Tennessee Department of Health

Communicable and Environmental Disease Services

2007 Annual Report

Tennessee Department of Health

Communicable and Environmental Disease Services

2007 Annual Report

Communicable and Environmental Disease Services Section
Tennessee Department of Health
1st Floor, Cordell Hull Building
425 5th Avenue North
Nashville, Tennessee 37243

Phone 615-741-7247 (24 hours a day/7 days a week)
Toll-Free 800-404-3006
Fax 615-741-3857

Tennessee Department of Health
Communicable and Environmental Disease Services

Susan R. Cooper, MSN, RN, Commissioner of Health

Cathy R. Taylor, DrPH, MSN, RN, Assistant Commissioner of Health,
Bureau of Health Services

Allen S. Craig, MD, State Epidemiologist (2001-2007);
Director, Communicable and Environmental Disease Services

Timothy F. Jones, MD, State Epidemiologist (current);
Director, Communicable and Environmental Disease Services

Available electronically at the Tennessee Department of Health website. Click on Program Areas, 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.

TABLE OF CONTENTS

SECTION I.

Introduction

Samir Hanna accepts the "Scholars' Choice Leadership Project Award" from Colonel Terry Walters for his project: "Evaluation of Tennessee Health Department Response to Legislation Calling for Looser Regulations of Unpasteurized Milk Sales" at Paul J. Rizzo Conference Center, Southeast Public Health Leadership Institute, School of Public Health, University of North Carolina, in December 2007. Colonel Walters was the keynote speaker on the graduation ceremony of SEPHLI Scholars Year 10.

Source: Southeast Public Health Leadership Institute.

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: Administrative Services, Breast & Cervical Cancer, Fiscal Services, General Environmental Health, Maternal & Child Health, Medical Services, Nutrition & Wellness, Personnel Services, Quality Improvement, Regional & Local Health, TennCare Services and Women's Health & Genetics. 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 1998 through 2007 and builds upon the 1999, 2000, 2001, 2002, 2003, 2004-2005 and 2006 annual reports that were previously published by CEDS.

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

B. Notifiable Diseases in Tennessee

A notifiable disease is one for which regular, frequent, and timely information regarding individual cases is considered necessary for the prevention and control of disease. In 1893, Congress authorized the weekly reporting and publication of notifiable diseases, collected from state and municipal authorities. The first annual summary of "The Notifiable Diseases" was published in 1912 and included reports of 10 diseases from 19 states, the District of Columbia, and Hawaii; by 1928, all states participated in the reporting. In 1961, the Centers for Disease Control and Prevention (CDC) assumed responsibility for the collection and publication of data concerning nationally notifiable diseases. As world travel becomes increasingly more common, the comparison of data about infectious diseases across states, nations and continents is crucial.

The list of notifiable diseases is revised periodically. As new pathogens emerge, new diseases may be added to the list. Public health officials at state health departments and the CDC collaborate in determining which diseases should be notifiable, but laws at the state level govern reporting. In Tennessee, State Regulations 1200-14-1, sections .02 through .06, require the reporting of notifiable diseases by physicians, laboratorians, infection control

personnel, nurses and administrators in settings where infectious diseases are diagnosed.

The Tennessee Department of Health "List of Notifiable Diseases" was last revised in 2004. Important additions to the list include Creutzfeld-Jakob disease and variant Creutzfeld-Jakob disease as well as West Nile fever and West Nile encephalitis. The list is presented in Section H. Section I lists those diseases for which bacterial isolates are to be sent to the Tennessee Department of Health State Laboratory.

C. Reporting Notifiable Diseases

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

Form PH-1600 is used for written reports to the health department. It can be obtained by calling your local health department or CEDS at 615-741-7247/800-404-3006. It can also be downloaded from the CEDS website at http://tennessee.gov/health. Click on Program Areas, then click on Communicable and Environmental Disease Services, and then click on Notifiable Diseases. CEDS as well as regional and local health departments welcome questions about disease reporting.

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

The numbers of reportable disease cases presented in the annual report should be considered as the minimum number of cases of actual disease. There are several reasons for this: a person must seek medical care to receive a diagnosis, not all cases are confirmed with laboratory testing and not all confirmed cases are reported. McMillian, et al,[1] utilizing FoodNet data from 2002-2003, estimated that though one in twenty persons reported diarrhea in the previous month, less than one in five sought medical care. Further, less than one in five who sought medical care submitted a stool sample which would be needed for laboratory confirmation of the diagnosis. The study data suggested that well over 28 cases of acute diarrheal illness occur in the population for each stool specimen positive for enteric pathogens. The data in this annual report do not represent all cases of disease; they track the geographic distribution of disease, as well as trends over time and serve as the foundation for the efforts of the Department of Health to control communicable diseases.

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

D. List of Notifiable Diseases

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

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

Anthrax
Botulism
- Foodborne
- Wound

Diphtheria
Disease Outbreaks
- Foodborne
- Waterborne
- All Other

Encephalitis, Arboviral
- California/LaCrosse serogroup
- Eastern Equine
- St. Louis
- Western Equine

Group A Strep Invasive Disease
Group B Strep Invasive Disease
Haemophilus influenzae Invasive Disease-
Hantavirus Disease
Hepatitis – Type A acute
Listeriosis
Measles (Imported, Indigenous)
Meningococcal Disease
Meningitis – Other Bacterial
Mumps
Pertussis
Plague
Poliomyelitis (Paralytic, Nonpara)
Prion Disease
- Creutzfeldt-Jakob Disease
- variant Creutzfeldt-Jakob Disease

Rabies – Human
Rubella & Congenital Rubella Syndrome
Severe Acute Respiratory Syndrome (SARS)
Staphylococcus aureus Vancomycin nonsensitive – all forms
Typhoid Fever
West Nile Infections
- West Nile Encephalitis
- West Nile Fever

Possible Bioterrorism Indicators
Anthrax
Plague
Venezuelan Equine Encephalitis
Smallpox
Botulism
Q Fever
Staphylococcus enterotoxin B pulmonary poisoning
Viral Hemorrhagic Fever
Brucellosis
Ricin poisoning
Tularemia

Category 2: Only written report using form PH-1600 required

Botulism – infant
Brucellosis
Campylobacteriosis
Chanchroid
Chlamydia trachomatis (Gen, PID, Other)
Cholera
Cyclospora
Cryptosporidiosis
Ehrlichiosis (HME, HGE, Other)
Escherichia coli 0157:H7
Giardiasis (acute)
Gonorrhea (Gen, Oral, Rectal, PID, Opht)
Guillain-Barre Syndrome
Hemolytic Uremic Syndrome
Hepatitis, Viral
- Type B acute
- HBsAg positive pregnant female
- HBsAg positive infant
- Type C acute

Influenza – weekly casecount
Legionellosis
Leprosy (Hansen Disease)
Lyme Disease
Malaria
Psittacosis
Rabies – Animal
Rocky Mountain Spotted Fever
Salmonellosis – other than *S. Typhi*
Shiga-like Toxin positive stool
Shigellosis
Staphylococcus aureus Methicillin Resistant – Invasive
Strep pneumoniae Invasive Disease
- Penicillin resistant
- Penicillin sensitive

Syphilis
Tetanus
Toxic Shock Syndrome
- Staphylococcal
- Streptococcal

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

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

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

Category 4: Laboratories required to report all blood lead test results

E. Isolate Characterization at the State Laboratory

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

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

According to Statutory Authority T.C.A. 68-29-107, and General Rules Governing Medical Laboratories, 1200-6-3-.12 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

Shiga-like toxin producing *Escherichia coli*, including *E. coli* O157 and *E. coli* non-O157

Clostridium botulinum

*Haemophlius influenzae**

*Neisseria meningitidis**

*Streptococcus pneumoniae**

*Group A Streptococcus**

Bacillus anthracis

Burkholderia mallei

Burkholderia psuedomallei

Vancomycin-resistant *Staphlyococcus aureus* (VRSA)

Vancomycin-intermediate *Staphlyococcus aureus* (VISA)

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 also be considered in isolates from necrotizing fasciitis wound cultures.

Information for Sending Cultures

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

<u>For UPS and Federal Express Items</u>

Tennessee Department of Health

Laboratory Services

630 Hart Lane

Nashville Tennessee 37216-2006

Phone 615-262-6300

<u>For U.S. Mail</u>

Tennessee Department of Health

Laboratory Services

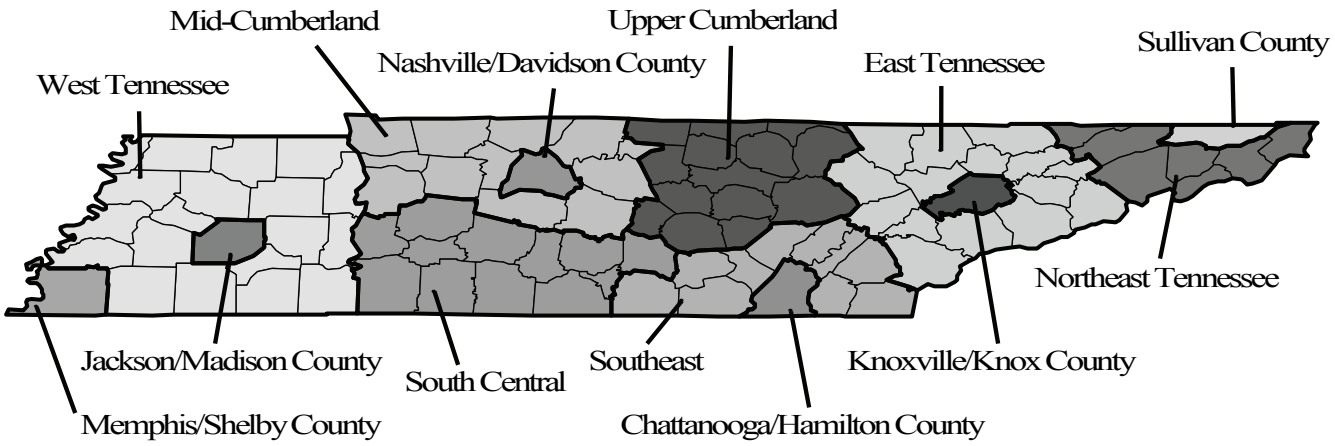
PO Box 305130

Nashville Tennessee 37230-5130

G. Tennessee Department of Health Regions

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

Tennessee's Department of Health Regions



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

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

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

Contacts	Health Officers		Directors of Communicable Disease Control	
Region	Name	E-mail	Name	E-mail
CHR	Valerie Boaz, MD	drvboaz@hamiltontn.gov	Nettie Gerstle, RN	nettieg@hamiltontn.gov
ETR	Tara Sturdivant, MD	tara.sturdivant@state.tn.us	Gail Baird, RN	gail.baird@state.tn.us
JMR	Tony Emison, MD	tremison@jmchd.com	Connie Robinson, RN	crobinson@jmchd.com
KKR	Martha Buchanan, MD	martha.buchanan@knoxcounty.org	Pat Hardcastle, RN	pat.hardcastle@knoxcounty.org
MSR	Helen Morrow, MD	hmorrow@co.shelby.tn.us	Anthony Otuka, MD, PhD	aotuka@co.shelby.tn.us
MCR	Barton Warner, MD	bart.warner@state.tn.us	Vicki Schwark, RN	vicki.schwark@state.tn.us
NDR	Charles Majors, MD	read.majors@nashville.gov	Nancy Horner, RN	nancy.horner@nashville.gov
NER	Lawrence Moffett, MD	lawrence.moffatt@state.tn.us	Jamie Swift, RN	jamie.swift@state.tn.us
SCR	Langdon Smith, MD	lang.smith@state.tn.us	Donna Gibbs, PHR	donna.j.gibbs@state.tn.us
SER	Jan Beville, MD	jan.beville@state.tn.us	Gayle Cross, RN	gayle.cross@state.tn.us
SUL	Stephen May, MD	asmay@sullivanhealth.org	Jennifer Williams, RN	jwilliams@sullivanhealth.org
UCR	Fred Vossel, MD	fred.vossel@state.tn.us	Debbie Hoy, RN	debbie.hoy@state.tn.us
WTR	Shavetta Conner, MD	shavetta.conner@state.tn.us	Susan Porter, RN	susan.porter@state.tn.us

I. Emerging Infections and the Emerging Infections Program

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

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

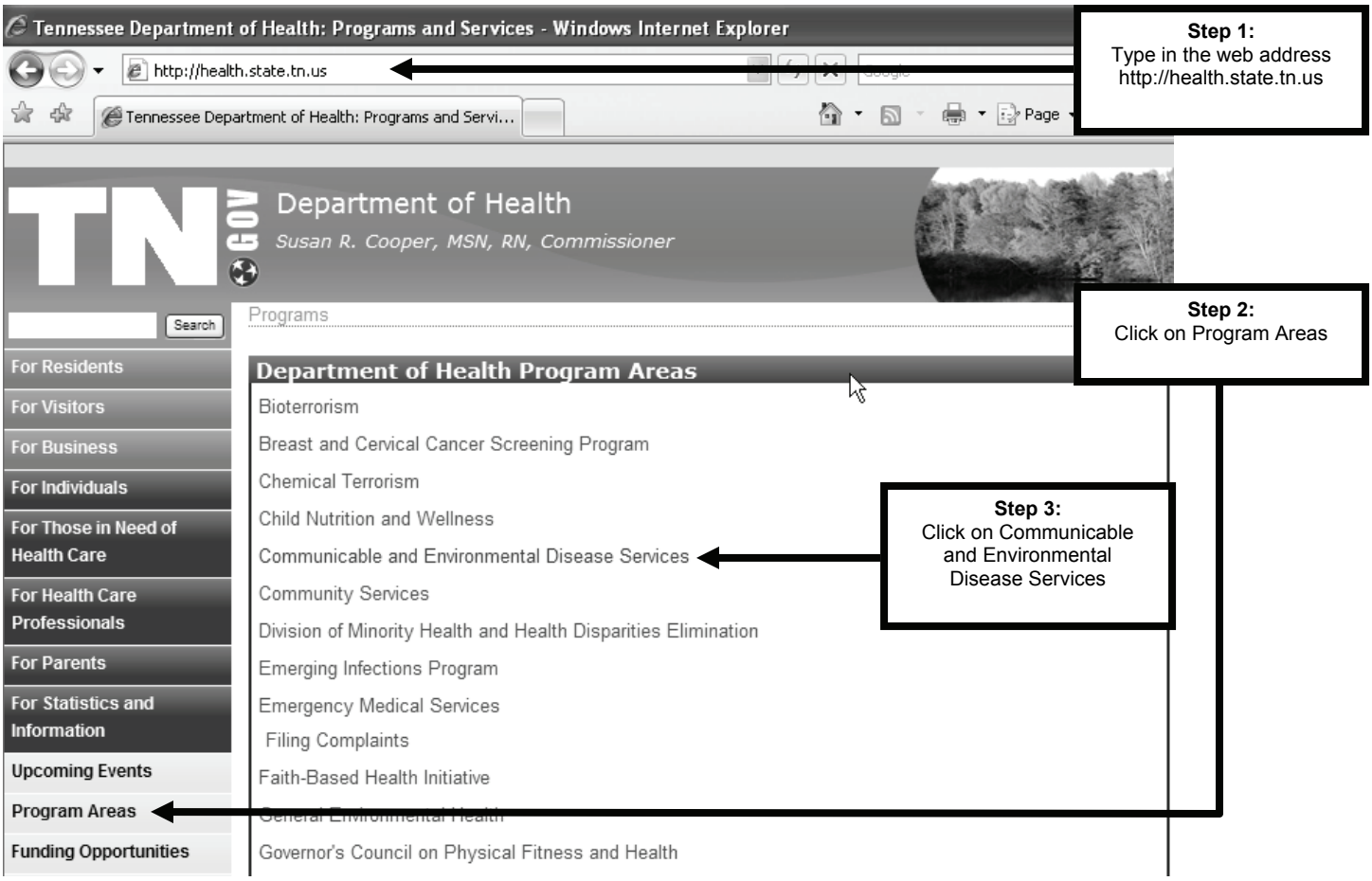
Currently, the EIP Network consists of ten sites: California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon and Tennessee.

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

The core activity of the EIP is active surveillance of laboratory-confirmed cases of reportable pathogens. Laboratory directors and staff, physicians, nurses, infection control practitioners, and medical records personnel are key participants in EIP. Components of the EIP in Tennessee investigate foodborne infections [Foodborne Diseases Active Surveillance Network (FoodNet) and Environmental Health Specialist Network (EHS-Net)], invasive bacterial infections [Active Bacterial Core Surveillance (ABCs)], unexplained encephalitis (TUES), and influenza surveillance and vaccine effectiveness.

J. Communicable and Environmental Disease Services Website

Further tabulations of data regarding disease surveillance in Tennessee are available at the CEDS web site. To access the web site, go to http://health.state.tn.us. Click Program Areas, and then click on Communicable and Environmental Disease Services.



K. Tennessee Population Estimates, 2007

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	2,957,759	<1	80,145	45-49	453,490
Female	3,097,071	1-4	319,292	50-54	426,758
RACE /SEX	**POPULATION**	5-9	402,822	55-59	376,802
White Male	2,418,040	10-14	414,550	60-64	305,723
White Female	2,496,801	15-19	418,730	65-69	236,656
Black Male	484,463	20-24	409,105	70-74	184,083
Black Female	543,140	25-29	402,568	75-79	144,716
Other Male	55,256	30-34	412,076	80-84	105,944
Other Female	57,130	35-39	420,138	85+	97,671
TOTAL	**6,054,830**	40-44	443,561		

L. Tennessee's Department of Health Regions: Counties and Population, 2007

East (Population 709,688)

County	Population	County	Population
Anderson	72,117	Loudon	42,462
Blount	114,523	Monroe	42,705
Campbell	41,190	Morgan	20,765
Claiborne	31,351	Roane	53,762
Cocke	35,569	Scott	22,770
Grainger	22,246	Sevier	79,939
Hamblen	61,137	Union	20,018
Jefferson	49,134		

Mid-Cumberland (Population 952,407)

County	Population	County	Population
Cheatham	39,732	Rutherford	212,208
Dickson	46,809	Stewart	13,642
Houston	8,257	Sumner	144,640
Humphreys	18,656	Trousdale	7,789
Montgomery	148,333	Williamson	150,741
Robertson	61,441	Wilson	100,159

Northeast (Population 336,923)

County	Population	County	Population
Carter	57,715	Johnson	18,442
Greene	65,524	Unicoi	17,952
Hancock	6,879	Washington	113,736
Hawkins	56,675		

South Central (Population 372,127)

County	Population	County	Population
Bedford	42,359	Lincoln	32,938
Coffee	51,361	Marshall	29,042
Giles	30,379	Maury	75,735
Hickman	24,921	Moore	6,065
Lawrence	41,872	Perry	7,764
Lewis	12,077	Wayne	17,614

Southeast (Population 315,267)

County	Population	County	Population
Bledsoe	13,031	McMinn	52,064
Bradley	94,445	Meigs	11,937
Franklin	41,262	Polk	16,575
Grundy	14,890	Rhea	30,029
Marion	28,516	Sequatchie	12,518

Upper Cumberland (Population 326,456)

County	Population	County	Population
Cannon	13,679	Overton	20,873
Clay	8,145	Pickett	5,192
Cumberland	51,276	Putnam	67,554
DeKalb	18,666	Smith	19,251
Fentress	17,520	Van Buren	5,683
Jackson	11,612	Warren	40,660
Macon	22,045	White	24,300

West (Population 535,288)

County	Population	County	Population
Benton	16,929	Haywood	19,954
Carroll	30,286	Henderson	26,965
Chester	16,710	Henry	31,995
Crockett	15,311	Lake	7,941
Decatur	11,863	Lauderdale	28,987
Dyer	38,461	McNairy	25,351
Fayette	32,204	Obion	33,097
Gibson	48,818	Tipton	57,585
Hardeman	30,224	Weakley	35,820
Hardin	26,787		

Metropolitan Regions (Population 2,506,674)

County	Population	County	Population
Davidson	599,518	Madison	96,981
Hamilton	314,003	Shelby	939,764
Knox	401,903	Sullivan	154,505

M. Notes on Sources Utilized in Preparing the Report

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

Disease rates for the United States come from the Centers for Disease Control and Prevention. Summary of notifiable diseases, United States, 2006, MMWR 2008; 55, No.53. The 2007 Summary of Notifiable Diseases has not been released.

Section II.

Tennessee Reported Cases, 1998-2007

Dr. L. Rand Carpenter investigates an outbreak of *Cryptosporidium* at a pool party for a little league baseball team in Madison county.

Source: Tennessee Department of Health.

Reported Cases, by Year of Diagnosis, Tennessee, 1998-2007

DISEASE	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
AIDS	790	650	674	606	663	600	694	809	284	582
Botulism, Foodborne	0	2	0	0	0	0	0	0	0	1
Botulism, Infant	1	2	1	4	3	1	1	0	1	1
Brucellosis	1	0	0	1	0	0	1	0	1	2
California/LaCrosse Encephalitis	9	6	19	17	15	14	13	2	7	14
Campylobacteriosis	285	251	272	364	298	448	438	403	443	448
Chlamydia	13,717	14,216	15,073	15,556	16,042	21,034	22,513	23,041	25,303	26,969
Cryptosporidiosis	11	12	12	25	60	41	55	44	47	137
E. coli 0157:H7	55	53	59	50	51	35	48	45	88	54
Ehrlichiosis	6	19	46	20	26	31	20	24	35	39
Giardiasis	207	159	184	190	188	187	251	225	246	297
Gonorrhea	11,840	11,366	11,877	10,144	9,348	8,717	8,475	8,619	9,687	9,584
Group A *Streptococcus*	42	50	83	87	89	167	144	152	160	149
Group B *Streptococcus*	*	*	87	157	164	264	245	368	379	302
Haemophilus influenzae	33	36	26	48	37	58	53	93	72	92
Hepatitis B Surface Antigen Positive, Pregnant	2	3	36	104	103	109	115	104	121	133
Hepatitis A	224	190	154	187	122	202	96	149	69	59
Hepatitis B, Acute	266	228	213	272	128	212	221	153	173	149
Hepatitis C, Acute	166	96	97	64	26	23	35	28	28	38
Hemolytic Uremic Syndrome	1	8	12	10	7	14	16	10	24	21
HIV	840	803	1,127	805	833	549	586	665	697	792
Legionellosis	23	23	14	30	20	37	44	40	50	40
Listeriosis	13	7	13	9	12	9	16	12	14	16
Lyme Disease	45	39	28	30	27	19	25	18	30	42
Malaria	16	7	13	14	4	7	13	14	9	19
Measles (indigenous)	1	0	0	0	0	0	0	1	0	1
Meningicoccal Disease	69	61	56	63	38	30	23	27	25	21
Meningitis, Other Bacterial	36	44	52	54	39	28	28	16	4	3
Methicillin-Resistant *Staphylococcus aureus*	*	*	*	*	*	*	946	1,972	2,005	1,973
Mumps	2	0	2	1	2	5	4	3	11	4
Penicillin-Resistant *Streptococcus pneumoniae*	192	291	266	226	125	133	153	163	154	199
Penicillin-Sensitive *Streptococcus pneumoniae*	*	*	353	500	471	493	534	807	837	722
Pertussis	41	40	41	72	119	82	179	213	179	75
Rocky Mountain Spotted Fever	31	55	57	87	81	74	99	139	260	186
Rubella	2	0	1	0	1	0	0	0	0	0
Salmonellosis, Non-Typhoidal	587	548	693	724	853	736	776	820	841	849
Shigellosis	884	622	344	124	175	396	570	507	198	363
Syphilis, Congenital	13	11	18	24	11	2	9	19	8	4
Syphilis, Early Latent	659	649	627	553	390	227	206	205	233	294
Syphilis, Late Latent	499	426	511	570	424	461	400	359	434	442
Syphilis, Neurological	15	12	14	10	17	6	7	8	0	0
Syphilis, Primary	143	223	162	89	40	43	24	62	80	109
Syphilis, Secondary	424	418	370	242	128	93	106	155	169	259
Tetanus	1	0	0	1	1	0	2	0	1	1
Toxic Shock *Staphylococcus*	4	3	3	1	2	1	2	1	4	0
Toxic Shock *Streptococcus*	6	5	1	0	0	1	0	0	0	0
Trichinosis	4	0	0	0	1	2	0	1	0	0
Tuberculosis	439	382	383	313	308	285	277	299	277	234
Tularemia	0	0	1	6	4	3	2	7	0	2
Typhoid Fever	2	1	2	1	1	3	4	3	1	1
Vancomycin Resistant *Enterococci*	322	447	524	711	649	802	406	278	388	287
Yersiniosis	*	*	7	14	19	24	26	18	29	13

Number of Reported Cases of Selected Notifiable Diseases with Rates per 100,000 Persons, by Age Group, Tennessee, 2007

DISEASE		<1Y	1-4	5-14	15-24	25-44	45-64	≥65
	Total population	80,145	319,292	817,372	827,835	1,678,343	1,562,773	769,070
AIDS Cases	Number	0	0	*	42	348	182	6
	Rate	0.0	0.0	~	5.1	20.7	11.6	0.8
Campylobacteriosis	Number	28	61	53	37	107	116	48
	Rate	34.9	19.1	6.5	4.5	6.4	7.4	6.2
Chlamydia	Number	31	*	429	19,397	6,663	315	16
	Rate	38.7	~	52.5	2,343.1	397.0	20.2	2.1
Gonorrhea	Number	5	0	147	5,742	3,207	440	20
	Rate	6.2	0.0	18.0	693.6	191.1	28.2	2.6
Group A Streptococcus	Number	5	11	17	8	33	43	34
	Rate	6.2	3.4	2.1	1.0	2.0	2.8	4.4
Hepatitis A	Number	0	1	5	4	19	20	10
	Rate	0.0	0.3	0.6	0.5	1.1	1.3	1.3
HIV Cases	Number	0	*	0	144	252	63	*
	Rate	0.0	~	0.0	17.4	15.0	4.0	~
Meningococcal Disease	Number	4	5	1	5	1	4	2
	Rate	5.0	1.6	0.1	0.6	0.1	0.3	0.3
Pertussis	Number	27	7	4	7	14	13	3
	Rate	33.7	2.2	0.5	0.8	0.8	0.8	0.4
Rocky Mountain Spotted Fever	Number	0	7	18	21	51	67	22
	Rate	0.0	2.2	2.2	2.5	3.0	4.3	2.9
Salmonellosis, Non-Typhoid	Number	115	140	113	72	147	159	114
	Rate	143.5	43.8	13.8	8.7	8.8	10.2	14.8
Shigellosis	Number	10	91	162	18	49	27	11
	Rate	12.5	28.5	19.8	2.2	2.9	1.7	1.4
Syphilis, Early Latent	Number	0	0	0	68	167	63	6
	Rate	0.0	0.0	0.0	8.2	10.0	4.0	0.8
Syphilis, Late Latent	Number	0	0	0	47	248	136	39
	Rate	0.0	0.0	0.0	56.8	147.8	87.0	50.7
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	15	64	25	0
	Rate	0.0	0.0	0.0	1.8	3.8	1.6	0.0
Syphilis, Secondary	Number	0	0	*	67	139	52	*
	Rate	0.0	0.0	~	8.1	8.3	3.3	~

SECTION III.

