epidemic Intelligence Service Officers, 1970-2005
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, 2004-2005

October 2005 — At the annual conference for Infectious Diseases Society of America, Dr. Rose Devasia's poster regarding the first reported Linezolid-resistant *Enterococcus* outbreak in a hospital was one of a select few chosen for discussion during the roundtable portion of the poster session.

Source: Tennessee Department of Health

Publications List

ATSDR Documents:

Bashor B. Health Consultation: Copper Basin Mining District. January 16, 2004. Agency for Toxic Substances and Disease Registry.

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Bashor B. Health Consultation: Big Bone Cave. September 13, 2004. Agency for Toxic Substances and Disease Registry.

Borowski D, Bashor B. Health Consultation: White Way Cleaners. January 13, 2004. Agency for Toxic Substances and Disease Registry.

Borowski D. Health Consultation: Downtown School -Update 2. February 27, 2004. Agency for Toxic Substances and Disease Registry.

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Borowski D, Bashor B. Health Consultation: White Way Cleaners. May 20, 2004. Agency for Toxic Substances and Disease Registry.

Borowski D, Bashor B. Health Consultation: Chromasco Mining and Smelting Corp. July 1, 2004. Agency for Toxic Substances and Disease Registry.

Borowski D. Health Consultation: Glover Site. July 9, 2004. Agency for Toxic Substances and Disease Registry.

Borowski D, Bashor B. Health Consultation: Wrigley Charcoal Athletic Field. September 13, 2004. Agency for Toxic Substances and Disease Registry.

Borowski D, Bashor B. Health Consultation: Chromasco Reuse Considerations. December 6, 2004. Agency for Toxic Substances and Disease Registry.

Clendening R, Borowski D. Health Consultation: Duracell. March 29, 2005. Agency for Toxic Substances and Disease Registry.

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Clendening R, Borowski D. Health Consultation: Walden's Ridge Utility District. November 9, 2005. Agency for Toxic Substances and Disease Registry.

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Book Publications:

Omohundro, E.L. 2004. Living in a Contaminated World: Community Structures, Environmental Risks and Decision Frameworks. Aldershot, UK/Burlington, VT: Ashgate Publishing, Environmental Policy and Practice Series, ISBN 0-7546-4299-2.

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