Disease Summaries

A. Foodborne Disease

After several reports of gastrointestinal illness due to *Salmonella* Anatum at a popular barbecue restaurant in Jackson, Tennessee Department of Health epidemiologists begin their investigation into the outbreak.

Source: Tennessee Department of Health.

The Tennessee FoodNet Program

The Foodborne Diseases Active Surveillance Network (FoodNet) is the principal foodborne disease component of the Centers for Disease Control and Prevention (CDC) Emerging Infections Program (EIP). FoodNet is a collaborative project between the CDC, the 10 EIP states (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New York, New Mexico, Oregon and Tennessee), the U.S. Department of Agriculture (USDA), and the Food and Drug Administration (FDA). The project consists of active laboratory surveillance for foodborne diseases and related studies designed to help public health officials better understand the epidemiology of foodborne diseases in the United States.

Foodborne diseases include infections caused by bacteria such as *Salmonella, Shigella, Campylobacter, Escherichia coli* O157, *Listeria monocytogenes, Yersinia enterocolitica,* and *Vibrio,* and parasites such as *Cryptosporidium* and *Cyclospora.* In 1995, FoodNet surveillance began in five locations: California, Connecticut, Georgia, Minnesota and Oregon. Each year the surveillance area, or catchment, has expanded, with the inclusion of additional counties or additional sites (New York and Maryland in 1998, eleven counties in Tennessee in 2000, Colorado in 2001, New Mexico in 2004). The total population of the current catchment is 44.9 million or 15% of the United States population.

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

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

Why is FoodNet important to public health?

Foodborne diseases are common; an estimated 76 million cases occur each year in the United States. Although most of these infections cause mild illness, severe infections and serious complications do occur. The public health challenges of foodborne diseases are changing rapidly; in recent years, new and emerging foodborne pathogens have been described and changes in food production have led to new food safety concerns. Foodborne diseases have been associated with many different foods. Food vehicles, such as eggs, peanut butter, and fruit juice, have been implicated in transmission of *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 passive 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 chain 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 603 clinical

laboratories that test stool samples in the ten participating states. In Tennessee, 135 laboratories are visited regularly by surveillance officers to collect information on laboratory-confirmed cases of diarrheal illnesses. Additionally, active surveillance for hemolytic uremic syndrome (HUS) (a serious complication of Shiga toxin-producing *E. coli* [STEC] infections) is conducted. The result is a comprehensive and timely database of foodborne illness in a well-defined population.

Survey of clinical laboratories: In 2007, a laboratory survey was carried out to determine current clinical laboratory practices for isolation and reporting of STEC and to assess compliance with the STEC diagnostic guidelines published by CDC in 2006. In Tennessee, responses were received from 132 (98%) of 135 laboratories surveyed. Analysis showed that of the 56 (42%) laboratories reporting testing on-site for *E. coli* O157/STEC, 55 (98%) reported using culture-based methods, 9 (16%) reported using non-culture based methods capable of detecting non-O157 STEC (e.g., enzyme immunoassay or immunocard), 8 (14%) reported using both culture and non-culture methods, and one laboratory reported using both culture and non-culture methods simultaneously as suggested by the CDC guidelines. Of the 9 laboratories reporting non-culture based methods, only 4 indicated using these methods to identify non-O157 STEC.

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. Analysis of the survey indicated that FoodNet sites with a high incidence of *Campylobacter* were more likely than low incidence sites, such as Tennessee,to: test routinely for *Campylobacter* (95% vs 87%, $p<0.01$), use Cary Blair transport media (87% vs 78%, $p=0.03$), reject specimens received without transport media (86% vs 74%, $p<0.01$), homogenize specimens (26% vs 16%, $p=0.02$), use Campy CVA media for direct plating (51% vs 30%, $p<0.01$), and hold plates for >48 hours before final examination (56% vs 41%, $p<0.01$). Transport times were not significantly different (4 vs 3 hours).

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 they sought treatment for the illness and whether they had consumed certain foods. Because many people who become ill with diarrhea are not evaluated by a healthcare provider, little is known about the number of cases of diarrhea in the general population and how often persons with diarrhea seek medical care. The population survey is an essential part of the evaluation of foodborne disease because it allows for an estimate of the population who does not seek medical care when affected by diarrheal illness. The fifth population survey, which began in mid-2006, is currently undergoing analysis.

Epidemiologic Studies: From 2002 through 2004, three case-control studies were conducted in FoodNet to study infants under the age of one year with *Campylobacter* and *Salmonella, Salmonella* Enteritidis, and *Salmonella* Newport. Upon analyzing the studies, several risk factors were identified among infants: riding in a shopping cart next to meat or poultry, drinking well water, visiting or living on a farm, having a pet with diarrhea in the home, eating fruits or vegetables prepared in the home, and travelling outside the United States. Breast-feeding was protective for the youngest infants and should continue to be encouraged.

Both the Selected *Salmonella* Serotype study and the Clinical Outcomes Among non-Typhi *Salmonella* study ended in 2007 and are undergoing analysis. Data continues to be collected for the *E. coli* O157 infection study, which began in 2006; the goal is to assess risk factors for HUS among patients with *E. coli* O157 infections.

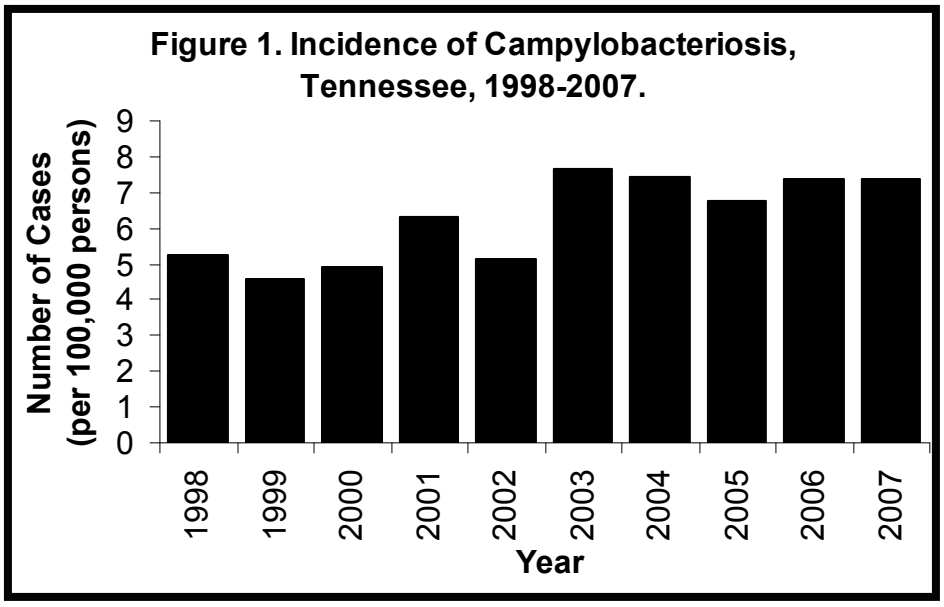
Environmental Health Specialist Network (EHS-Net)

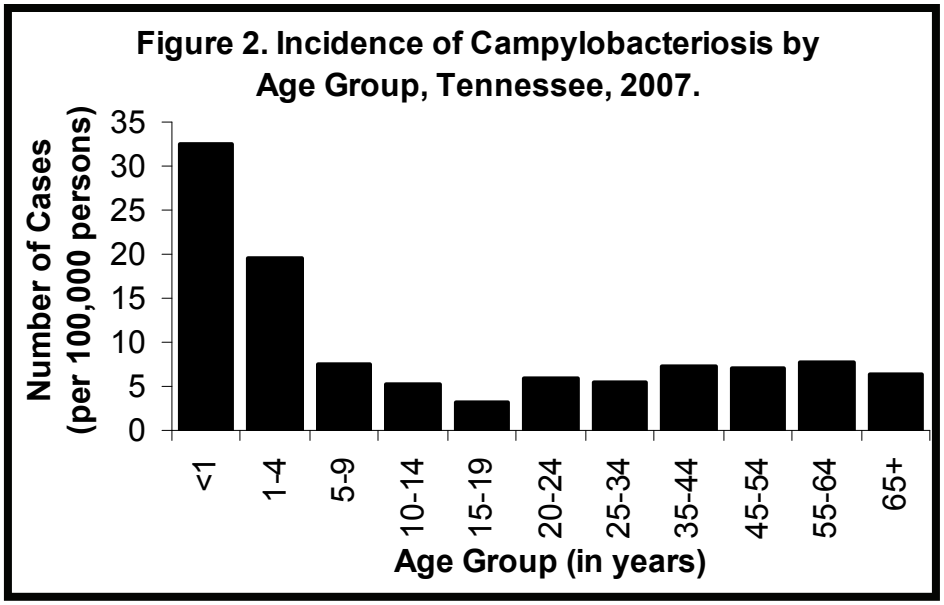
The Environmental Health Specialist Network (EHS-Net) represents collaboration between environmental health specialists, epidemiologists, laboratories, state food protection programs, the Environmental Health Branch of the National Center of Environmental Health at CDC, the Food and Drug Administration, and FoodNet. EHS-Net's mission is to identify environmental antecedents to foodborne and waterborne illness and disease outbreaks through work in areas where active foodborne and waterborne disease surveillance systems are in place.

Ongoing projects include a survey of restaurant procedures for cooling cooked products, surveys of restaurant procedures for safely handling fresh produce and poultry products, and a large survey to learn more about consumers' perception of the usefulness of food product recalls. A study characterizing restaurants that have been associated with foodborne outbreaks is being completed. Data continues to be collected for the retail meat study; the goal is to determine the prevalence of contamination and 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. Water projects include a study of the health effects of failures of water systems to decontaminate water lines properly following maintenance and a pilot study of a small water system investigation tool.

Campylobacteriosis

Campylobacteriosis is one of the most commonly reported gastrointestinal illnesses in Tennessee and the United States. The causative agent is primarily *Campylobacter jejuni*; *Campylobacter coli* cases occur less commonly. Most persons infected with *Campylobacter* develop diarrhea, cramping, abdominal pain and fever within two to five days after exposure. The disease is typically self-limited lasting approximately one week.



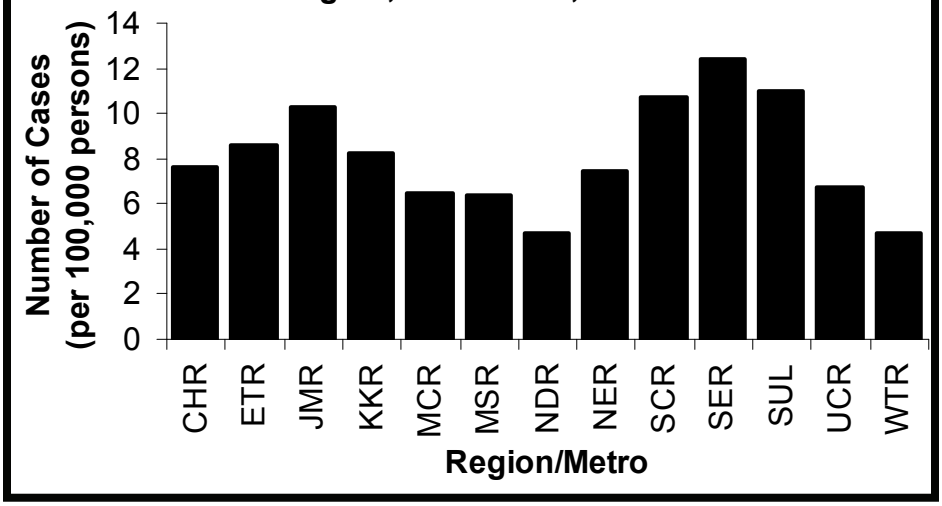


After an apparent decline from 1997 to 1999, for the past five years rates of campylobacteriosis have been fairly steady at approximately 7.3 cases per 100,000 persons (**Figure 1**). Active laboratory surveillance for *Campylobacter* is carried out statewide under the auspices of the FoodNet program. Unlike other foodborne pathogens, isolates of *Campylobacter* are not required by state law to be sent to the state laboratory. Those at greatest risk of developing infection are under the age of five years (**Figure 2**). In 2007, the rate of disease in this population was 22.2 cases per 100,000 persons. The risk for those under the age of one is even greater (32.4 cases per 100,000 persons).

Regional differences in rates of *Campylobacter* infection have been described internationally and domestically. In FoodNet sites alone, there is remarkable variation in rates of campylobacteriosis. According to 2007 preliminary FoodNet data, Maryland reported the lowest rate of disease, with 7.2 cases per 100,000 persons, while California reported a rate almost quadruple that

(28.2 cases per 100,000 persons). Within Tennessee, campylobacteriosis rates also vary regionally with higher rates in eastern Tennessee (**Figure 3**). This phenomenon is consistent year after year. In 2007, the rate of disease varied region to region across the state, with the highest rate in the Southeast Region with 12.4 cases per 100,000 persons. Whereas, the lowest rates of the state were found in both Nashville/Davidson County metropolitan area and West Tennessee Region with 4.7 cases per 100,000 persons each.

Figure 3. Incidence of Campylobacteriosis by Region, Tennessee, 2007.



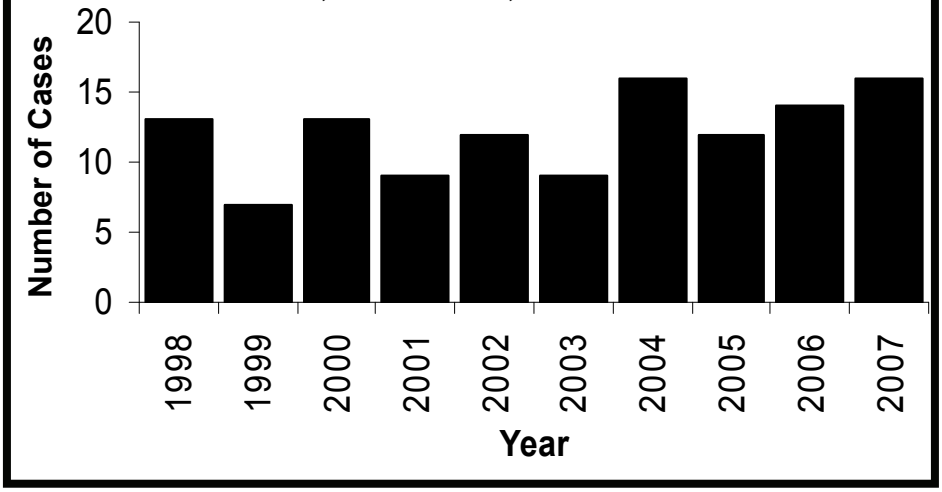
To better understand this variation, FoodNet has undertaken several studies: an analysis of hospitalization rates, a survey of laboratories, a survey of the general population, and a survey of physicians. None have fully explained the differences. Examination of the differences in food consumption preferences 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 conducted from 2002-2004. Several risk factors were identified among infants, and these risk factors vary by age, suggesting that prevention measures be targeted accordingly. Riding in a shopping cart next to meat or poultry, drinking well water, visiting or living on a farm, having a pet with diarrhea in the home, eating fruits or vegetables prepared in the home, and travelling outside the United States were among the risk factors identified. Breast-feeding was protective for the youngest infants and should continue to be encouraged. The study was published in the Pediatric Infectious Diseases Journal in January 2007. The results of this important project should help to better understand the reasons for the disproportionately high rates of these diseases among one of the most vulnerable age groups.

Listeriosis

The bacterium *Listeria monocytogenes* causes listeriosis, a rare but serious foodborne disease. It accounts for only about 2,500 of the estimated 76 million foodborne illnesses per year in the US; however, listeriosis results in 500 deaths and 2,300 hospitalizations per year, the highest rate of hospitalization of any foodborne illness. Listeria can cause severe neurological disease (including meningitis), spontaneous abortion, and infection in the newborn infant. The primary vehicle is food.

Figure. Number of Cases of Listeriosis by Year, Tennessee, 1998-2007.

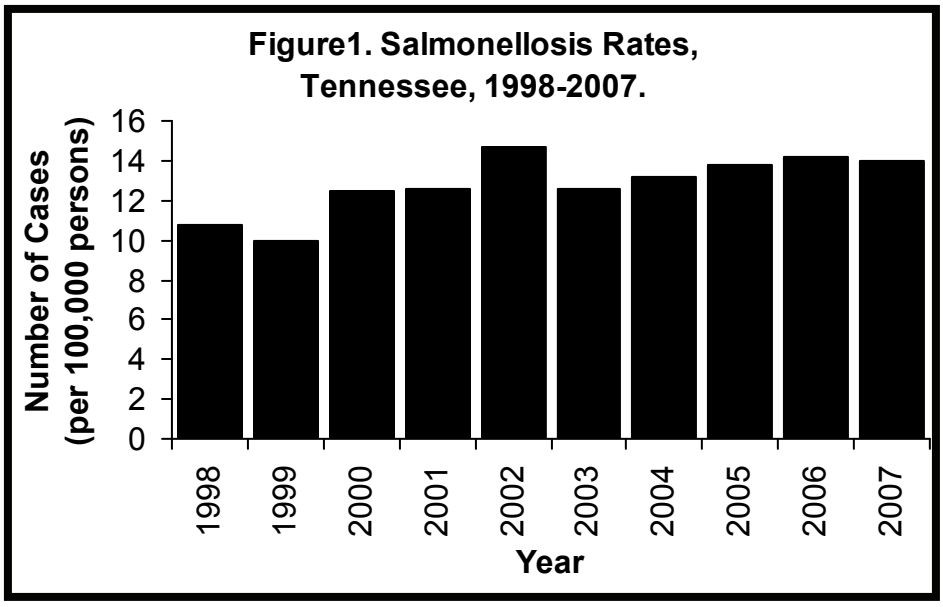


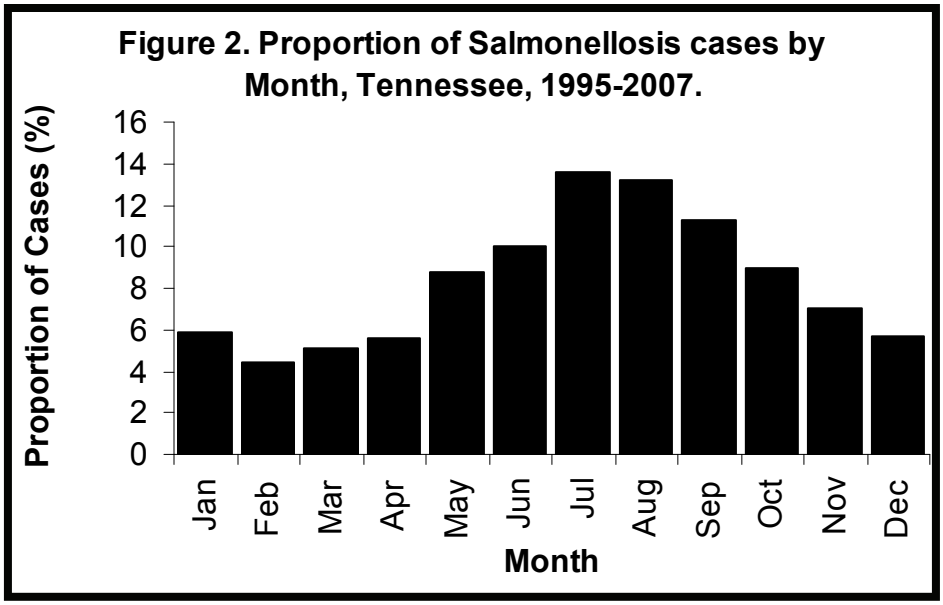
The major risk factors for infection with *Listeria monocytogenes* include the consumption of high-risk foods (non-pasteurized dairy products, frankfurters, and ready-to-eat deli meats) by those who are immunosuppressed or pregnant.

In Tennessee, listeriosis became a reportable disease in 1996. That year 6 cases were reported; the next year that number jumped to 14. In 1998, a multistate outbreak of listeriosis resulted from post-processing contamination in a hot dog manufacturing plant in another state. Tennessee Department of Health staff assisted in the early identification of that outbreak. The number of cases in Tennessee has remained fairly constant since 1997. Among FoodNet sites in 2007, the overall rate was 0.27 cases per 100,000 persons. Tennessee reported 16 cases **(Figure)** in 2007 or 0.26 cases per 100,000 persons.

Salmonellosis

Salmonellosis is a gastrointestinal infection with a bacterium called *Salmonella*. Common symptoms include nausea, diarrhea, abdominal cramps, and sometimes vomiting. Although the illness is generally regarded as a relatively mild disease, death can occur in some cases, especially among the very young, very old, or immunocompromised. Salmonellosis usually appears 6 to 74 hours after eating contaminated food and lasts for 4 to 7 days. Every year, approximately 40,000 cases of salmonellosis are reported in the United States. Because many milder cases are not diagnosed or reported, the actual number of infections may be thirty or more times greater.





The average incidence rate of salmonellosis in Tennessee from 2000 through 2007 was 42% higher than the rates from 1995 through 1999 **(Figure 1)**. A total of 849 cases were reported to the health department in 2007, representing a 9% increase from the 2000-2006 average. The overall rate in 2007 was 14 cases per 100,000 persons, which was lower than the national rate (15 cases per 100,000 persons in 2006) but higher than the National Health Objective 2010 for incidence of salmonellosis (6.8 per 100,000 persons).

Rates of infection varied by region in 2007. Jackson/Madison County, West Tennessee Region, Mid-Cumberland Region, and Hamilton County, each reported the highest rates of *Salmonella* infections (18 cases per 100,000 persons) compared with 9 cases per 100,000 each in Davidson County,

and South-Central Region. Four foodborne outbreaks of *Salmonella* were reported in Tennessee in 2007, including an outbreak of *Salmonella* Heidelberg associated with a restaurant in Shelby County with 16 ill persons. A total of 36 cases from all over Tennessee were associated with the peanut butter linked *Salmonella* Tennessee multi-state outbreak in 2006/2007.

From 1995 to 2007, salmonellosis reports followed a typical seasonal trend with two thirds of cases occurring during the summer and fall. **Figure 2** depicts this trend. During this time period, 66% of cases were reported during the months of May through October. In 2007, salmonellosis peaked in July with 104 (12%) cases.

As shown in **Figure 3**, from 1995 to 2007, *Salmonella* was isolated most frequently from children under 5 years of age, who accounted for 33% of all salmonellosis cases. In 2007, the incidence rates of salmonellosis were 133 cases per 100,000 infants under the age of one and 40 cases per 100,000 children 1-4 years of age.

Figure 3. Salmonellosis Rates by Age Group, Tennessee, 1995-2007.

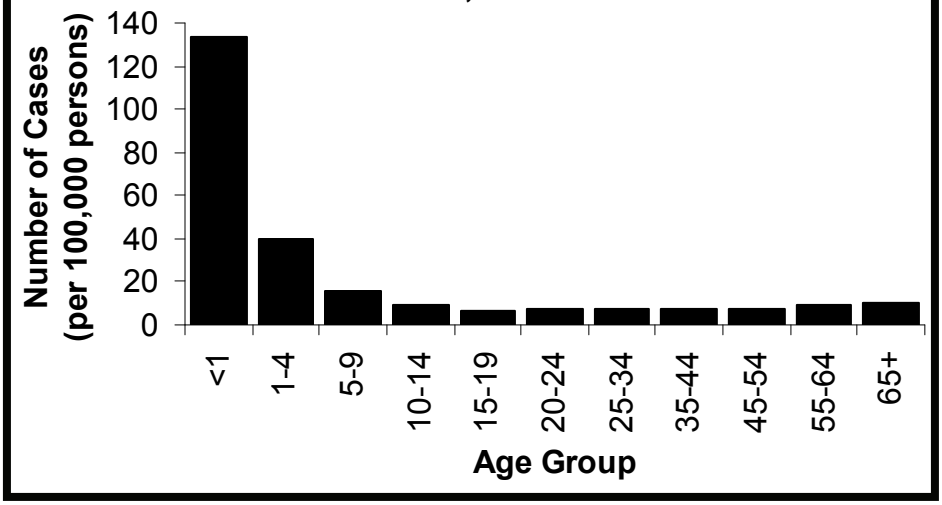
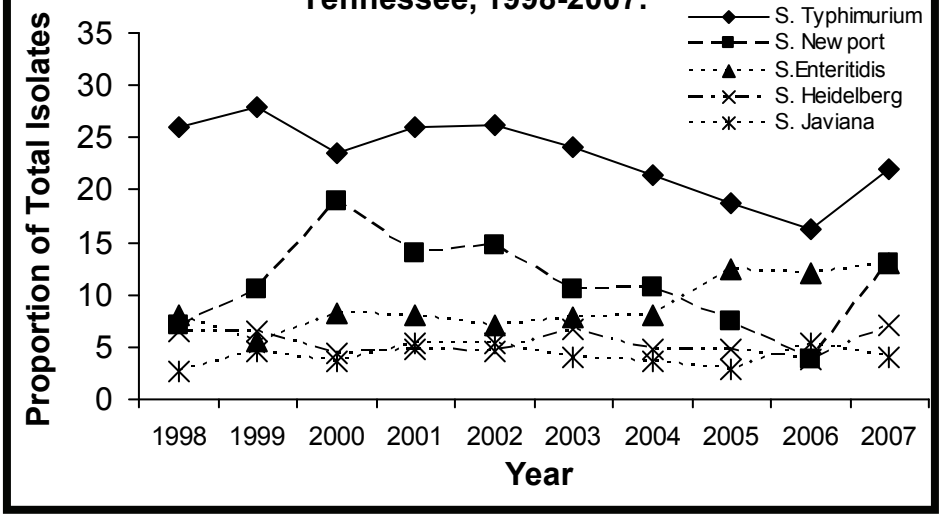


Figure 4. The Top 5 serotypes of *Salmonella*, Tennessee, 1998-2007.



The five most common serotypes of *Salmonella* [*S.* Typhimurium including S. I 4,[5],12:i:- (a monophasic variant of *S.* Typhimurium), *S.* Enteritidis, S. Newport, S Heidelberg, and *S.* Javiana] accounted for 60% of all *Salmonella* isolates sent to Tennessee Department of Health State Laboratory in 2007 (**Figure 4**). Only one case of *S.* Typhi was reported in 2007 for an adult male from Davidson County with travel history to Mexico prior to the illness.

Nationwide, resistance among non-Typhi *Salmonella* has increased to a number of clinical important antimicrobial agents like ampicillin and trimethoprim/sulfamethxazole. In recent years, resistant strains to third-generation cephalosporines (e.g., ceftiofur), and quinolones (e.g. nalidixic acid) has emerged. In Tennessee, the proportion of resistance to ceftiofur was 2-3% in years 2001 through 2004 and 0% in 2005, while resistance to nalidixic acid remained 0-1% in the same years.

Tennessee participated in the FoodNet cohort study on the impact of resistance on clinical outcome among non-Typhi *Salmonella* serotypes in 2006 and 2007 years and the analysis is ongoing. Tennessee also participated in the FoodNet Case-Control Study of Selected *Salmonella* Serotypes that ended in December 2007 as an attempt to identify modifiable risk factors to prevent illness caused by three emerging serotypes of interest within FoodNet sites: *S.* Javiana, *S.* Infantis, and *S.* I 4, [5],12:i:-.

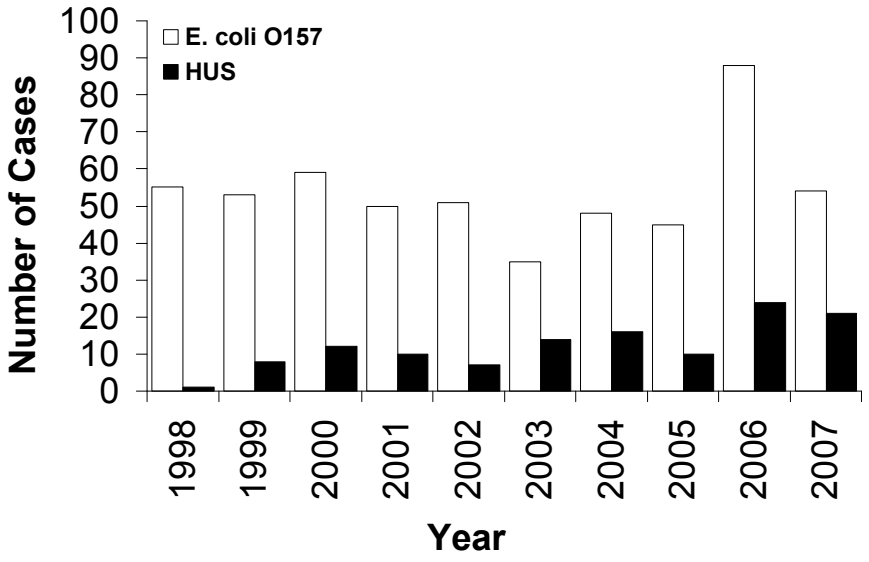
Shiga-toxin Producing *E. coli*, *E. coli* O157 and Hemolytic Uremic Syndrome

Escherichia coli are common gram-negative bacteria with many subtypes causing a range of clinical illnesses. Although most *E. coli* are non-pathogenic residents of the colon, various subtypes cause urinary tract infections and other extra-intestinal infections and are common causes of diarrhea worldwide.

Shiga toxin-producing *E. coli* (STEC) are a group of E coli that cause dysentery (blood diarrhea). STEC possess several virulence factors, including Shiga toxin. Shiga-toxin, also called verotoxin, is essentially identical to a toxin produced by *Shigella dysenteriae*. Livestock, especially cattle, are thought to be the primary reservoir for STEC. Reservoir species are clinically unaffected. Transmission has been associated with foods like ground meat and contaminated produce, contaminated water, and direct contact with STEC colonized animals and their environment. Enterohemmorhagic *E. coli* (EHEC) are diarrheagenic *E. coli* which are a subset of Shiga toxin-producing *E. coli* (STEC). In the United States and in Tennessee, EHEC are important pathogens causing sporadic illness and outbreaks. The most commonly isolated EHEC is *E. coli* O157. Identification is facilitated by certain biochemical properties (does not ferment the sugar sorbitol), which are distinctive.

EHEC, including *E. coli* O157, can cause watery or bloody diarrhea and hemorrhagic colitis. Severe abdominal cramping or pain are often reported. Nausea, vomiting and fever are less commonly reported. 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%. HUS is characterized by the clinical triad of microangiopathic hemolytic anemia, thrombocytopenia, and acute renal failure. 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. Tennessee is involved in conducting the largest study to date to address the effects of antimicrobial use in persons infected with *E. coli* O157.

Figure. Culture-confirmed *E. coli* O157 cases and HUS cases, Tennessee, 1998-2007.



Although *E. coli* O157 is the most commonly isolated, there are 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.

Most clinical laboratories have the capacity to identify *E. coli* O157 by culture, isolating sorbitol-negative *E. coli*. Of 135 Tennessee laboratories surveyed in 2007, 132 (98%) responded regarding STEC isolation practices. Fifty six (42%) of the 132 clinical laboratories reported testing on-site for *E. coli* O157/STEC. Fifty-five (98%) of the 56 laboratories reported using culture-based methods. Only 9 (16%) of the 56 laboratories reported using non-culture based methods that can identify non-O157 STEC (e.g., enzyme immunoassay or immunocard). All positive STEC infections, including *E. coli* O157, are re-

portable to TDH. Any clinical material, culture material (i.e. broth cultures), or isolates positive for Shiga toxin (including *E. coli* O157) must be forwarded to the state public health laboratory per Tennessee law. This is especially important as more labs begin using non-culture based methods. Isolation of the bacteria is important for serotyping and DNA fingerprinting by pulsed-field gel electrophoresis (PFGE). PFGE helps to identify cases with potential epidemiologic links to other sporadic cases, recognized outbreaks, or contaminated foods.

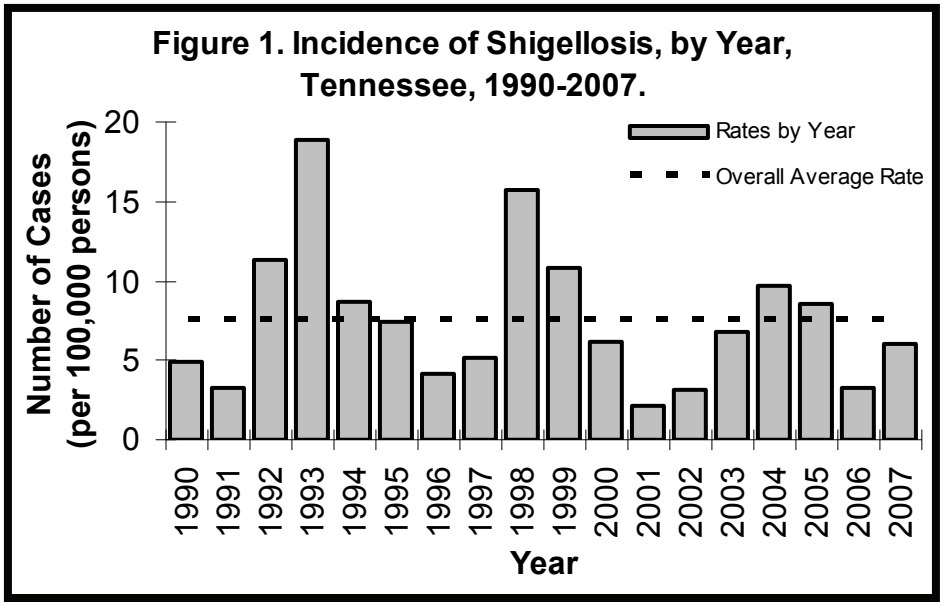
In 2007, 118 cases of STEC were reported to the Tennessee Department of Health. Of these, 54 (**Figure**) were culture confirmed *E. coli* 0157, 18 were culture-confirmed non-O157 STEC, and 1 was culture-confirmed STEC with O antigen undetermined. In 2007, 21 cases of HUS were reported in persons under 18 years of age. Of these, laboratory evidence of a preceding STEC infection was obtained in 16 (76%).

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* by the FoodNet program.

Even though the number of cases reported in Tennessee has varied over the years, the rate of disease has declined overall since 1962 (average incidence rate of 7.1 cases per 100,000 persons). However, in the early 1990s, things began to change. With major increases in incidence in 1993 (18.9 cases per 100,000 persons), 1998 (15.7 cases per 100,000 persons) and 2004 (9.7 cases per 100,000), it is apparent that shigellosis is at the beginning of its fourth five-year cycle of intermittent increase (**Figure 1**).

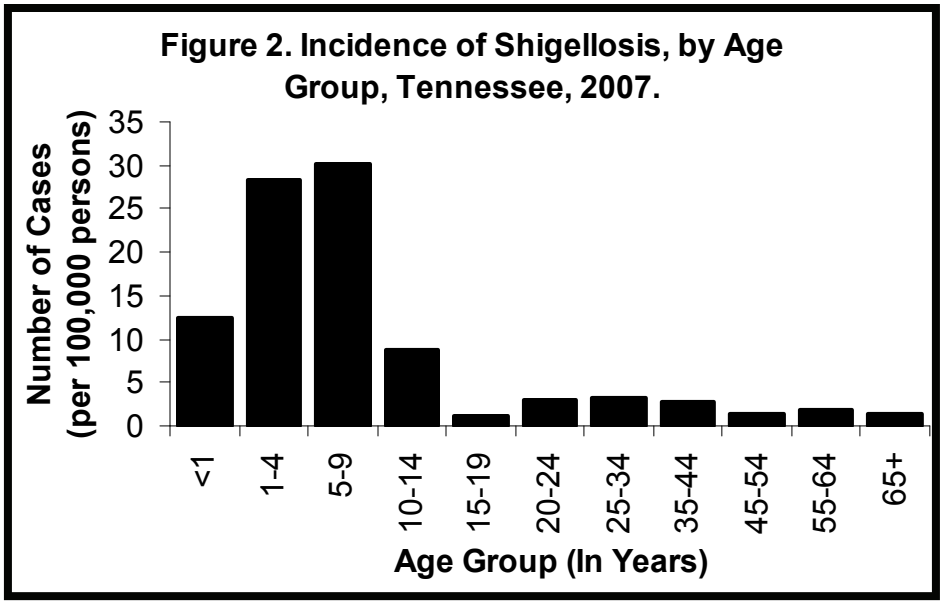


In 2007, there were 363 cases of shigellosis reported in Tennessee (6.0 cases per 100,000 persons). This represents a significant increase in incidence of more than 80% from the previous year. The majority of those cases were concentrated in Knoxville/Knox County (25.9%) metropolitan area and East Tennessee Region (22.0%), which were experiencing community-wide outbreaks of a clonal strain of *Shigella*.

The driving factor in many shigellosis outbreaks is daycare-associated cases, including attendees, employees, or the family members of either group. However in 2007, there was a slight shift in the demographics of our outbreak-associated cases to school-aged children. Of those 363 cases reported in 2007, close to 72% were under the age of fifteen (for a rate of 21.3 cases per 100,000 persons in that age group). The rate of disease is even greater for those children between the ages of five and nine – 30.2 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.



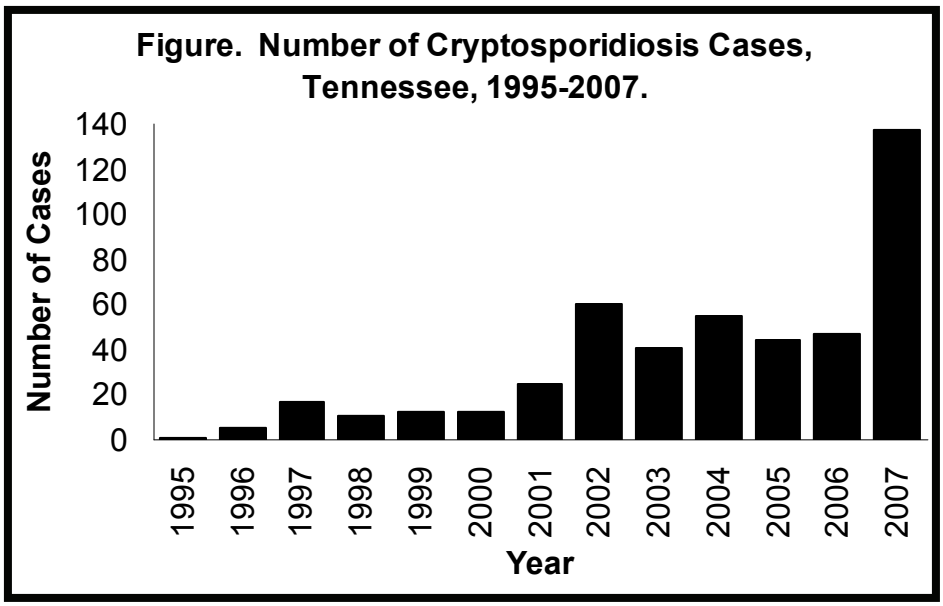
If a child in diapers has shigellosis, everyone who changes the child's diapers should be sure the diapers are disposed of properly in a closed-lid garbage can, and should wash his or her hands carefully with soap and warm water immediately after changing the diapers. After use, the diaper changing area 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 various and diverse geographic locations worldwide. Tourists returning to their own countries, immigrants from endemic areas and immunocompromised persons are at risk for acquiring parasitic diseases in non-endemic areas. Three parasitic diseases are reportable in Tennessee: cryptosporidiosis, cyclosporiasis and giardiasis.

Cryptosporidiosis

Cryptosporidium is a protozoal parasite affecting both animals and humans. The 2 species most commonly seen in humans, *C. parvum* and *C. hominis*, are resistant to chlorine and difficult to filter, making them substantial threats in both drinking and recreational water. *Cryptosporidium* oocysts (eggs protected by a shell) remain viable in a variety of harsh environmental conditions and for long periods of time.



C. parvum has long been seen in persons, pets, and ruminant animals in agricultural settings. Contemporary urban settings and demographics are contributing to an environment that may enhance the spread of crypto-

sporidia. In fact, a dramatic increase in cases has occurred nationally and in Tennessee. Human factors that may be contributing to the rise include expanded use of day care centers by infants and young children, an increase in the numbers of elderly people who live in institutions, and the growing numbers of immunocompromised persons. Water distribution issues may contribute as well because water supplies are increasingly piped long distances from their source to the point of use.

The number of cryptosporidiosis cases in Tennessee has increased dramatically. In 1995 a single case was reported. During 2002–2007, a mean of 64 cases was reported each year. **(Figure)** The 137 cases reported in 2007 included cases from at least 2 recreational water outbreaks, one of which was attributed to *C. hominis*. This increase in Tennessee in recent years mirrors the national trend as discussed above. Some portion of the increase in reporting may be attributable to the availability of a new anti-*Cryptosporidium* drug, nitazoxanide, approved in 2005, which is thought to have made patients and providers more aware of cryptosporidiosis and more likely to pursue diagnosis.

In 2007, TDH Laboratory Services acquired the equipment and training necessary to speciate *Cryptosporidium* specimens and to test drinking or recreational water for presence of *Cryptosporidium*. Tennessee Department of Health distributes information on recreational water safety each year in an effort to reduce Cryptosporidium risks.

Cyclosporiasis

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

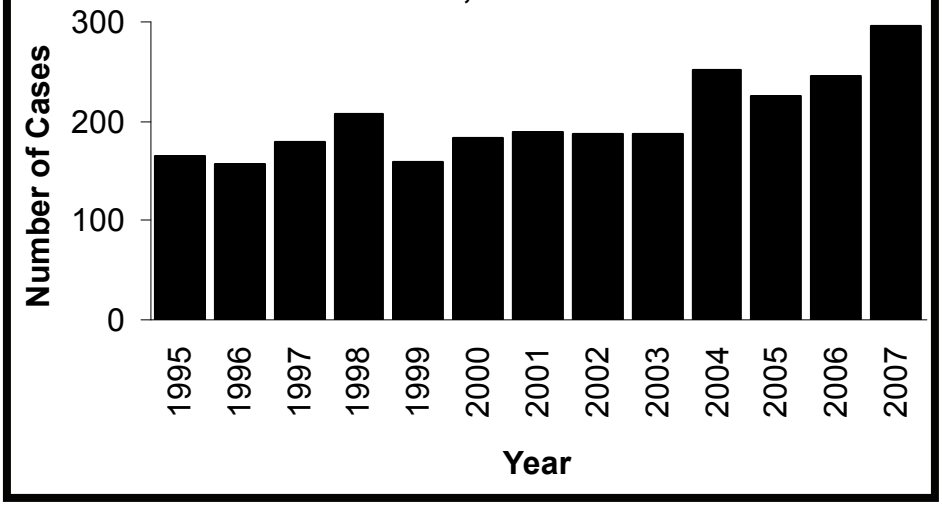
During 1995–2000, large outbreaks of cyclosporiasis in North America were associated with the consumption of fresh raspberries from Central America. These outbreaks prompted intensive study of *Cyclospora* in the United States. In April 2005, another large outbreak in Florida was attributed to consumption of fresh basil; more than 300 individuals were infected in 32 Florida counties.

Despite these outbreaks, the overall US incidence of *Cyclospora* infections is thought to be low. In 2007, only 13 cases were reported for an incidence rate of 0.03 per 100,000 persons in FoodNet. A single case was reported in Tennessee during 2002–2004. Three cases were reported in 2005, 3 cases in 2006, and 1 case in 2007.

Giardiasis

Giardia is the most common 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 26% of giardiasis cases 1995–2007.

Figure. Number of Giardiasis Cases, by Year, Tennessee, 1995–2007.



Infection with the parasite requires oral ingestion of *Giardia* cysts. This can occur in three ways: the ingestion of contaminated water (the most fre-

quent), person-to-person transmission, and the consumption of contaminated food. Waterborne outbreaks usually are related to untreated or inadequately treated surface water. Person-to-person transmission occurs through fecal exposure and most frequently occurs among small children in day-care centers, persons in custodial living centers, and through sexual contact.

The **figure** depicts the number of cases of giardiasis reported in Tennessee 1995–2007; the numbers have remained fairly consistent, ranging from a low of 146 in 1995 to a high of 295 in 2007. For the period 1995-2007, giardiasis reports followed a typical seasonal trend with over 60% 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 food with a common source of contamination. All suspected outbreaks and unusual patterns of diarrheal illness should be reported promptly to the local health department (**Figure 1**).

In 2007, 21 foodborne disease outbreaks were reported in Tennessee (**Table**). The increasing use of pulsed-field gel electrophoresis (PFGE) to determine relatedness of bacterial iso-

Figure 1. Reported Foodborne Disease Outbreaks, Tennessee, 1998-2007.

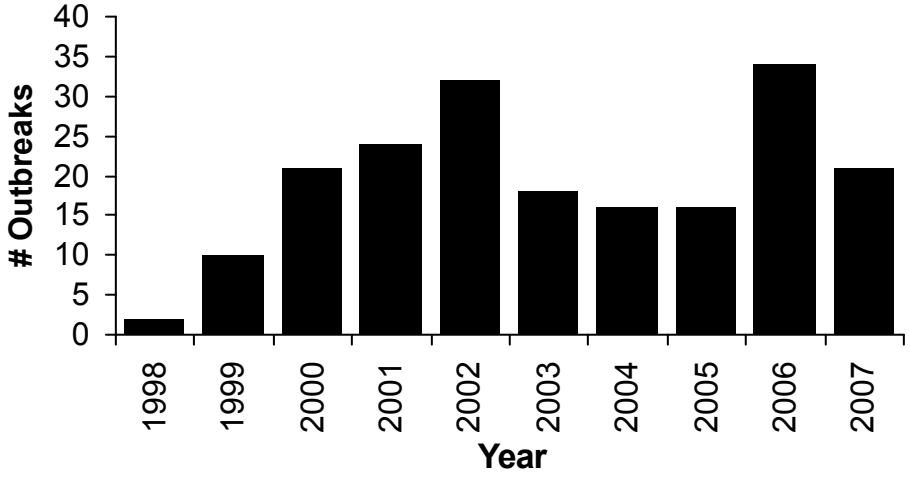


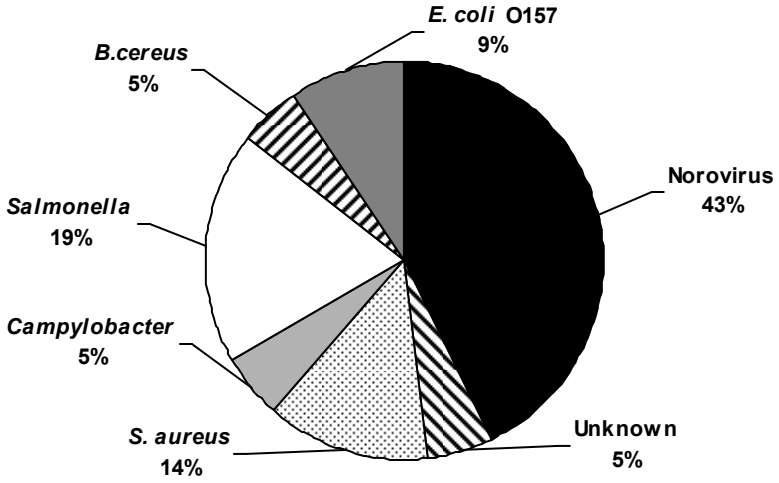
Table. Reported Foodborne Disease Outbreaks, Tennessee, 2007.

ONSET	COUNTY	# ILL	ETIOLOGY	SITE	SUSPECTED VEHICLE
1/11/2007	Hamilton	4	Norovirus	Restaurant	Unknown
1/14/2007	Hamilton	4	Norovirus	Restaurant	Unknown
1/20/2007	Shelby	16	*S.* Heidelberg	Restaurant	pork rib, shoulder suspected
2/12/2007	Davidson	8	Norovirus	Restaurant	Unknown
2/14/2007	Hamilton	3	*S. aureus*	Restaurant	Fried chicken, salsa/ranch dressing
2/18/2007	Hamilton	4	Norovirus	Restaurant	Unknown
2/22/2007	Hamilton	3	*B. cereus*	Restaurant	Fried rice
2/25/2007	Madison	10	Norovirus	Restaurant	Unknown
3/5/2007	Hamilton	15	Norovirus	Restaurant	Unknown
5/6/2007	Warren	20	Unknown	Restaurant	Unknown
5/13/2007	Hamilton	11	*S. aureus*	Restaurant	Rice suspected
10/9/2007	Davidson	3	*B. cereus/S. aureus*	Restaurant	Rice
8/5/2007	Greene, Franklin, Davidson, Hickman	5	*S.* Typhimurium	Commercial	Pot pies
9/29/2007	Knox	4	*E. coli* O157:H7	Commercial	Ground beef
10/23/2007	Shelby	50	Norovirus	Workplace	Unknown
8/16/2007	Hamilton, Wilson, Blount, Hawkins, White, Lincoln	8	*E. coli* O157:H7	Commercial	Pepperoni-containing Pizza
11/5/2007	Blount	8	Norovirus	Restaurant	Unknown
10/15/2007	Davidson	2	*S.* Norwich	Restaurant	Unknown
12/13/2007	Hamilton	8	Norovirus	Restaurant	Raw oysters
11/10/2007	Shelby	6	*S.* Braenderup	Unknown	Unknown
10/14/2007	Hamilton	13	*Campylobacter*	Retirement center	Unknown

lates 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 2007, 95% of reported foodborne disease outbreaks had a laboratory-confirmed etiology (**Figure 2**).

Figure 2. Etiology of Reported Foodborne Disease Outbreaks, Tennessee, 2007.



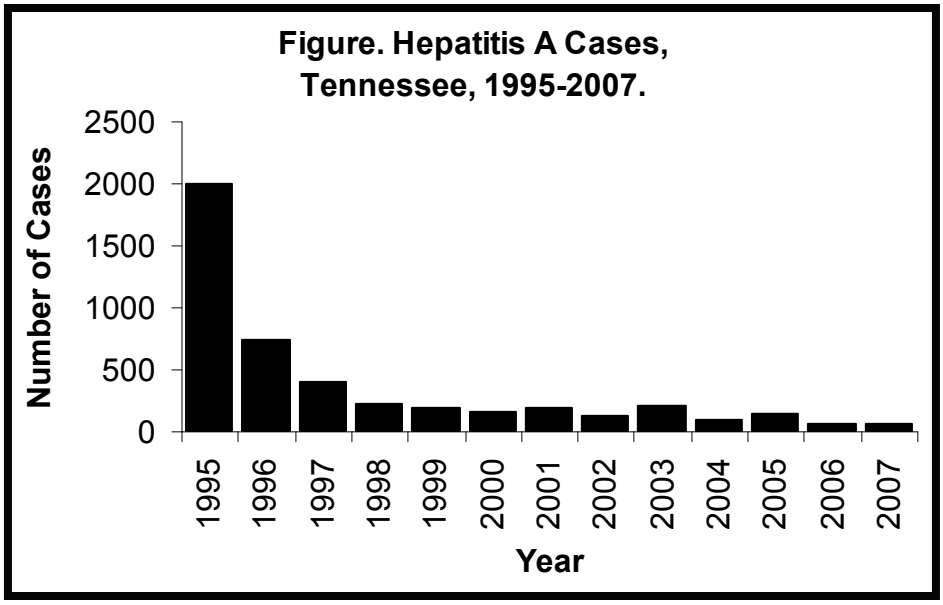
B. Hepatitis

Northeast Regional Office staff prepare to open a Hepatitis A post-exposure prophylaxis clinic for residents and recent visitors to a small lakeside community in Campbell county.

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 only about 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 in approximately 15% of cases. Fulminant hepatitis is rare but is more common in people with underlying liver disease. Chronic HAV infection does not occur; infection confers lifelong immunity. One-third of Americans have evidence of past infection (immunity).



Hepatitis A virus is an RNA virus classified as a member of the picornavirus group. The most common mode of transmission is person-to-person, resulting from fecal contamination and oral ingestion (ie, the fecal-oral route). 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 aged 5 to 14 years, and the lowest rates occurred among adults aged greater than 40 years. In the late 1990s, hepatitis A vaccine was more widely used and the number of cases reached historic lows. In Tennessee, an epidemic of hepatitis A occurred in 1995 in Shelby County accounting for almost 1600 of the nearly 2000 cases reported in the state that year (**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. In general, the number of cases continues to decline over time; only 59 cases (1.0 per 100,000 persons) were reported in 2007 in Tennessee, the lowest number to date.

Among cases of hepatitis A infection reported to the CDC, the identified sources of infection included 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 injecting and non-injecting drug users. In child care centers, recognized symptomatic (icteric) illness occurs primarily among adult contacts of children. Most infected children in child care are asymptomatic or have nonspecific manifestations, so spread of HAV infection within and outside a child care center often occurs before recognition of the index case(s).

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

Immune globulin (IG) or vaccine, when given within 2 weeks after exposure to HAV, is greater than 85 % effective in preventing symptomatic infection. For healthy persons aged 12 months--40 years, hepatitis A vaccine is preferred to IG because of vaccine advantages that include long-term protection and ease of administration

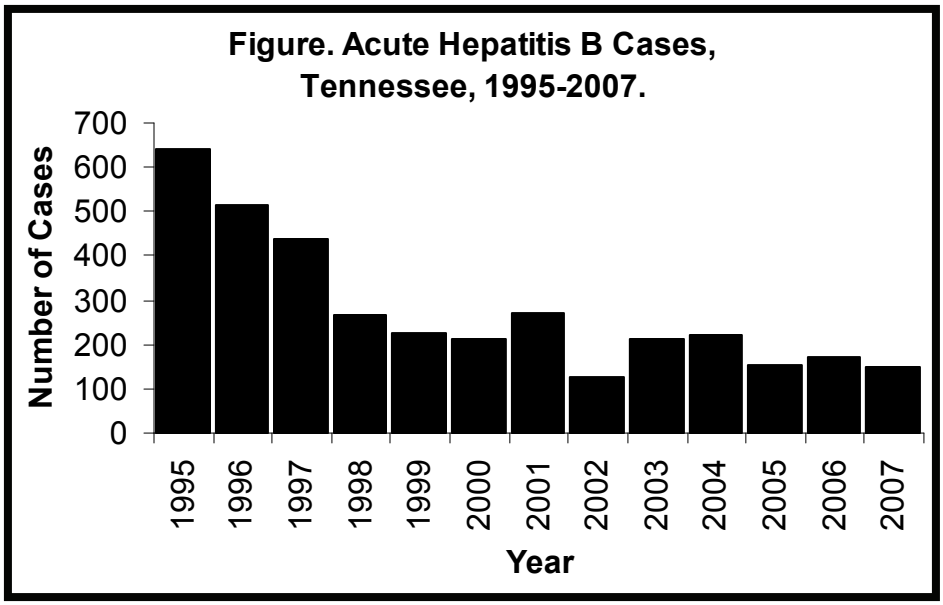
(MMWR 2007;56:1080-4). Prevention is important; recommendations include hand hygiene with soap and water after using the bathroom, changing a diaper, and before preparing and eating food. Hepatitis A vaccine is the best protection, and there are two inactivated hepatitis A vaccines, Havrix and Vaqta. These two vaccines are approved for people 2 years of age and older. Twinrix, a hepatitis A/B combination vaccine, was recently approved by FDA for use in adults > 18 years of age.

Hepatitis B

Persons 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 30-50% of persons aged ≥5 years have symptoms of acute infection. These symptoms include jaundice, fatigue, abdominal pain, loss of appetite, nausea and/or vomiting, and joint pain. Most children aged <5 years are asymptomatic. Acute hepatitis B can not be distinguished from other forms of acute viral hepatitis on the basis of clinical signs and symptoms or liver function tests. 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 perinatal (mother-to-child), percutaneous and mucosal exposure to infectious body fluids, sharing or using non-sterilized needles or syringes, sexual contact with an infected person, household contact with chronically infected persons, occupational exposure among healthcare and public safety workers, and healthcare-associated (eg, hemodialysis). Persons at risk for HBV infection might also be at risk for infection with hepatitis C virus (HCV) or HIV. Abusing alcohol can increase risk for severe liver disease.

Figure. Acute Hepatitis B Cases, Tennessee, 1995-2007.



Hepatitis B case reports in Tennessee have decreased over time (**Figure**). A total of 149 cases were reported in 2007 (2.4 cases per 100,000 persons). 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, 5% to 8% of the total population has been infected with HBV, 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 persons aged 0–18 years and vaccination of risk groups of all ages is recommended. The number of new infections per year in the United States has declined 80% since 1991, when routine vaccination of children

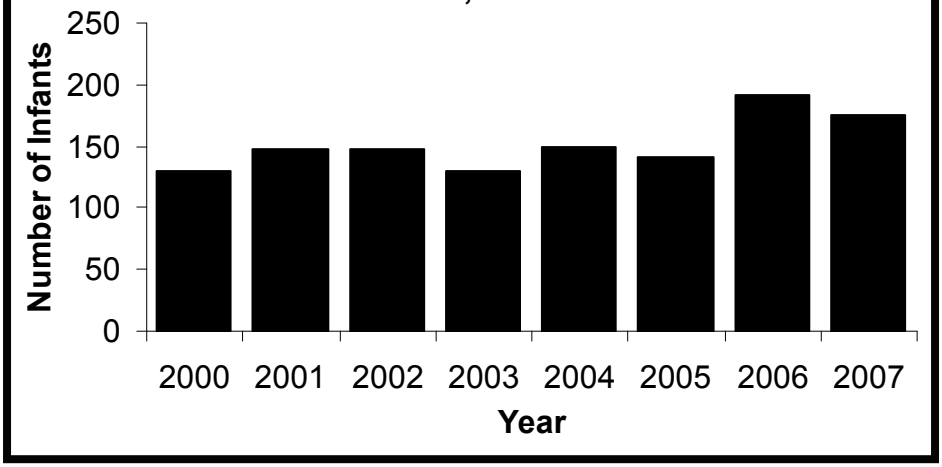
was first recommended. The highest rates of disease occur in 20–49 year olds with the greatest decline among children and adolescents due to routine hepatitis B vaccination. Approximately 1.25 million Americans are chronically infected with HBV of which 20–30% acquired their infection during childhood.

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, 2000-2007.



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. Because the CDC estimates that approximately 300 women with hepatitis B give birth each year in Tennessee, the increase in infants identified in 2007 is interpreted as an improvement in detection, rather than an increase in the actual number of infants at risk.

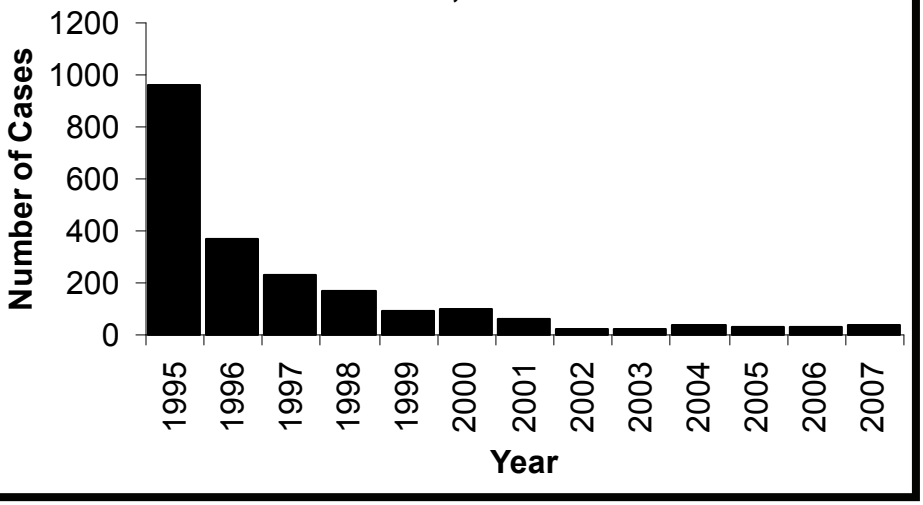
Hepatitis C

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 70% of infected adults, limited data indicate that <10 % of infected children develop chronic hepatitis, and <5 % develop cirrhosis. Deaths from chronic liver liver disease occurs in 1-5% of infected persons. Infection with HCV is the leading reason for liver transplantation among adults in the United States. The number of reported cases of acute illness in Tennessee has remained low since chronic infections were excluded; the number of reported cases in 2007 was 38 (0.6 per 100,000 persons) (**Figure**).

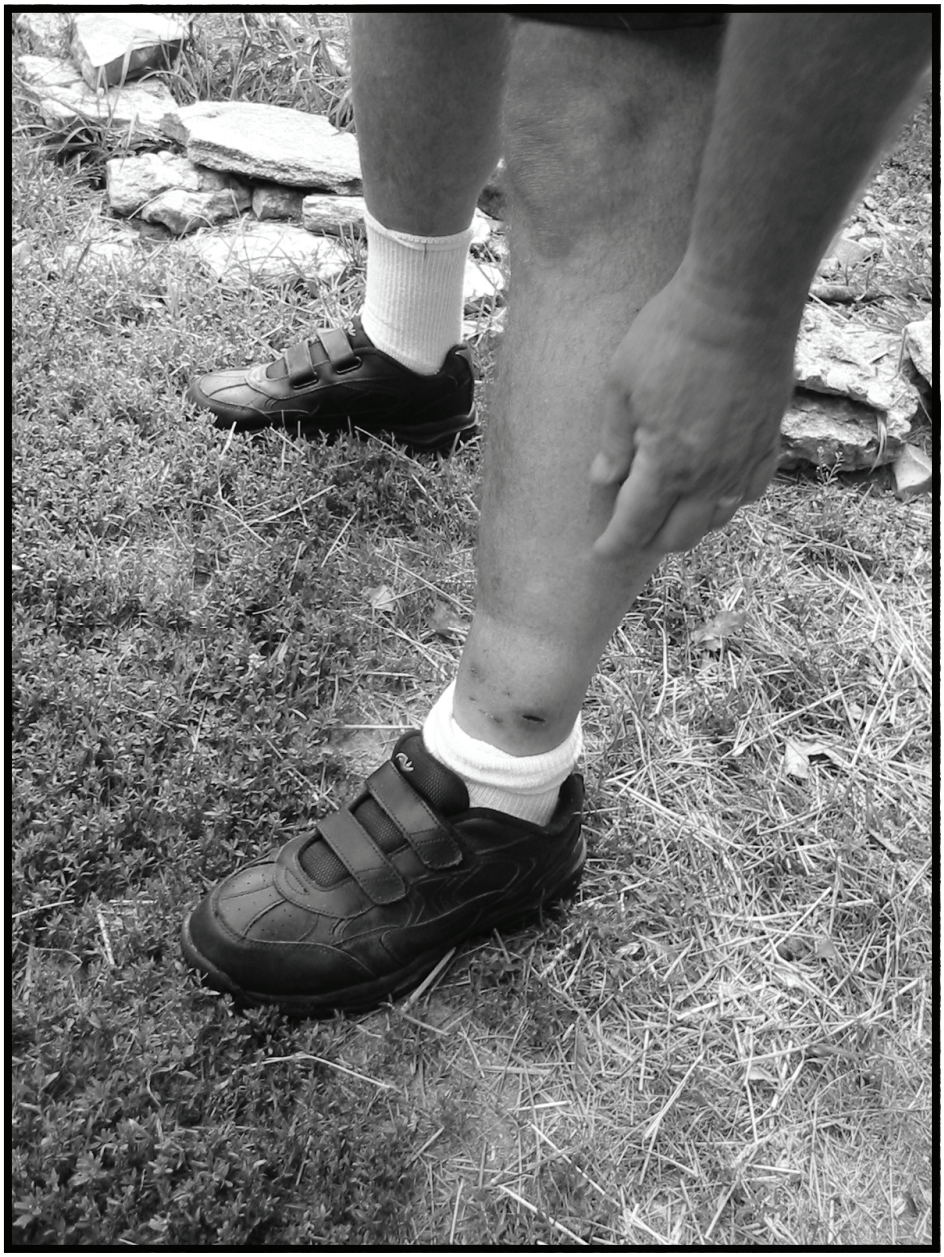
The prevalence of HCV infection in the general population of the United States is approximately 1.6 %. The seroprevalence is 0.2 % for children younger than 12 years of age and 0.4 % for adolescents 12 to 19 years of age. The seroprevalence varies among populations according to their associated risk factors. Infection is spread primarily by exposure to blood of HCV infected people, including needle needles among injection drug users, occupational needlesticks or sharps injuries, and infected mother to child during birth (perinatal). 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. Nationally, 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 co-infected 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. Abusing alcohol can increase the risk of severe liver disease.

Figure. Acute Hepatitis C, Tennessee, 1995-2007.



C. Meningitis/Encephalitis and Septicemia



Dr. L. Rand Carpenter investigates a call about a man being bitten by a rabid cat at a petting farm in Sumner county.

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

Over 10 million non-invasive group A streptococcal (GAS) infections (primarily throat and skin infections) occur annually in the United States. In contrast, 9000-11,500 cases of invasive GAS are reported, which result in approximately 1000-1800 deaths each year. Invasive GAS disease occurs when the bacteria invade normal sterile sites such as blood, lungs, and muscle. Nationally, Streptococcal Toxic Shock Syndrome (STSS) and Necrotizing Fasciitis (NF) accounted for approximately 5% and 7% of invasive cases of GAS, respectively. STSS and NF have higher case fatality rates than other invasive GAS infections and occur more often among persons infected with GAS serotypes M-1 and M-3, which are toxin-producing strains.

Figure 1. Number of Cases of Invasive Group A Streptococcus, Tennessee, 1997-2007.

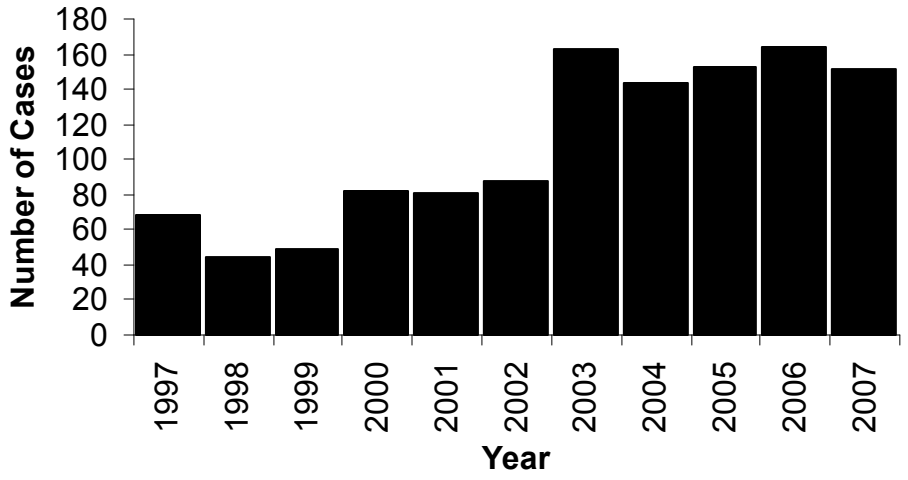
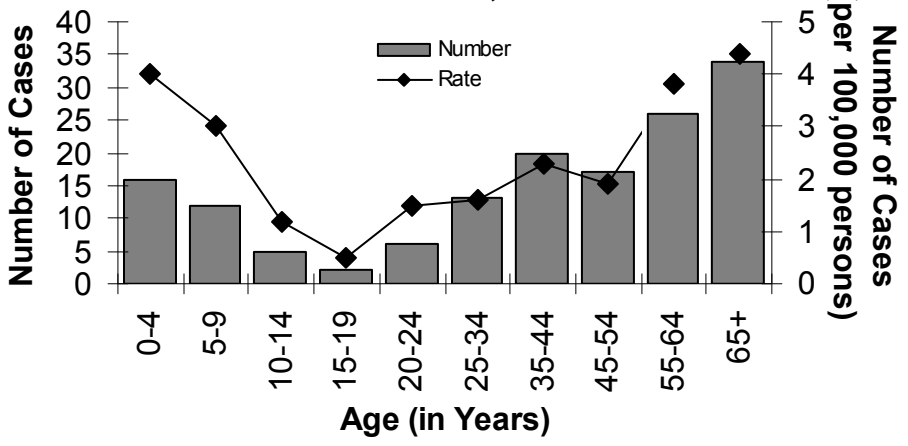


Figure 2. Number of Cases and Rate of Group A Streptococcal Infections by Age, Tennessee, 2007.



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 (including Tennessee). The average number of cases per year in Tennessee more than doubled for the period 2003-2007 compared to the period 1997-2002 (**Figure 1**). The rate of invasive GAS in Tennessee in 2007 (2.5 cases per 100,000 persons) was lower than the national rate of 3.5 cases per 100,000 persons (2000-2004). The highest rates of invasive GAS in Tennessee in 2007 occurred in Chattanooga/Hamilton County, East Tennessee Region, and Mid-Cumberland Region with rates of 6.7, 3.1, and 3.0 per 100,000 persons, respectively.

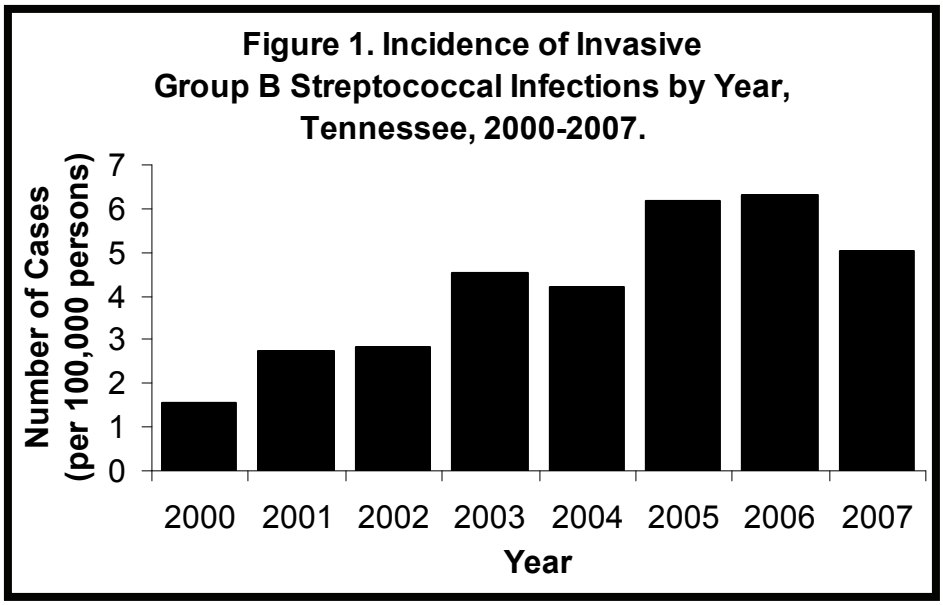
Tennessee age-adjusted data indicate that invasive GAS disease occurred most frequent in children aged <5 years (4.0 cases per 100,000 persons) and persons aged 65 years and over (4.4 cases per 100,000 persons) (**Figure 2**). This is fairly consistent with the average age-adjusted rates in Tennessee for the period 2003-2006. Invasive GAS disease occurs more frequently among the elderly, the immunosuppressed, and persons with chronic cardiac, respiratory, or metabolic disease (diabetes). Persons with skin lesions (ie, children with varicella) and intravenous drug users are other

groups at higher risk for invasive GAS. National, African-Americans (4.7 cases per 100,000 persons) are disproportionately affected. The rates among African-Americans were also higher compared to whites in Tennessee during 2003-2007 (2.8 vs 2.2 per 100,000 persons).

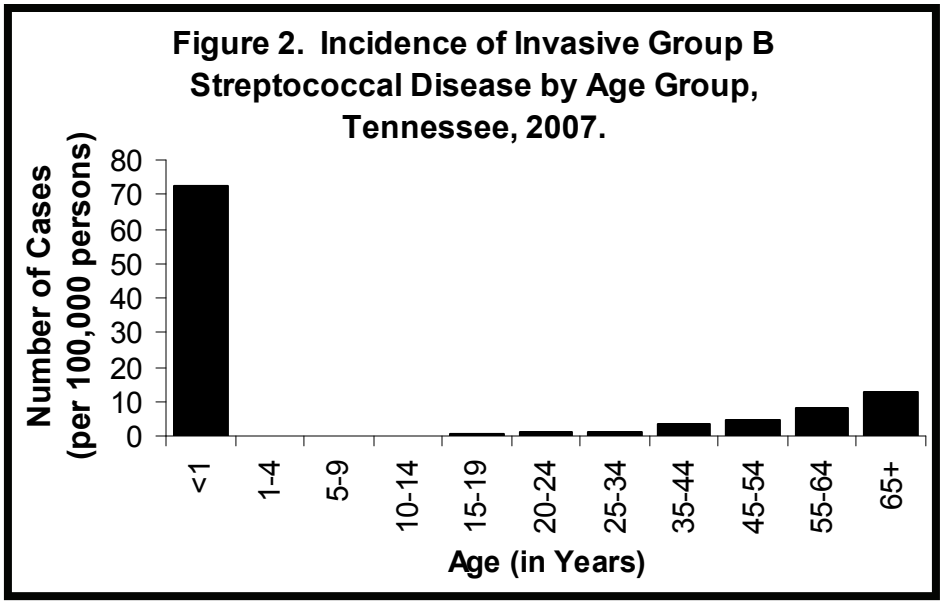
Worldwide rates of GAS invasive disease, including STSS and NF, increased from the mid-1980s to early 1990s. Rates of invasive disease have been stable over the last 5 years throughout the United States. Increases in the rate and severity of GAS invasive disease are associated with increases in the prevalence of the M-1 and M–3 serotypes. Development of a genotyping system for GAS isolates (*emm* typing) at the Centers for Disease Control and Prevention (CDC) allows for better strain identification. Investigating clusters of disease will help identify interventions that can help to prevent the spread of infection.

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 2007, 302 cases were reported for a rate of 5.0 per 100,000 population **(Figure 1)**.



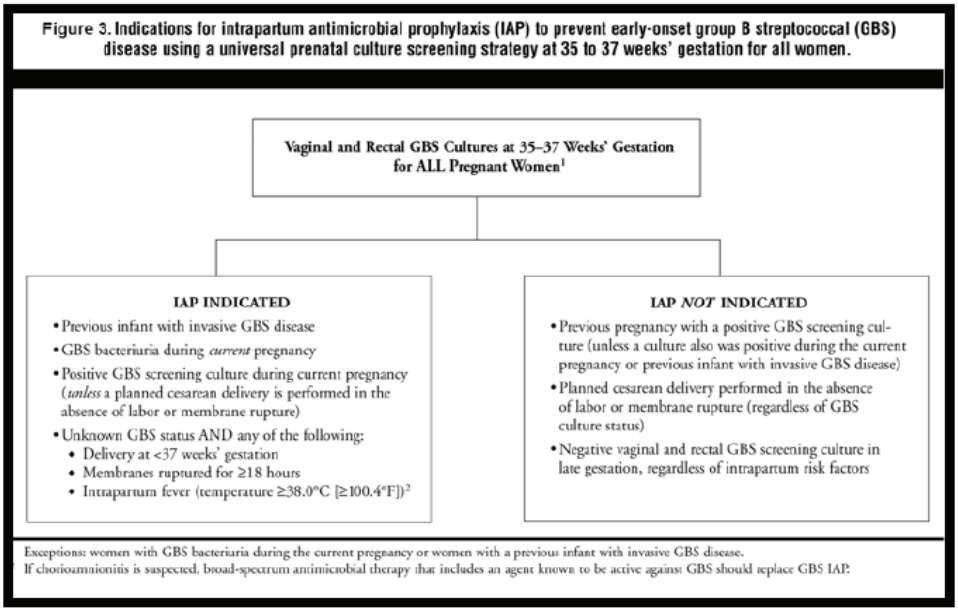
Those persons at greatest risk of developing infection are newborns, pregnant women, persons aged 65 years and older, and persons with certain underlying illnesses such as diabetes mellitus or liver disease. Rates of disease in Tennessee are highest for infants (<1 year old) (72.4 cases per 100,000 persons) followed by persons aged 65 years or older (12.6 per 100,000 persons) **(Figure 2).**



Infection in newborns is classified into two distinct categories: early-onset disease (0-6 days old) and late-onset disease (7-89 days old). Early-onset disease is characterized by sepsis, respiratory distress, apnea, shock, and pneumonia. Early-onset infection is either acquired *in utero* or during delivery. Newborns delivered at less than 37 weeks 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 58

GBS cases were reported among infants age 0-89 days in Tennessee in 2007. Among the 58 cases, 33 (57%) were classified as early-onset disease and 25 (43%) were classified as late-onset disease.

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 **(Figure 3)**. Colonized women are then offered antibiotics at the time of labor. Increased surveillance and awareness may be partly responsible for the increase in incidence in 2006. Efforts have been made over the past two years to improve physician awareness of the new guidelines statewide and to target areas with a history of lower screening rates. This effort to decrease GBS disease in infants complements the Department of Health campaign to lower infant mortality.



To examine rates of neonatal GBS disease after the revised guidelines were issued, CDC analyzed surveillance data from the Active Bacterial Core surveillance (ABCs) system, which conducts active, laboratory- and population-based surveillance in selected counties of 10 states (including Tennessee) for invasive GBS disease. Analysis of data from the period 2003--2005 compared with data from 2000--2001, the period immediately preceding the universal screening recommendations, indicated that annual incidence of early onset GBS disease was 33% lower during 2003--2005. However, although incidence among white infants decreased steadily during 2003--2005, incidence increased 70% among black infants (MMWR 2007;56:701-5).

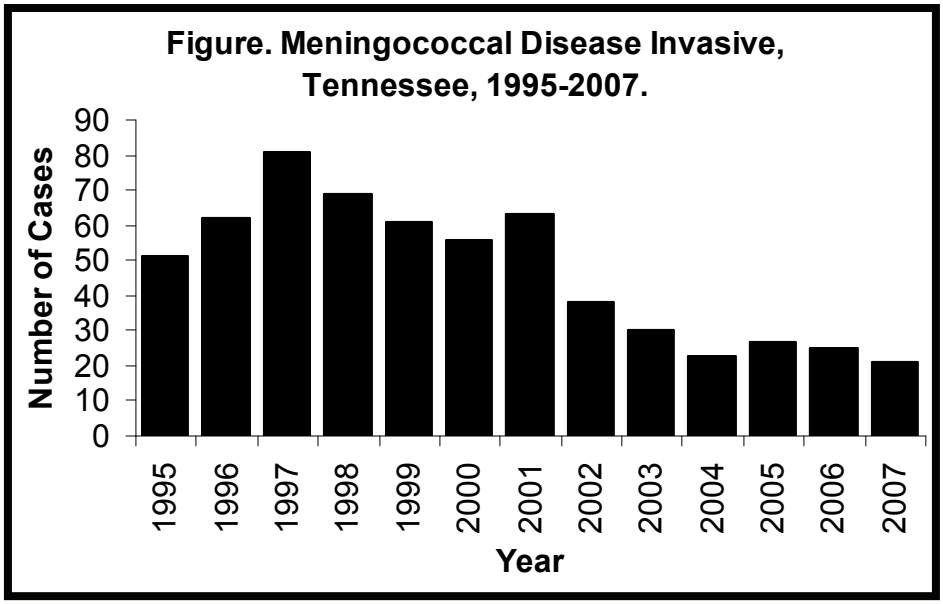
Meningococcal Disease

Invasive infection usually results in meningococcemia, meningitis, or both. Onset often is abrupt in meningococcemia, with fever, chills, malaise, prostration, and a rash that initially can be macular, maculopapular, or petechial. The progression of disease often is rapid. The signs and symptoms of meningococcal meningitis are indistinguishable from signs and symptoms of acute meningitis caused via *Streptococcus pneumoniae* or other meningeal pathogens. The case fatality rate for meningococcal disease in all ages remains at 10 %; mortality in adolescents approaches 25 %. Invasive meningococcal infections can be complicated by arthritis, myocarditis, pericarditis, and endophthalmitis. Sequelae associated with meningococcal disease occur in 11 % to 19 % of patients and include hearing loss, neurologic disability, digit or limb amputation, and skin scarring.

Neisseria meningitidis is a gram-negative diplococcus with at least 13 serogroups. Strains belonging to groups A, B, C, Y, and W-135 are implicated most commonly in invasive disease worldwide. Approximately 67 % of cases among adolescents and young adults are caused by serogroups C, Y, or W135 and potentially are preventable with available vaccines. In infants, nearly 50 % of cases are caused by serogroup B and are not preventable with vaccines available in the United States. Transmission occurs from person to person through droplets from the respiratory tract. Disease most often occurs in children younger than 5 years of age; the peak attack rate occurs in children younger than 1 year of age. Another peak occurs in adolescents 15 to 18 years of age. Freshman college students who live in dormitories have a higher rate of disease compared with individuals who are at the same age and are not attending college. Outbreaks have occurred

in communities and institutions, including child care centers, schools, colleges, and military recruit camps. Multilocus enzyme electrophoresis and pulsed-field gel electrophoresis of enzyme-restricted DNA fragments can be used as epidemiologic tools during a suspected outbreak to detect concordance among strains. The incubation period is 1 to 10 days and usually less than 4 days.

Surveillance in Tennessee 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 by a written report within one week. Serogrouping of meningococcal isolates are performed routinely at the Tennessee Department of Health Laboratories.



Since 1997, the number of reported cases in Tennessee has continued to decline. Twenty-one cases (0.3 cases per 100,000 persons) were reported in 2007 (**Figure**).

Methicillin-resistant *Staphylococcus aureus* (MRSA)

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

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

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

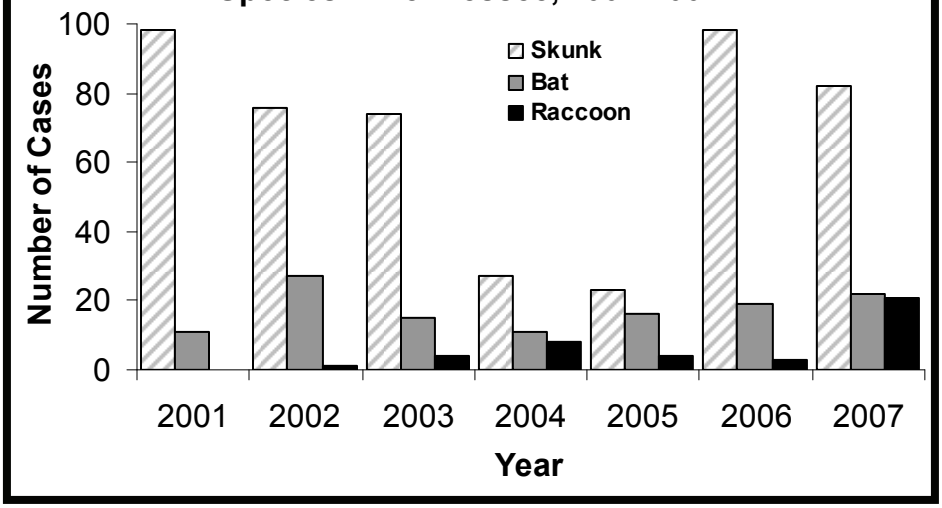
Invasive MRSA was made reportable in Tennessee in June 2004. From July to December of 2004, there were 882 cases (30 cases per 100,000 persons) of MRSA reported. In 2005, the number of cases increased more than two-fold to 1,978 cases, with 2,005 cases in 2006 (33 cases per 100,000 persons) and 1,973 cases in 2007.

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

Rabies

In 2007, no documented human rabies cases occurred in Tennessee. Only one case was reported nationally. The lone 2007 case was reported in a Minnesota resident who had handled a bat with his bare hands. Family members reported that the man had felt a needle prick on his finger prior to releasing the bat. The last confirmed rabies case in Tennessee occurred in 2002 following a bite from a rabid bat. The total number of rabies positive animals remained stable relative to 2006. Raccoon-variant rabies cases increased in eastern Tennessee, particularly northeast Tennessee. The Tennessee Department of Health Communicable and Environmental Diseases Section worked collaboratively with United States Department of Agriculture - Wildlife Services (USDA-WS) and other state and federal agencies in an attempt to slow the westward spread of raccoon rabies. The WS program to control rabies consists of enhanced surveillance and the Oral Rabies Vaccination (ORV) campaign. ORV baiting was conducted in the fall of 2007.

Figure 1. Rabies Cases Among Wildlife Vector Species in Tennessee, 2001-2007.



There were 2,287 animals tested in state laboratories, including 838 dogs and 572 cats. The majority of domestic dog and cat submissions were from metropolitan areas. In 2007, 132 cases of animal rabies were confirmed statewide (**Table**). Tennessee has three rabies vector species (RVS): bats, skunks, and raccoons. Each of these RVS can carry a host-adapted rabies virus variant, and together they accounted for 125 (95 %) of the 132 animal rabies cases. The remaining 7 (5%) rabies cases in 2007 were among domestic animals infected with one of the three RVS host-adapted virus variants. Among animals tested by Tennessee Department of Health Laboratories, the percent-positive for various species submitted in 2007 was, 38.1% of skunks, 11.7% of bats, 4.7% of raccoons, 0.6% of dogs, and 0.2% of cats. Excessive testing of low-risk domestic species has previously been documented. Whenever possible, methods to assess rabies risk should include a 10-day observation period for dogs and cats that bite humans.

Table. Animals Testing Positive for Rabies by Species, Tennessee, 1998-2007.

Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Skunk	127	79	88	98	76	74	27	23	98	82
Bat	5	10	15	11	27	15	11	16	19	22
Dog	6	5	3	2	2	3	1	1	2	5
Raccoon	0	0	0	0	1	4	8	4	3	21
Fox	1	1	0	0	1	2	1	3	4	0
Horse	1	0	0	0	0	4	0	1	0	0
Cattle	1	0	0	0	1	0	0	0	2	1
Cat	0	0	1	0	0	1	0	0	3	1
Goat	1	0	0	0	0	0	0	0	0	0
Opossum	0	0	0	0	0	0	1	0	0	0
Total	**142**	**95**	**107**	**111**	**108**	**103**	**49**	**48**	**131**	**132**

Raccoon-variant rabies cases increased in 2007 with an epizootic occurring in Washington County. Twenty-six raccoon-variant rabies cases occurred in 6 east Tennessee counties: Carter (1), Greene (1), Hamilton (1), Johnson (2), Sullivan (3), and Washington (18). Of note, 5 of the 26 raccoon-variant rabies cases were among skunks, indicating transmission from a rabid raccoon to a skunk. Raccoon-variant rabies cases continue to increase **(Figure 1)** with activity in eastern counties. Since raccoon-variant rabies was first documented in Tennessee in 2003, nine counties have had laboratory-confirmed animal cases.

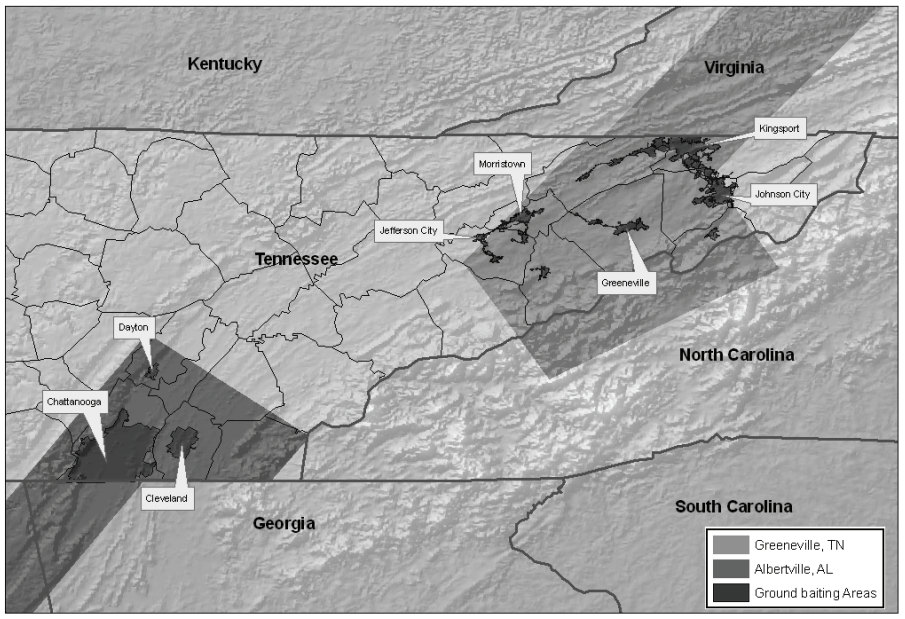


Figure 2. 2007 Bait Zones in Tennessee.

In 2007, there were twenty-two rabies-positive bats distributed sporadically across the state. A total of seven cases of animal rabies occurred among domestic animals in 2007. All were infected with north-central skunk variant rabies. These included dogs in Greene, Hamblen, Jefferson, Smith, and Trousdale counties. All five dogs had not been previously vaccinated as required by state law. One cat and one cow were confirmed from Lincoln and Smith counties, respectively.

The USDA-WS program to prevent the spread of raccoon-variant rabies continued in 2007 **(Figure 2)**. As part of the ongoing ORV campaign, twelve counties were baited in northeast Tennessee: Greene, Grainger, Hamblen, Hancock, Hawkins, Sevier, Sullivan, Washington, Cocke, Jefferson, Unicoi, and Carter. Almost 500,000 baits were dispersed over 2741 square miles by ground and aerial crews. The ORV campaign in southeast Tennessee included Hamilton, Marion, Sequatchie, McMinn, Bradley, Bledsoe, Rhea, Meigs, Monroe, and Polk counties. Over 340,000 baits were dispersed over 2005 square miles by ground and aerial crews. Containing or slowing the spread of raccoon-variant rabies westward into Tennessee will require continued support from USDA-WS and other partners.

Streptococcus pneumoniae Invasive Disease

Streptococcus pneumoniae is the leading cause of meningitis and pneumonia in hospitalized patients and is the second leading cause of bacteremia in the very young and very old, causing serious invasive disease. In 2007, 722 cases of *Streptococcus pneumoniae* (11.8 cases per 100,000 persons) were reported in Tennessee.

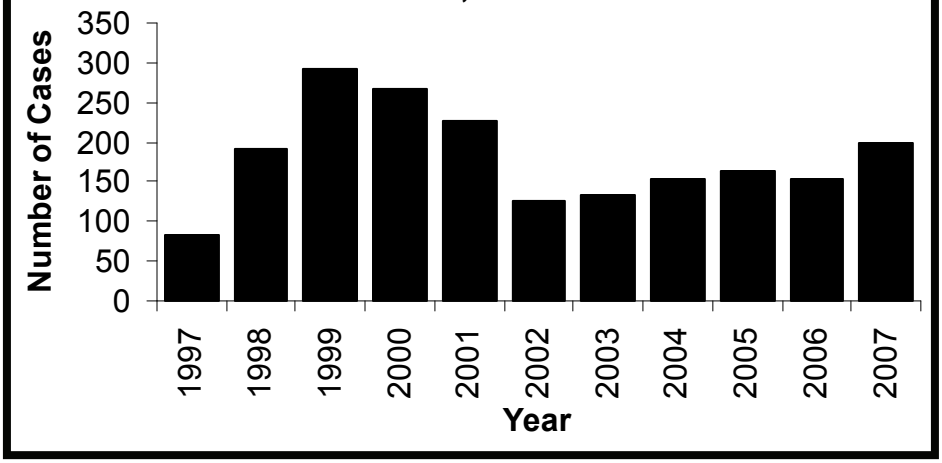
Before routine use of heptavalent pneumococcal vaccine (PCV7), *Streptococcal pneumoniae* was the most common bacterial cause of otitis media and of invasive bacterial infections in children. *Streptococcus pneumoniae* and *Neisseria meningitidis* are the two most common causes of bacterial meningitis in infants and young children.

Pneumonococci are ubiquitous, with many people having colonization of their upper respiratory tract. Transmission is from person to person, presumably via respiratory droplet contact. Viral upper respiratory infections, including influenza, may predispose to pneumococcal infections. These infections are most prevalent during winter months.

Streptococcus pneumoniae strains that are non-susceptible to penicillin G, cefotaxine, ceftriaxone, and other antimicrobial agents have been identified throughout the United States and

worldwide. In Tennessee since 1997, penicillin non-susceptible invasive pneumococcal infections have been reportable **(Figure)** with 199 cases reported during 2007 (3.3 cases per 100,000 persons) in Tennessee. The Tennessee Department of Health is concerned about appropriate antibiotic use and is educating physician groups, managed care organizations, hospitals, pharmaceutical companies, nurse practitioner groups, childcare centers, schools, and other interested parties. Parents of young children and practitioners are educated about the importance of appropriate antibiotic use and encouraged to use pneumoncoccal conjugate vaccine (Prevnar) in young children.

Figure. Penicillin Non-susceptible Invasive *Streptococcus pneumonia* Infections, Tennessee, 1997-2007.



Tennessee Unexplained Encephalitis Study (TUES)

Encephalitis is inflammation of the brain commonly caused by infection and is a potentially devastating neurologic disease. Over 100 different viral, bacterial, fungal, and parasitic agents have been associated with this syndrome; however, no pathogen is identified in up to 75% of cases. One reason for the high proportion of unexplained cases is the difficulty in culturing organisms causing encephalitis from cerebrospinal fluid (CSF).

In the last decade, diagnostic tests targeting species-specific genetic sequences, such as the polymerase chain reaction, have emerged as rapid, highly sensitive methods to detect pathogens in the central nervous system (CNS). In response to the development of these improved diagnostic methods, the Centers for Disease Control and Prevention Emerging Infections Program initiated encephalitis surveillance at 3 sites nation-wide. The Tennessee Unexplained Encephalitis Study (TUES) began in January 2000. The objectives of the study include: identifying pathogens causing encephalitis; determining the epidemiology of encephalitis; describing short- and long-term clinical outcomes; devising clinically useful testing algorithms for laboratory diagnosis; and collaborating with investigators on discovery of novel pathogens causing CNS infection.

Between the beginning of the study in 2000 and the end of 2007, 559 patients meeting study criteria were enrolled and specimens tested. Among the 559 patients, 281 (50%) were determined to have an infectious etiology, 66 (12%) a non-infectious etiology, and 212 (38%) remained unexplained. Among the 281 patients with evidence of an infectious etiology, 180 (64%) were either confirmed or probable based on laboratory criteria **(Table)**. The most commonly recovered microbes from patients with previously unexplained encephalitis included *Bartonella* (bacteria associated with Cat Scratch Disease), La Crosse virus, herpes simplex virus-1, and Epstein-Barr virus.

To be included in the study, a patient must have altered mental status for more than 24 hours plus at least one of the following: fever (>38°C), seizures, abnormal neurologic exam, abnormal neuroimaging study (CT or MRI), abnormal EEG, or CSF pleocytosis (>5 WBC/mm3). Patients aged less than 6 months, patients not hospitalized (outpatients), and patients with immunocompromise (organ transplant, bone marrow transplant, or AIDS) are excluded from participating. To find out more about the TUES study, or to enroll a patient, please call the TUES Study Coordinators at (615) 322-1519 or toll-free (877) 756-5800.

Table. Tennessee Unexplained Encephalitis Study Cases with Confirmed or Probable Etiology by Pathogen, 2000-2007.

	Species	Number		Species	Number
Virus	Enterovirus	1	**Bacteria**	*Bartonella* spp.	35
	Epstein-Barr Virus	18		*Chlamydia pneumoniae*	0
	Herpes Simplex Virus (not typed)	1		*Coxiella burnetti*	1
	Herpes Simplex Virus-1	22		*Ehrlichia chaffeensis*	11
	Herpes Simplex Virus-2	4		*Mycobacterium tuberculosis*	1
	Human Herpes Virus-6	1		*Mycoplasma pneumoniae*	1
	HIV (acute infection)	1		*Rickettsia rickettsii*	10
	La Crosse Virus	31		*Treponema pallidum*	1
	Parvovirus B-19	1	**Fungal**	*Blastomyces dermatitidis*	1
	Rabies Virus	1		*Cryptococcus neoformans*	1
	Rotavirus	1		*Histoplasma capsulatum*	1
	Vaccinia Virus	1	**Other**	*Acanthamoeba* spp.	1
	Varicella Zoster Virus	15		Bacterial inf (CNS & non-CNS)	4
	West Nile Virus	12		Creutzfeld Jakob	1
			TOTAL		180

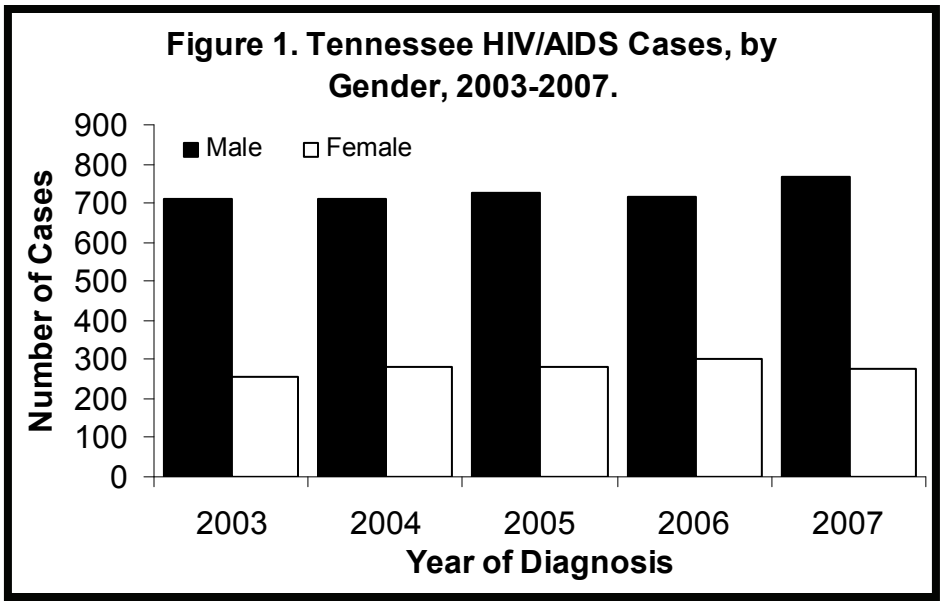
D. Sexually Transmitted Diseases

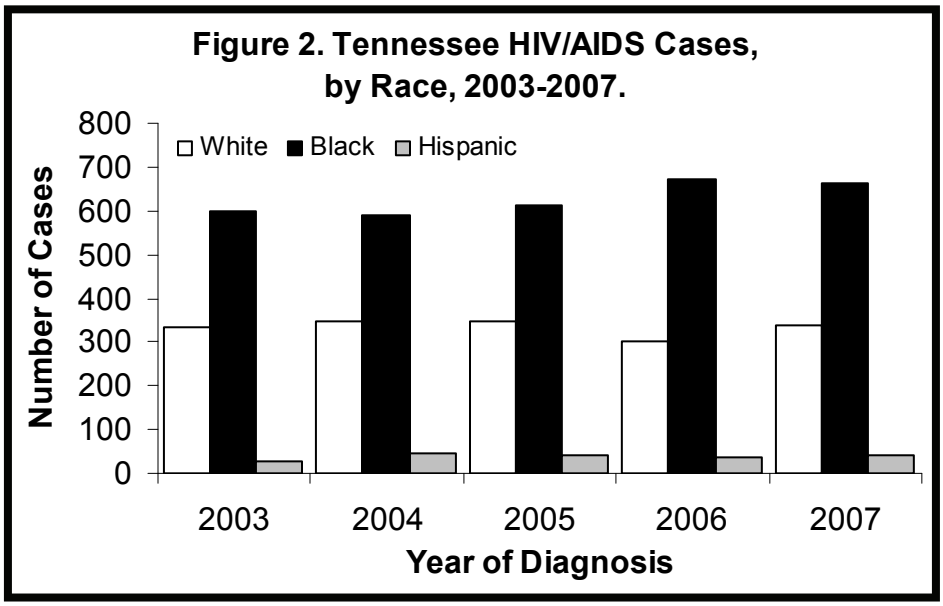
Minority AIDS Initiative Coordinator Helen Adams speaks to teens and young adults at a local church about the perils of HIV/AIDS and why they should remain abstinent.

Source: Tennessee Department of Health.

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

Acquired Immunodeficiency Syndrome (AIDS) became reportable in Tennessee in January 1982. Human Immunodeficiency Virus (HIV), the virus that causes AIDS, has been a reportable disease in Tennessee since 1992. For the calendar year ending December 31, 2007, 1,043 cases of HIV/AIDS were diagnosed and reported to the State of Tennessee Health Department's HIV/AIDS/ STD Section. The cumulative total of reported HIV/AIDS cases, as of 12/31/07 was 21,358.





For those cases reported in 2007 among Tennessee residents, approximately 73% were among men and 68% of all cases reported were among African-Americans. As shown in **Figure 1**, males have historically contributed the majority of all HIV/AIDS cases reported in Tennessee. The proportion of males within overall reported HIV/AIDS cases has remained at approximately 70% for the past five years. Reported cases of HIVAIDS have increased most substantially among minority populations; cases of HIVAIDS among whites increased 1.2% from 2003-2007 while reported cases increased 11.1% and 37.9% among African-Americans and Hispanics, respectively (**Figure 2**). However, caution should be used when evaluating these increases among Hispanics as the numbers reported are relatively small (40 cases were reported in 2007).

During 2007, all 95 counties in Tennessee reported cases of individuals living with HIV/AIDS. Incidence of HIV/AIDS remained the highest in the Tennessee's urban centers with Memphis/Shelby County reporting the greatest rate of infection per 100,000 followed in rank order with lesser rates of infection by Nashville/ Davidson County, Chattanooga/ Hamilton County, Knoxville/Knox County, and Jackson/Madison County. In 2007, the statewide incidence rate of HIV was approximately 13.1 per 100,000 people.

Reported HIV/AIDS deaths totaled 232 persons in 2007, and include persons who died from complications due to their illness or other causes including suicide, motor vehicle crashes, and so on. Annual deaths among the HIV/AIDS infected population have decreased 40.9% over the past five years. These decreases are a nationwide trend, and they can be directly attributed to the success and availability of antiretroviral medications used

since 1995. From 1982 through 2007, the total number of deaths among Tennessee residents infected with HIV/AIDS was 7,009.

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 2007 increased to 26,868.

Figure 1. Number of Cases of *Chlamydia trachomatis* , by Gender, Tennessee, 2001-2007.

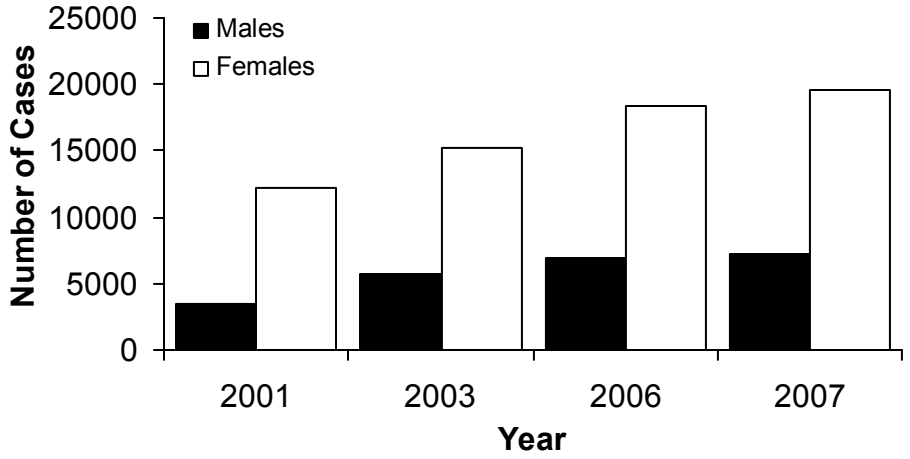
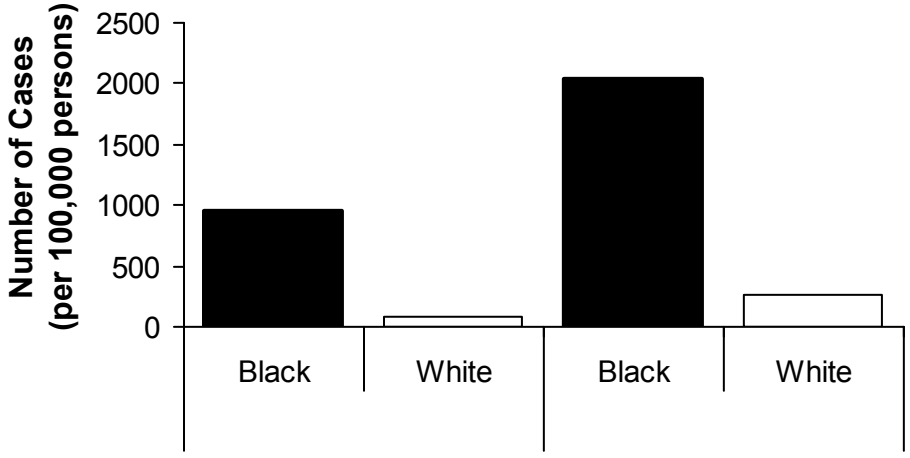


Figure 2. Incidence of *Chlamydia trachomatis* , by Gender and Race, Tennessee, 2007.



In 2007, 87% of Chlamydia morbidity occurred among patients aged 15-19 years (10,010) and 20-29 years (13,425). Females comprised 73% 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, 56% percent of female morbidity was reported among blacks and 33% among whites, while 10% had no race category identified. There were 960 cases per 100,000 population among black males and 83 cases per 100,000 population among white males with Chlamydia in 2007. There were also 2,039 cases per 100,000 population among black females and 256 cases per 100,000 population among white females with Chlamydia (**Figure 2**). Black females aged 20-29 years have the highest rate of infection with 6,074 cases per 100,000 persons. Moreover, screenings of just over 125,794 patients for Chlamydia in health department STD, prenatal and family planning clinics, in 2007, resulted in a range of 7% to 16% positivity rates in metropolitan areas and 5% to 11% positivity rates in rural areas. The overall statewide screening positivity rate for Chlamydia increased from 7% in 2002 to 9% in 2007. 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, 2001-2007.

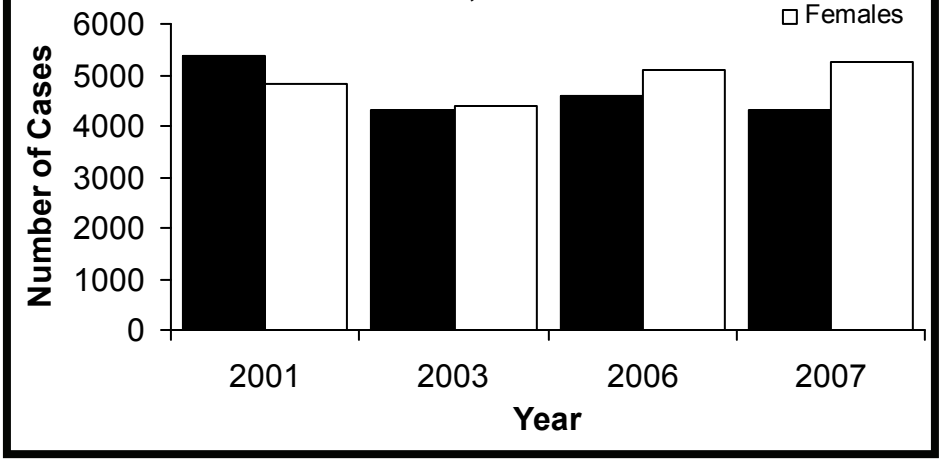
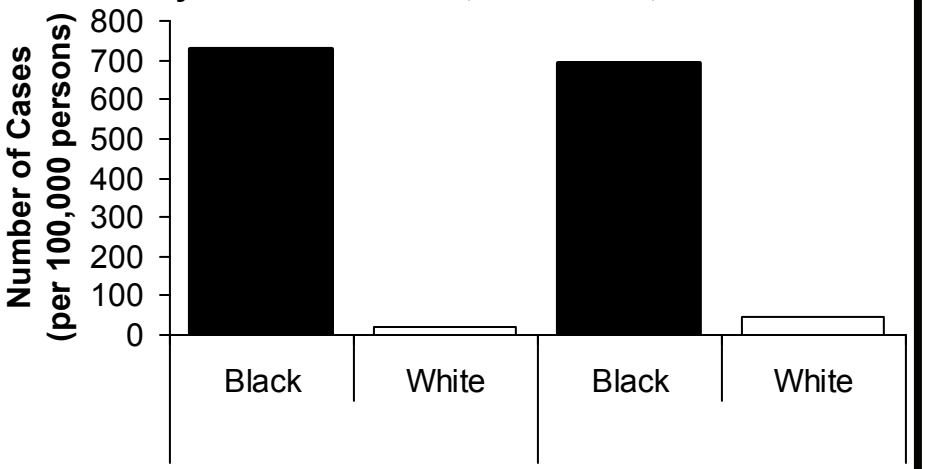


Figure 2. Incidence of *Neisseria gonorrhoeae*, by Gender and Race, Tennessee, 2007.



Following a record high of 35,362 gonorrhea cases reported in 1976 (rate=817 cases per 100,000 persons), the number decreased by 73% to 9,566 cases in 2007 (rate=158 cases per 100,000 persons). In 2007, there were 4318 reported cases of Gonorrhea among males and 5248 reported cases among females (**Figure 1**). The metropolitan regions of the state have consistently accounted for 78% of the state's morbidity during this time period. In 2007, 76% of all reported cases of gonorrhea in Tennessee were among blacks. Additionally, there were 727 cases per 100,000 population among black males and 22 cases per 100,000 population among white males in 2007. There were also 692 cases of gonorrhea per 100,000 population among black females and 46 cases per 100,000 population among white females (**Figure 2**). This is in contrast to the first half of the 1990s, when cases decreased dramatically. The decrease in reported cases has been less striking in the past few years. The overall rate of 158 per 100,000 persons was well above the Healthy People 2010 national goal of 19.

In 2007, women aged 15-19 had higher rates of gonorrhea (988 cases per 100,000 persons) than women aged 20-29 (601 cases per 100,000 persons). The rate of gonorrhea in men aged 20-29 was 491 cases per 100,000 persons in 2007. Additionally, screening approximately 125,794 patients for Gonorrhea in health department STD, prenatal and family planning clinics in 2007 detected a range of 1-10% 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 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 2001-2007.

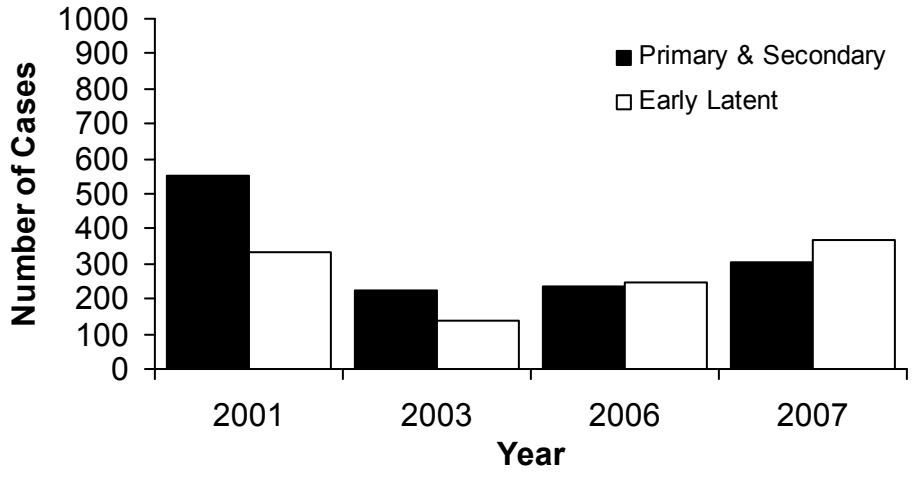
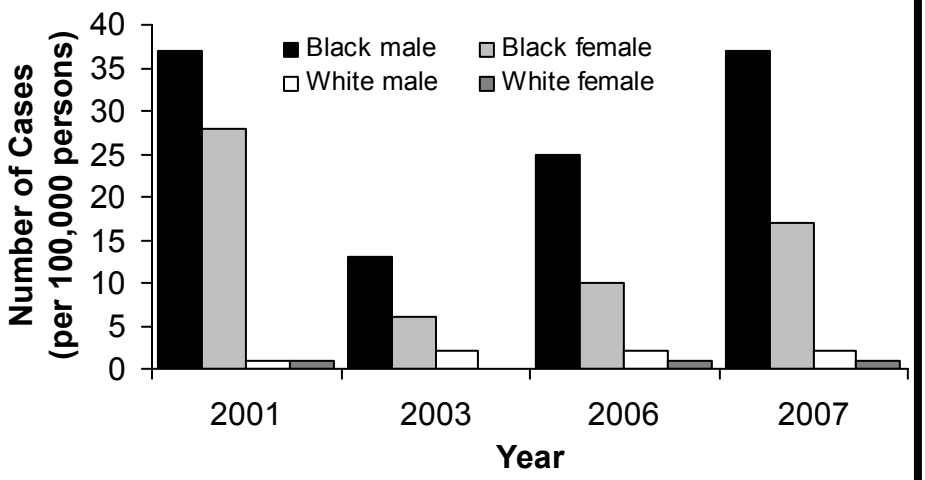


Figure 2. Incidence of Primary and Secondary Syphilis, Tennessee, 2001-2007.



Historically, most syphilis cases in Tennessee occur in the large metropolitan areas. The six Tennessee metropolitan regions collectively represent 41% of the state's population; however, they account for 89% of 671 cases of early syphilis (primary, secondary and early latent) in 2007 (**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 2007, two metropolitan areas, Shelby County and Davidson County, reported 395 and 111 cases, respectively, or 75% of the state's early syphilis cases. The seven remaining rural regions comprise 59% of the state's population but accounted for only 11% of the early syphilis cases in 2007.

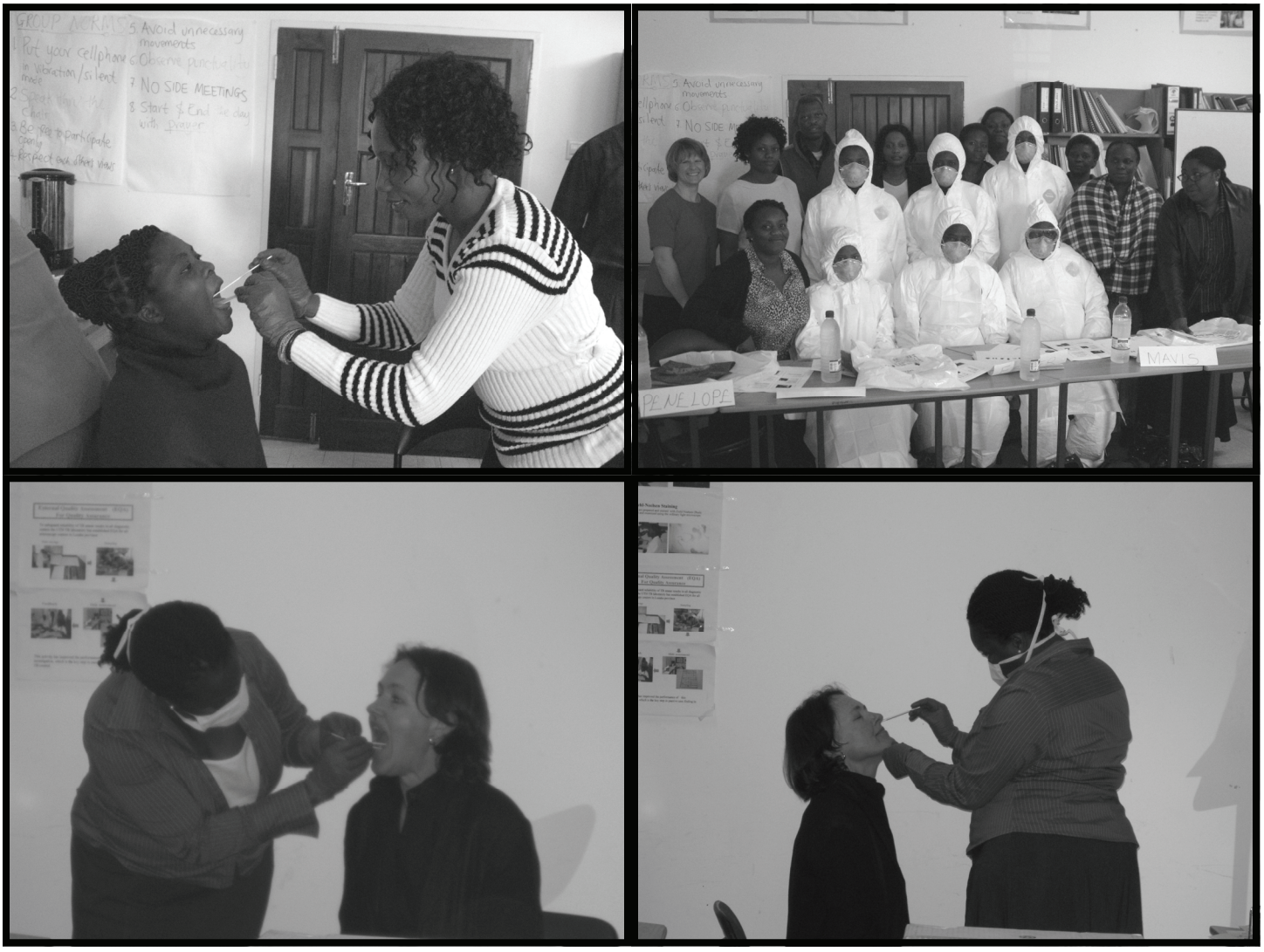
Early syphilis cases are higher among males than females. In addition, early syphilis rates among both black males and females are disproportionately high. Blacks make up 17% of the state's population, but historically represent about 75% of reported early Syphilis cases. In 2007, the rate for early syphilis within Tennessee was 11 cases per 100,000 persons; the rate for blacks was 49. When looking at primary and secondary syphilis, the rate among white males was 2 cases per 100,000 population, and the rate among white females was 1 case per 100,000 population. Furthermore, the rate was 37 cases per 100,000 population among black males and 17 cases per 100,000 population among black females (**Figure 2**). In 2000, the overall syphilis rate was 30 cases per 100,000 persons. However, in 2007,

the overall syphilis rate was 20 cases per 100,000 persons. This represents a 33.3% decrease during this period. Among blacks, the overall Syphilis rate was 152 cases per 100,000 persons in 2000, and 87 cases per 100,000 persons in 2007. This represents a 43% decrease for blacks during this time. In 2000, blacks aged 20-29 years and 30-39 years had rates of 285 and 312 cases per 100,000 persons, respectively. By 2007, the rate for blacks aged 20-29 years had fallen to 169 cases per 100,000 persons, representing a 41% decrease. Additionally, the rate for blacks aged 30-39 years had fallen to 140 cases per 100,000 persons, representing a 55% decrease in 2007.

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 2007, the rate of syphilis in Memphis among males was 87 cases per 100,000 population and for females the rate was 66 cases per 100,000 population.

In 2007, 367 cases were diagnosed with primary or secondary syphilis, 304 with early latent (less than one year) syphilis, 537 were late or latent cases and 4 were congenital cases. Statewide, the 367 primary and secondary cases combined represent a rate of 6.1 cases per 100,000 persons. This is much greater than the Healthy People 2010 national objective of 0.2 cases per 100,000 persons.

E. Vaccine-Preventable Diseases



Jennifer MacFarquhar traveled to Lusaka, Zambia, to provide consultation on implementing influenza sentinel site surveillance. Services consisted of protocol development, laboratory procedure preparation, and healthcare worker training.

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 2002 to 2007.

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. Also reported for the first time in 2007 was the on-time

Table 1. Vaccine-Preventable Disease Morbidity, Tennessee, 2002-2007.

Disease	Pertussis	Diphtheria	Tetanus	Polio	Measles	Mumps	Rubella	Hepatitis B	*H. influenza* type b *<5 yo*
2002	119	0	1	0	0	2	1	128	5
2003	82	0	0	0	0	5	0	213	8
2004	179	0	2	0	0	4	0	221	0
2005	213	0	0	0	1	3	0	153	4
2006	179	0	1	0	1	11	0	173	0
2007	75	0	1	0	1	4	0	149	0

Table 2. Immunization Survey Results, Tennessee, 2007.

Survey	Immunization Level
24-Month-Old Children*	82.45%
Day Care Center Enrollees**	92.45%
Public Kindergarten Survey**	97.65%
Private Kindergarten Survey**	96.34%

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

** Compliance with State Immunization Requirements

completion of 4 doses of pneumococcal conjugate vaccine (PCV7) and at least two doses of influenza vaccine (Flu). 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, 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 2007 surveys are presented below (**Figures 1-3**).

Findings from the 2007 Survey

The 2007 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 2007 survey include:

a. The 4:3:1:3:3:1 on-time level remained stable at 82.4%.

b. Assessed individually, vaccination against all antigens in the 4:3:1:3:3:1 series are in excess of 90% on-time coverage, except DTaP 4, at 85.5%.

c. The patient population vaccinated at health departments versus those vaccinated by private providers

Figure 1. 2007 Tennessee Immunization Status Survey of 24-Month-Old Children: Percent with Age-Appropriate Immunization Levels by Vaccine.

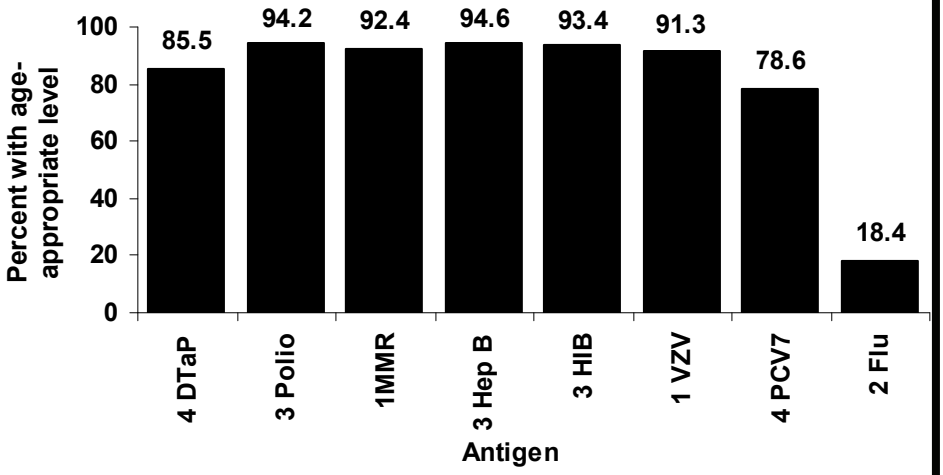


Figure 2. 2007 Tennessee Immunization Status Survey of 24-Month-Old Children: "4:3:1" and "4:3:1:3:3:1" Percent Immunized on Time: 2000 to 2007.

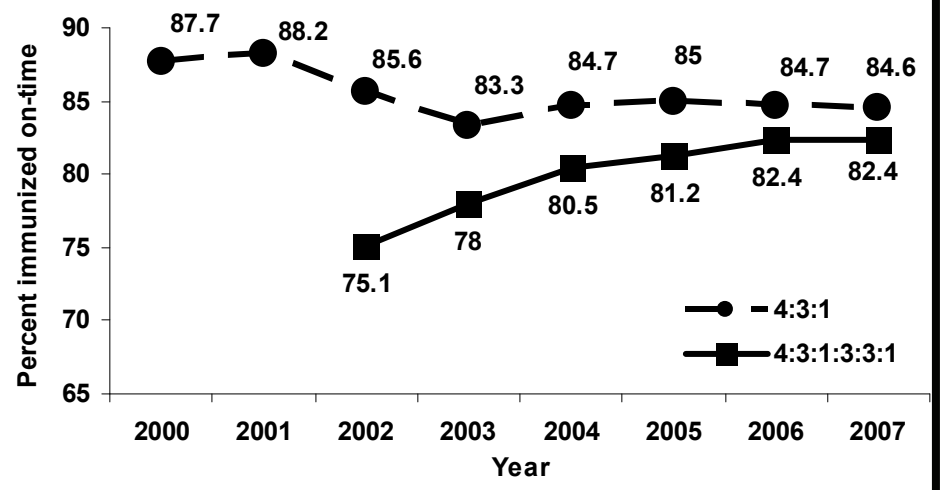
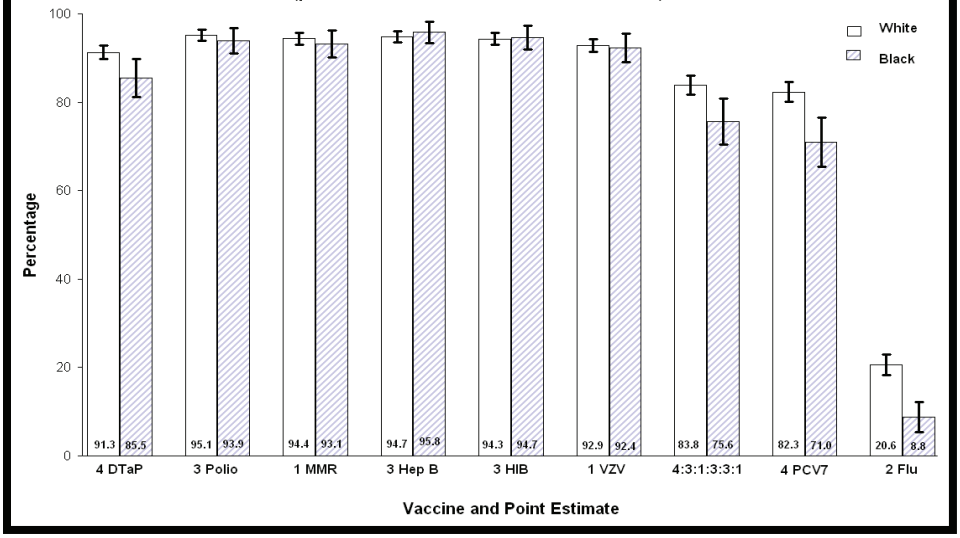


Figure 3. 2007 Immunization Status of 24-Month-Old Children in Tennessee: Statewide Percentage of Children with Age-appropriate Immunization Levels by Vaccine and Race (point estimates and 95% confidence intervals).



had a higher prevalence of risk factors for failure to complete. Despite this, 4:3:1:3:3:1 on-time level did not differ by where the immunizations were given.

d. The 2007 point-estimate for on-time 4:3:1:3:3:1 immunization rates for WIC-enrolled children versus those not enrolled was 2.8 percentage points closer than in 2006, making this difference statistically insignificant.

e. The disparity in on-time 4:3:1:3:3:1 immunization of black and white children, which emerged in 2002 and fluctuated since, was statistically significant. However, among individual vaccines in the series, a statistically-significant difference was detected only in the completion of DTaP and in the newly-assessed pneumococcal and influenza vaccines.

f. On-time vaccination with PCV7 and influenza were the lowest measured; the racial disparity in uptake of these two vaccines is the most pronounced. These are the only two recommended vaccines that are not required for pre-school or school entry.

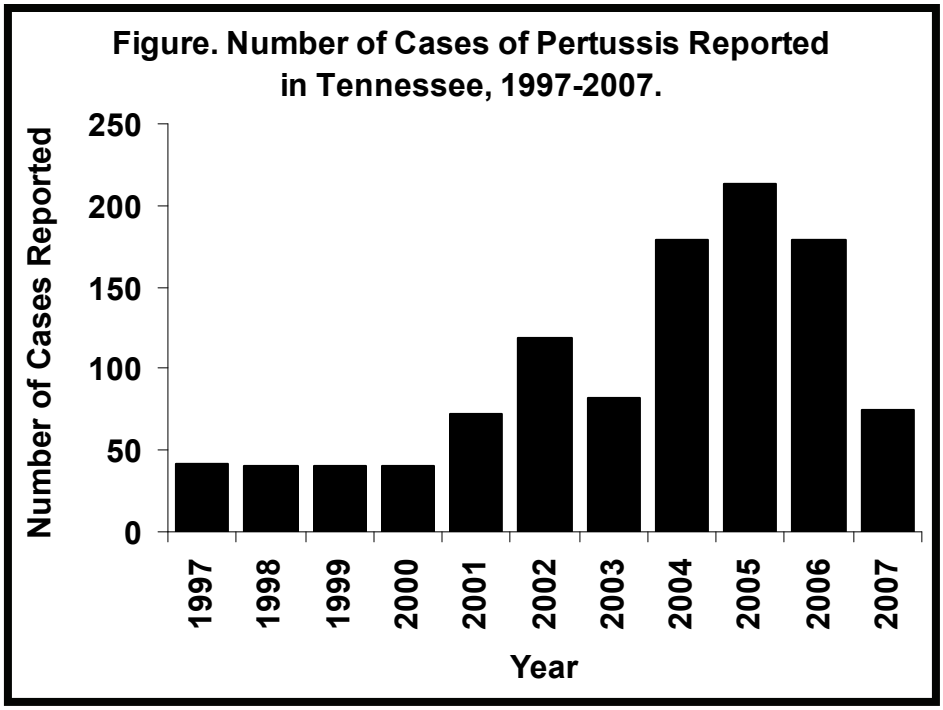
The current Childhood and Adolescent Immunization Schedule is presented at the end of this section and can be accessed at www.cdc.gov/vaccines/recs/schedules. The website of the Centers for Disease Control and Prevention's National Center for Immunization and Respiratory Diseases (www.cdc.gov/vaccines) contains valuable information for both clinicians and the lay public about vaccines and vaccine-preventable diseases.

Pertussis

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

Infants are at greatest risk from complications or death from pertussis, but the disease causes significant illness in adolescents and adults, who account for more than half of all reported cases and are often the source of illness in infants. The most common complication among those with pertussis, as well as the leading cause of mortality, is secondary bacterial pneumonia. Seizures and encephalopathy are also complications. These are more frequent in young children. Pertussis remains one of the most common childhood diseases and a major cause of childhood mortality in the United States. The **figure** shows the number of pertussis cases from 1997 to 2007 in Tennessee.

Figure. Number of Cases of Pertussis Reported in Tennessee, 1997-2007.



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

Childhood immunization against pertussis has reduced the disease burden in that population; the introduction of a vaccine to protect older children and

adults aged 11-64 in 2005 (Tetanus, diphtheria, pertussis, or "Tdap") will boost waning immunity following childhood immunization and has the potential to shrink the reservoir of *B. pertussis* disease among adolescents and adults. The vaccine is recommended to replace the tetanus-diphtheria booster for all persons aged 11-64 years.

Tetanus

Tetanus is an acute, often fatal disease caused by an exotoxin produced by *Clostridium 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.

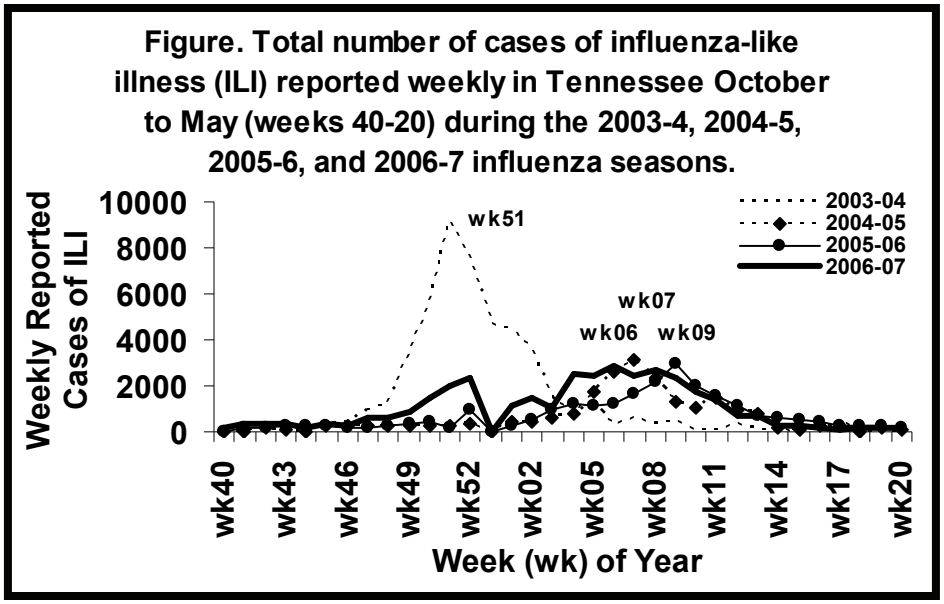
Complications of tetanus include the following: laryngospasms; fractures of the long bones; hyperactivity of the autonomic nervous system; secondary infections, such as sepsis, pneumonia, decubitus ulcers (due to long hospitalizations, in-dwelling catheters, etc.) and aspiration pneumonias. The fatality 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 5 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 whom are 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, 2005-6, and 2006-7 influenza seasons.



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

persons younger than 65 years.

There are several systems used to track influenza virus activity in Tennessee and nationally. The Sentinel Provider Network (SPN) consists of healthcare providers who report the proportion of patients seen each week with influenza-like-illness ("ILI," defined as fever with cough or sore throat). SPN participants also submit specimens for culture at the State Public Health Laboratory from ILI patients in order to permit further characterization of circulating influenza strains. Although non-specific, the number of persons with ILI rises dramatically when influenza virus is circulating in the community. The number of cases of ILI in health departments and clinics are reported to the state health department weekly. The **figure** shows the number of cases reported weekly from October through May (weeks 40-20) during the 4 influenza seasons from the fall of 2002 through spring 2007. 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 Immunization Schedule

Recommended Immunization Schedule for Persons Aged 0 Through 6 Years—United States • 2009

For those who fall behind or start late, see the catch-up schedule

Vaccine ▼ Age ▶	Birth	1 month	2 months	4 months	6 months	12 months	15 months	18 months	19–23 months	2–3 years	4–6 years
Hepatitis B[1]	HepB	HepB		see footnote 1	HepB						
Rotavirus[2]			RV	RV	RV[2]						
Diphtheria, Tetanus, Pertussis[3]			DTaP	DTaP	DTaP	see footnote 3	DTaP				DTaP
Haemophilus influenzae type b[4]			Hib	Hib	Hib[4]	Hib					
Pneumococcal[5]			PCV	PCV	PCV	PCV				PPSV	
Inactivated Poliovirus			IPV	IPV	IPV						IPV
Influenza[6]					Influenza (Yearly)						
Measles, Mumps, Rubella[7]						MMR		see footnote 7			MMR
Varicella[8]						Varicella		see footnote 8			Varicella
Hepatitis A[9]						HepA (2 doses)				HepA Series	
Meningococcal[10]										MCV	

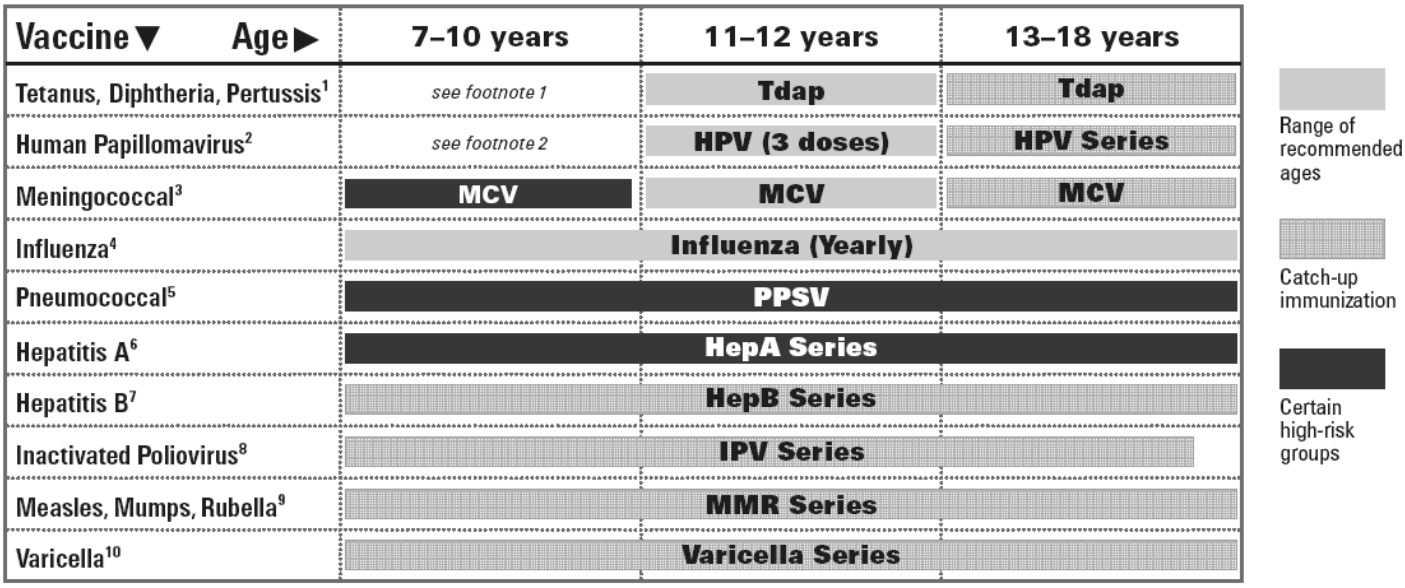
Range of recommended ages

Certain high-risk groups

This schedule indicates the recommended ages for routine administration of currently licensed vaccines, as of December 1, 2008, for children aged 0 through 6 years. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. Licensed combination vaccines may be used whenever any component of the combination is indicated and other components are not contraindicated and if approved by the Food and Drug Administration for that dose of the series. Providers should consult the relevant Advisory Committee on Immunization Practices statement for detailed recommendations, including high-risk conditions: http://www.cdc.gov/vaccines/pubs/acip-list.htm. 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 is available at http://www.vaers.hhs.gov or by telephone, 800-822-7967.

Recommended Immunization Schedule for Persons Aged 7 Through 18 Years—United States • 2009

For those who fall behind or start late, see the schedule below and the catch-up schedule



This schedule indicates the recommended ages for routine administration of currently licensed vaccines, as of December 1, 2008, for children aged 7 through 18 years. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. Licensed combination vaccines may be used whenever any component of the combination is indicated and other components are not contraindicated and if approved by the Food and Drug Administration for that dose of the series. Providers should consult the relevant Advisory Committee on Immunization Practices statement for detailed recommendations, including high-risk conditions: http://www.cdc.gov/vaccines/pubs/acip-list.htm. 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 is available at http://www.vaers.hhs.gov or by telephone, 800-822-7967.

F. Vectorborne Diseases

Beth Huddleston of the vectorborne diseases section drags for ticks in Tennessee for pathogen testing.

Source: Tennessee Department of Health.

Arboviral Diseases

La Crosse Encephalitis (LAC)

La Crosse (LAC) 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 during 1964-2005 and includes case counts. Five of the eight states bordering Tennessee reported La Crosse encephalitis cases in 2005. La Crosse encephalitis is the leading cause of pediatric arboviral encephalitis and considered an emerging disease in Tennessee.

In 2002, 164 cases of La Crosse encephalitis were reported from 16 states in the United States, representing the most reported to CDC in any year since 1964. Due to the similarity of symptoms between LAC and West Nile virus (WNV), 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 2005-2007 nationwide. 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**). Tennessee has reported cases of LAC encephalitis every year since 1996, indicating that the disease in endemic in the state. In Tennessee, the disease primarily occurs from late May through October with peak transmission in August (**Figure 2**). In 2007, Tennessee experienced 14 cases (twice the number of

Figure 1. Human California Serogroup Viral Encephalitis Cases, by State, 1964-2007.

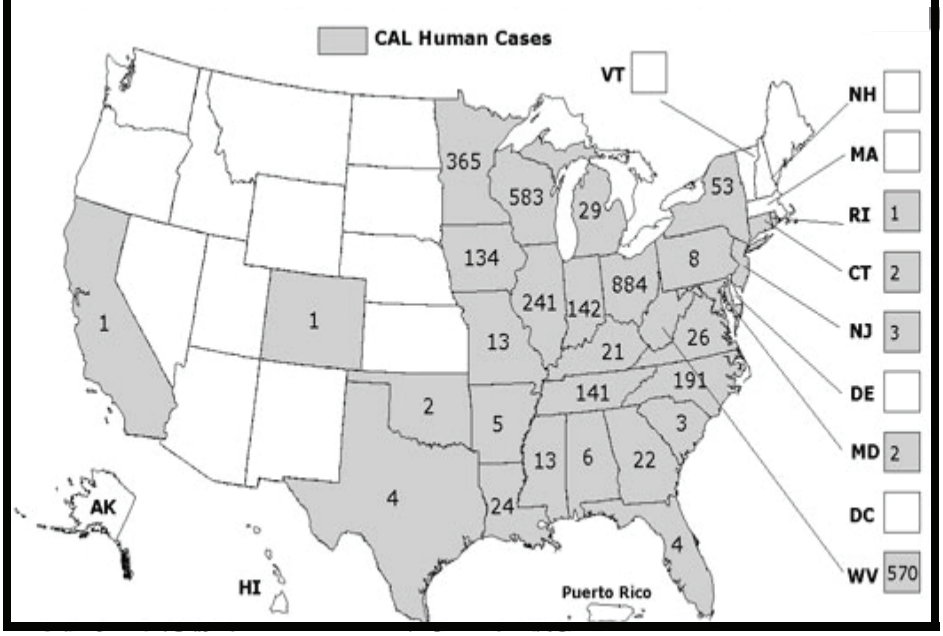


Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of La Crosse Encephalitis, by Year, Tennessee and the United States, 1998-2007.

	1998		1999		2000		2001		2002		2003		2004		2005		2006		2007	
	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR
TN	9	0.17	6	0.11	19	0.33	17	0.3	15	0.26	14	0.24	13	0.22	2	0.03	7	0.11	14	0.23
US	97	0.04	70	0.03	114	0.04	128	0.05	164	0.06	NA	NA	112	0.04	73	0.02	67	0.02	53	0.02

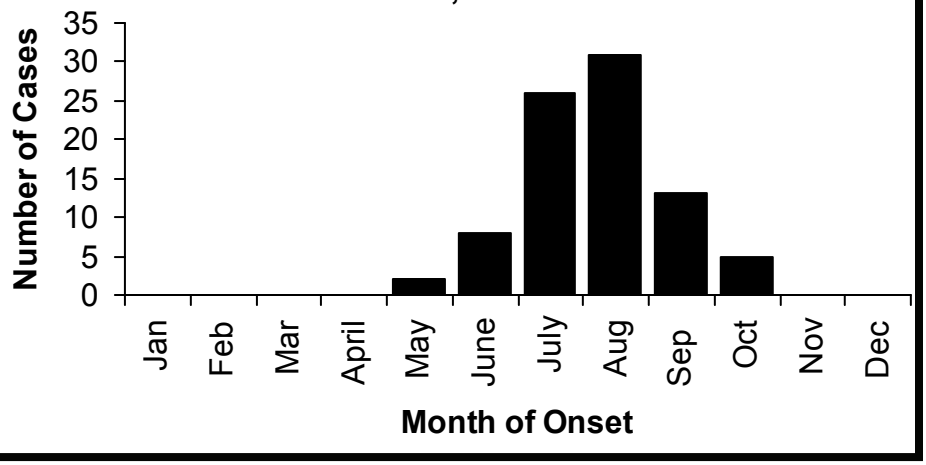
IR=Incidence Rate

NA= Notifiable Diseases is not compiled

cases as in 2006), indicating that LAC virus continues to be an important vector-borne disease in eastern Tennessee.

Traditionally, *Ochlerotatus triseriatus* (eastern treehole mosquito) is the primary vector of LAC virus, but in recent years *Aedes albopictus* (Asian tiger mosquito) have been associated with LAC encephalitis cases in eastern Tennessee. The first detection of LAC virus infection in Tennessee in 1996 and proliferation of cases since then 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 LAC encephalitis were identified in Hickman (2 cases) and Robertson (1 case) counties which adds to the increasing evidence that the virus is moving westward across the state due to the increasing presence of *Aedes albopictus* mosquito. In 2004, a case in Cocke County also emerged, suggesting that transmission TN is possible near the northeast region of the state as well. In 2006, the northeast region was directly affected with one case in Greene County. In 2007, Cocke County had two cases and 4 cases occurred in the Upper Cumberland region of the state, west of the traditional East region surrounding Cumberland County.

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



LAC 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 LAC encephalitis. Although most cases occurred in white children, there was one African Ameri-

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of La Crosse Encephalitis, by Age Group, Tennessee and the United States, 2003-2007.

	<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	12	1.5	0	0.00	0	0.00	0	0.00	1	0.16
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
TN (2006)	0	0.00	1	0.12	6	0.74	0	0.00	0	0.00	0	0.00	0	0.00
TN (2007)	0	0.00	1	0.31	11	1.35	2	0.24	0	0.00	0	0.00	0	0.00
US (2003)	3	0.08	35	0.23	100	0.24	5	0.01	10	0.02	11	0.01	0	0.00
US (2004)	1	-	17	-	78	-	7	-	4	-	3	-	2	-
US (2005)	0	-	16	-	44	-	4	-	1	-	2	-	6	-

can child who was affected in 2005. Among white children, 21% were of Hispanic 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.

LAC 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.

<u>Addition reading:</u>

Hardin SG, Erwin PC, Patterson L, New D, Graber C, Halford SK. Clinical comparisons of LA Crosse encephalitis and enterovirial central nervous system infections in a pediatric population: 2001 surveillance in East Tennessee. Am J Infect Control 2003 Dec;31(8):508-510.

Jones TF, Craig AS, Patterson L, Ussery X, Nasci R, Schaffner W. A newly recognized focus of La Crosse encephalitis in Tennessee. Clin Infect Dis 1998;28:93-97.

Boyce TG, Craig AS, Schaffner W, Dermondy TS. Fever and encephalopathy in tow school age boys. Pediatri Infect Dis J 1998;17:939-940.

Jones TF, Erwin PC, Craig AS, Baker P, Touhey KE, Patterson LER, Schaffner W. Clinical evidence in children and serosurvey of La Crosse virus infections in Tennessee. Clin Infect Dis 2000;31:1284-1287.

Gerhardt, RR, Gottfried KL, Apperson CS, Davis BS, Erwin PC, Smith AB, Panella NA, Powell EE, Nasci RS. First isolation of La Crosse virus from naturally infected *Aedes albopictus*. Emerg Infec Dis 2001;7;807-811.

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

Gottfried KL, Gerhardt RR, Nasci RS, Crabtree MB, Karabatsos N, Burkhalter KL, Davis BS, Panella NA, Paulson DJ. Temporal abundance, parity, survival rates, and arbovirus isolation of field-collected container inhabiting

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.

From 1995 to 2007, there have been 161 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., US-born persons traveling to malaria endemic regions or foreign-born

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of Malaria, by Year, Tennessee and the United States, 1998-2007.

Year		TN	US	Year		TN	US
1998	No.	16	1227	2003	No.	4	1278
	IR	0.17	0.45		IR	0.24	0.44
1999	No.	9	1540	2004	No.	13	1324
	IR	0.11	0.56		IR	0.22	0.45
2000	No.	13	1402	2005	No.	14	NA
	IR	0.33	0.50		IR	0.23	NA
2001	No.	14	1383	2006	No.	9	NA
	IR	0.30	0.49		IR	0.15	NA
2002	No.	15	1337	2007	No.	19	NA
	IR	0.26	0.46		IR	0.31	NA

NA= Notifiable Diseases is not compiled IR= Incidence Rate

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of Malaria, by Age Group, Tennessee, 2007.

<1 year		1-4 years		5-14 years		15-24 years		25-39 years		40-64 years		>65 years	
#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
0	0.00	2	0.63	1	0.12	5	0.60	3	0.24	6	0.30	2	0.26

persons coming from these regions to the US). Although 27 counties have reported cases, most of these have been from Davidson (31%) and Shelby (16%) counties, which are metropolitan populations that include persons that are more likely to travel abroad (eg, business travelers and foreign-born persons). 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 virus encephalitis. Malaria is reported in all age groups in Tennessee (**Table 2**), and almost all are susceptible when traveling because of lack of previous exposure. Among the 13,594 cases of malaria in the US from 1995-2004, about 1% were from Tennessee. Of the approximately 1300 cases of malaria per year diagnosed in the US, about 73% are from US nationals and 27% are foreign-born. Almost 70% of all US reported malaria cases have a travel history to continental Africa. Occasionally, small local outbreaks of malaria occur in the US around an imported case due to the presence of *Anopheles* mosquitoes here. This has been referred to as "airport" malaria. Even though malaria has been eradicated from the US, it continues to be a public health concern due the potential of re-introduction. Even without established transmission zones of malaria, we still see large numbers of cases annually. Travelers should take the appropriate precautions when traveling to areas with malaria.

The CDC recommends the following for persons traveling to malaria endemic areas:

- 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 an EPA-approved insect repellent to prevent mosquito and other insect bites, especially 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.

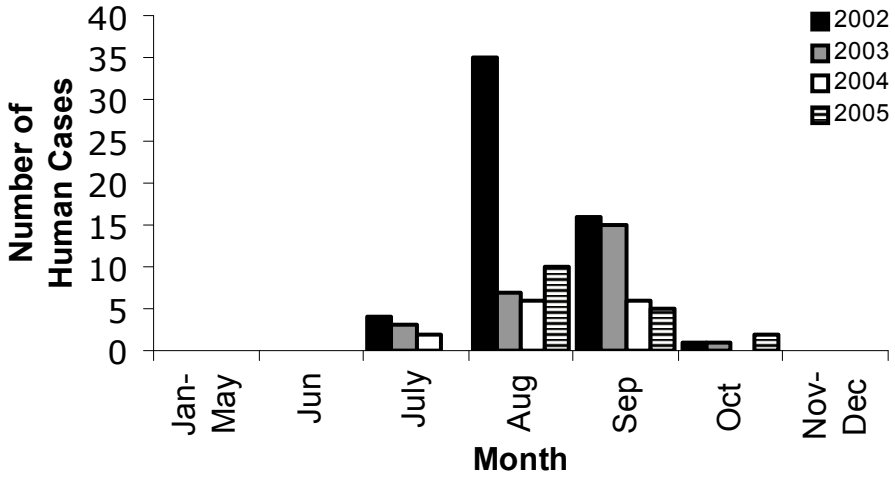
West Nile Virus

The natural transmission cycle of West Nile virus (WNV) involves birds and the mosquitoes that feed on them. As the summer progresses and the viral load builds in the bird population, there is an increased risk that oppor-

tunistic mosquitoes (those feeding on birds and mammals) will 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 reinfect a subsequent feeding mosquito.

Tennessee reported 22 cases in 2006 and 11 cases in 2007. WNV cases peaked in 2002 with 56 cases. Cases occurred across the state in 2007 but were mainly focused in Shelby county with 5/11. Horse cases peaked in 2004 with 17 that were scattered throughout the state. In 2005, 2006, and 2007 there were 7, 8 and 4 horse cases, respectively. This difference is most likely due to increase in awareness of the need for vaccinating horses rather than a reduction of risk in 2005-2007. In Tennessee, human cases occur from late July through early October with peaks in August and September which coincides with the primary mosquito vector activity (**Figure 1**).

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



The incidence rate of WNV infection 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. WNV incidence in 2007 was the lowest yet (0.18/100,000), most likely due to extreme drought conditions experienced in Tennessee (**Table 2**). The rate of disease in various age groups has followed a consistent pattern with

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of West Nile Virus, Tennessee and the United States, 2002-2007.

	2002		2003		2004		2005		2006		2007	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
TN*	56	0.97	26	0.44	14	0.24	18	0.30	22	0.37	11	0.18
US Total	310	1.06	969	3.30	241	0.82	2901	0.98	4268	1.43	3630	1.21

*6 fatalities in 2002 and 1 in each of 2003 and 2005.

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of West Nile Virus, by Age Group, Tennessee and the United States, 2003-2007.

	<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	0	0	0	0	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
TN (2006)	0	0	0	0	0	0	1	0.12	2	0.16	8	0.40	11	1.46
TN (2007)	0	0	0	0	0	0	1	0.12	3	0.24	3	0.15	4	0.52
US (2003)	10	0.26	14	0.09	47	0.11	135	0.34	405	0.65	1065	1.26	1159	3.31

*One Fatality in 2005.

the highest rates among people aged 65 years and older. About 50% percent of the cases in 2004-7 were in people aged ≥65 years; over 80 % of cases were aged ≥40 years. Over 30% of cases (2004-7) occurred in Africa-Americans, which may reflect the higher incidence rate in Shelby County.

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 nation's blood supply remained safe. Through this screening process, blood donors infected with WNV 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 developed disease symptoms and was subsequently identified as a case.

After a thorough review of the 2002 WNV human cases, we found that WNV infections lead to high rates of mortality and 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 WNV meningoencephalitis patients over the age of 70 years, 42% had not returned to previous functional levels at least one year after acute illness. Although WNV fever is considered a "milder" form of the illness than meningoencephalitis, our findings suggest that WNV fever can also be associated with substantial morbidity. Prevention efforts should be targeted to populations at highest risk of severe sequelae.

Tick-borne Diseases

Erlichiosis

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 under-reported. 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 anaplasmosis (HGA). 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 non-specific signs and symptoms. Rashes are not common but may occur in 20-30% of cases. Rashes associated with HME do not typically involve the palms or soles as they do in Rocky Mountain Spotted Fever. 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

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

Disease	Human Monocytic Ehrlichiosis	Human Granulocytic Anaplasmosis
Fatality Rate	2-5%	7-10%
Year Discovered	1987	1994
Etiologic Agent	Ehrlichia chaffeensis	Anaplasma phagocytophilum
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, 2003-2007.

	<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
TN (2006)	0	0.00	0	0.00	2	0.25	1	0.12	5	0.41	6	0.30	14	1.85
TN (2007)	0	0.00	1	0.31	1	0.12	1	0.12	5	0.40	11	0.55	7	0.91
US (2003)	1	0.00	4	0.03	7	0.02	9	0.02	37	0.06	97	0.12	59	0.17

Table 3. Reported Cases and Incidence Rates (per 100,000 persons) of Human Monocytic Ehrlichiosis, by Year, Tennessee and the United States, 2001-2007.

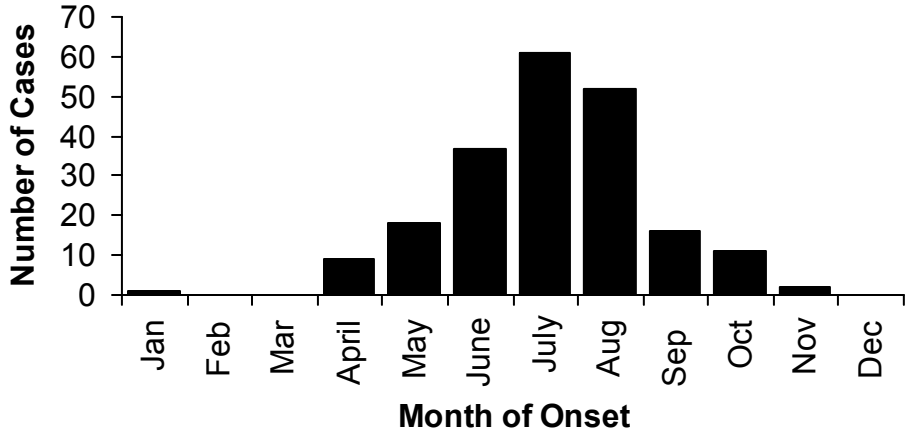
	2001		2002		2003		2004		2005		2006		2007	
	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR
TN	20	0.35	26	0.45	31	0.53	20	0.34	24	0.40	35	0.57	39	0.64
US	142	0.05	216	0.08	321	0.11	NA	NA	NA	NA	NA	NA	NA	NA

NA= Notifiable Diseases is not compiled IR= Incidence Rate

40 years and 87% over the age of 25 years (**Table 2**). The disease is more common in males than females (55% vs 45%). In 2007, 32% of the cases were reported in the Mid-Cumberland region and Nashville/Davidson metropolitan area with another 32% 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.

Most cases in Tennessee occurred 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 2007, the incidence of ehrlichiosis in Tennessee was 0.64/100,000.

Figure 1. Distribution of Human Monocytic Ehrlichiosis Cases by Month of Onset, Tennessee, 1998-2007.



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

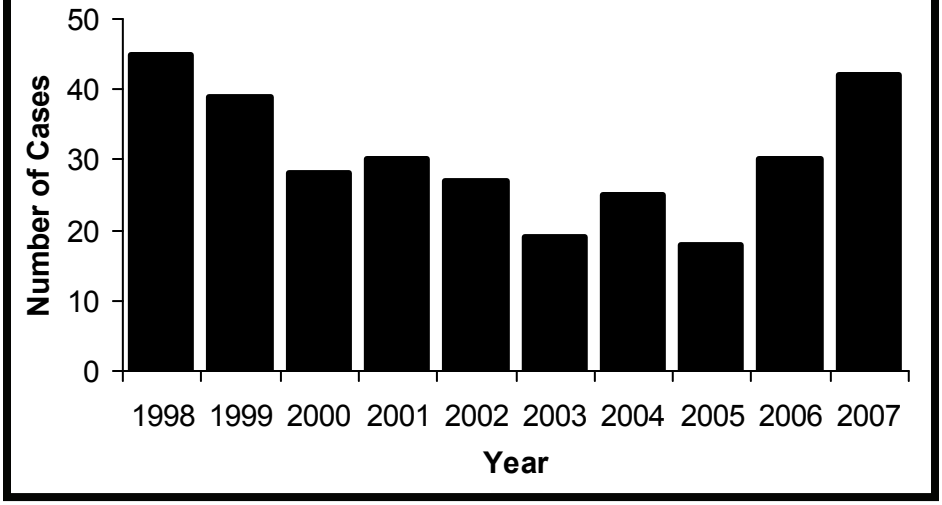
larval and nymphal stages, they are no bigger than a pinhead. Ticks feed by inserting their mouths into the skin of a host and slowly take in blood. *Ixodes* ticks are most likely to transmit infection after feeding for two or more days.

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. Tennessee's incidence rate of 0.30 per 100,000 population in 2005 was well below the national incidence rate that same year of 7.86 cases per 100,000 population. The number of cases of Lyme disease reported in 2007 was higher than the average number reported since 1995.

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

Figure. Number of Cases of Lyme Disease, by Year, Tennessee, 1998-2007.



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

STARI is not a nationally notifiable disease and the true prevalence/ incidence is not known. Currently, no commercial diagnostic test is available for STARI. It is possible that some of the Lyme disease cases reported in Tennessee are actually STARI. Patients suspected of having 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 *Rickettsia rickettsii*. 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. 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 zoonoses in the world, humans and companion animals (canines) are incidental hosts. The risk of humans becoming infected with RMSF is extremely low, even in habitats with ticks. Only 1-3% of the ticks carry the pathogen. In addition, prolonged tick attachment is required for transmission. Ticks are considered both the vectors and reservoirs of the pathogen and can become infected in 3 ways. The pathogen can be passed horizontally from a viremic rodent to a feeding tick, which will remain infected for life. The pathogen can also be passed via transovarial transmission (from the female tick to the offspring) and venereal transmission (from male to female during mating).

From 1997 to 2002, Tennessee reported 8% of the RMSF cases in the nation; 56% of the cases in the US were reported from TN, NC, SC, OK, and AR. From 1995 to the present, the overall incidence rate in Tennessee has been consistently higher than the national incidence rates (**Table 1**). Tennessee incidence rates appear to be increasing gradually over time although this could be attributed to many factors such as increased patient testing and reporting. Within the past decade, there has been a dramatic rise in RMSF incidence in Tennessee (and surrounding states) with a large spike in cases in 2006 in Tennessee (63% increase from 2005). In 2007 186 cases of RMSF were reported in TN, the second highest total since 1995. In 2007, TN experienced extreme drought and heat conditions which may have reduced the contact between humans and ticks. 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 most cases are reported between April and September with a peak in June (**Figure**).

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of Rocky Mountain Spotted Fever, by Year,

Year		TN	US	Year		TN	US
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	1938
	IR	1.00	0.18		IR	2.33	0.66
2001	No.	85	695	2006	No.	260	2288
	IR	1.50	0.25		IR	4.33	0.77
2002	No.	81	1014	2007	No.	186	2081
	IR	1.40	0.39		IR	2081	0.69

NA= Notifiable Diseases is not compiled IR= Incidence Rate

Figure. Distribution of Rocky Mountain Spotted Fever Cases by Month of Illness Onset, Tennessee, 1996-2007.

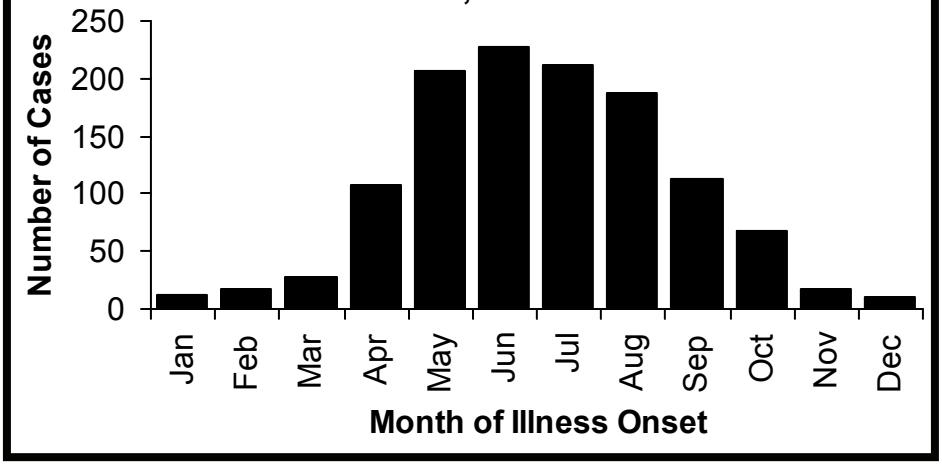


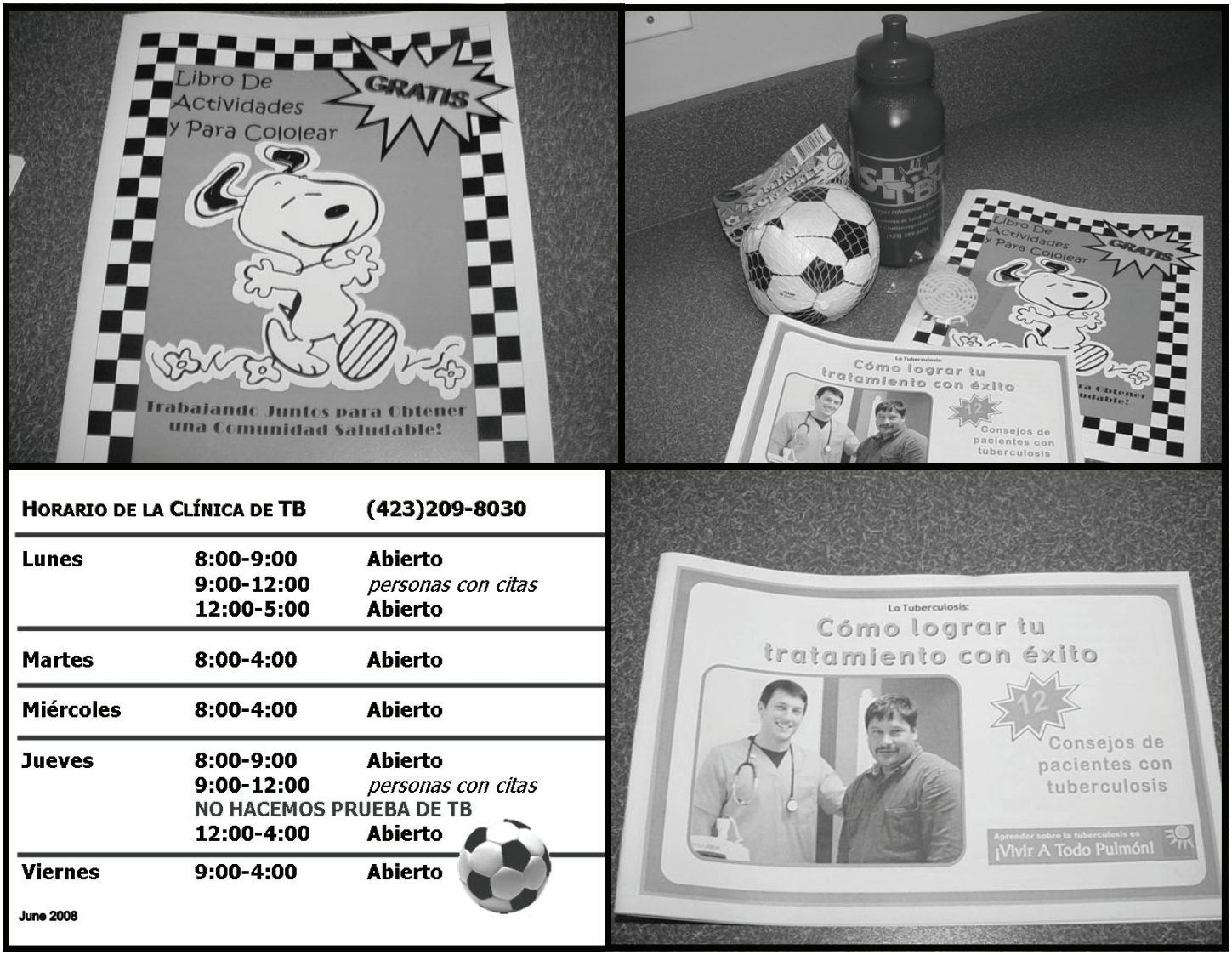
Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of Rocky Mountain Spotted Fever, by Age Group, Tennessee and the United States.

	<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 (2005)	0	0.00	1	0.33	21	2.59	17	2.08	24	1.95	56	2.85	19	2.56
TN (2006)	1	1.25	7	8.73	30	3.69	20	2.43	54	4.38	97	4.89	49	6.49
TN (2007)	0	0.00	7	2.19	18	2.20	21	2.54	38	3.08	80	3.99	22	2.86
US (2002)	4	0.11	43	0.28	137	0.33	100	0.26	227	0.36	437	0.52	148	0.42

The incubation period for RMSF 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 gastrointestinal involvement. A rash occurs 3-5 days after symptoms begin in most but not all cases. The rash, if present, usually begins on the extremities (ankles and/or wrists) and then spreads to the rest of the body. RMSF cases can be misdiagnosed due to severe gastrointestinal 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; 2% will die even with proper treatment.

Community supported prevention measures to reduce tick populations are not practical, which makes public education prevention critical to reducing the chance of exposure. Prevention measures include wearing light-colored clothing to help see ticks, tucking pants legs into socks, and wearing appropriate repellents. Additionally, because transmission requires prolonged attachment, conducting body checks after returning from tick-infested habitats can prevent illness.

G. Tuberculosis



HORARIO DE LA CLÍNICA DE TB		(423)209-8030
Lunes	8:00-9:00	Abierto
	9:00-12:00	*personas con citas*
	12:00-5:00	Abierto
Martes	8:00-4:00	Abierto
Miércoles	8:00-4:00	Abierto
Jueves	8:00-9:00	Abierto
	9:00-12:00	*personas con citas*
	NO HACEMOS PRUEBA DE TB	
	12:00-4:00	Abierto
Viernes	9:00-4:00	Abierto

June 2008

Problem: The Chattanooga/Hamilton Co. Health Department TB Program noticed that Hispanic women and children were visiting the health department for a variety of reasons and being seen in different clinics; however, Hispanic men were mainly being seen in the STD clinic. The health department wanted to provide a more friendly/relaxed opportunity to mingle with the Hispanic male population.

Plan: The health department recognized that Hispanic men play a lot of soccer so health dept. staff planned to visit soccer fields and introduce themselves and give away some gifts to make this population aware of who they were and what they did.

Action Steps: The health department talked with soccer tournament organizers, visited soccer fields (with bilingual staff) and even formed a health department soccer team that would play against these Hispanic males (although they never played because not enough health department staff joined).

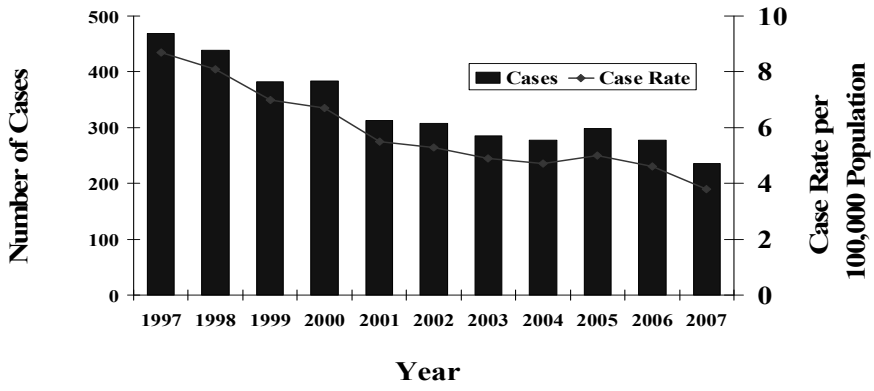
Result: The health department noticed more Hispanic males showing up to TB clinic for testing. They increased the awareness of TB in the Hispanic population and an increased knowledge of the TB program and services offered.

Source: Tennessee Department of Health.

Tuberculosis Elimination Program

Tennessee reported 235 cases of tuberculosis (TB) in 2007, which represented a decrease of 15% compared with the 277 TB cases reported in 2006. Corresponding to the decrease in cases was a decrease in Tennessee's TB case rate from 4.6 per 100,000 population in 2006 to 3.8 per 100,000 population in 2007. During 2007, Tennessee's two largest metropolitan areas had the highest incidence of TB disease in the state: Memphis/Shelby County reported 73 cases (case rate 8.0 per 100,000 population) and Nashville/Davidson County reported 61 cases (case rate 9.8 per 100,000 population). Until 2005, Tennessee experienced a steady decline of TB morbidity over the previous 10 years as illustrated in **Figure 1.** The overall decrease in cases during 2007 may be attributed, in part, to increased targeted testing and assertive contact investigations, particularly in Memphis/Shelby County which experienced a decrease of 34 cases (107 to 73) compared to 2006.

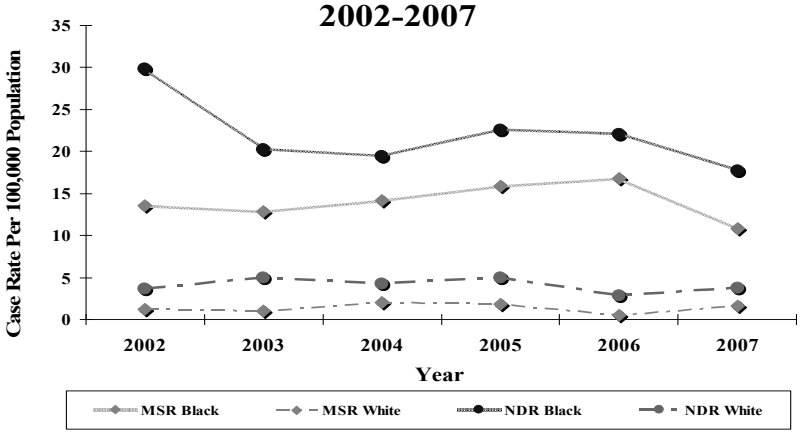
Figure 1. Number of Tuberculosis Cases, Tennessee, 1997-2007



Racial and Ethnic Distribution

During 2007, the racial and ethnic distribution of TB cases in Tennessee changed very little from 2006. In 2007, Tennessee reported 41% of TB cases as black non-Hispanic, 35% as white non-Hispanic, 8% as Asian/Pacific Islander, and 15% as Hispanic of any race; in 2006, the racial and ethnic distribution was 46%, 34%, 8% and 12%, respectively. Among the 95 black non-Hispanic cases reported in 2007, 51 (54%) were from Memphis/Shelby County and 28 (30%) were from Nashville/Davidson County. In 2007, Memphis/Shelby County had a black non-Hispanic case rate of 10.8 cases per 100,000 population compared to 1.6 for white non-Hispanics. Similarly, Nashville/Davidson County had a black non-Hispanic case rate of 17.7 cases per 100,000 population compared to 3.7 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.

Figure 2. Non-Hispanic White & Non-Hispanic Black Tuberculosis Case Rates, Memphis/Shelby & Nashville/Davidson Counties, 2002-2007



Population estimates are from the US Census Data and represent estimates at midpoint of each year.
2007 estimates are using 2006 population estimates and are preliminary.

TB Genotyping Program

The implementation of a statewide TB genotyping program in 2004 has added a new dimension to the traditional epidemiologic investigation of TB transmission, 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* strains are 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.

Table. TB Clustering Percentages Tennessee & the United States, 2004-2007.

Categories	Case Counts	
	2004 - 2005	2004 - 2007
# of Reported Cases in TIMS	576	1,090
Total # of Submissions	401	759
# of Clustered Isolates	201	428
Tennessee Clustering Percentage	50%	56%
# of US-born Submissions	323	591
# of US-born Clustered isolates	189	380
US-Born Clustering Percentage	59%	64%
# of Foreign-Born Submissions	78	168
# of Foreign-Born Clustered Isolates	12	48
Foreign-born Clustering Percentage	15%	29%

† TIMS: Tuberculosis Information Management System

‡ Submission: Verified case of Tuberculosis submitted for genotyping

The clustering percentage for TB cases in Tennessee has increased from 50% in 2004-2005 to 56% for 2004-2007. When the clustering percentages were compared in the US-born and foreign-born populations from 2004-2005 to 2004-2007, the clustering percentages increased from 59% to 64% and from 15% to 29% respectively (**Table**). In addition to monitoring the clustering percentages within the state, the TTBEP monitors data provided by the CDC that describe the number and percentage of isolates with a particular polymerase chain reaction (PCR) genotype in Tennessee, and the distribution of that PCR genotype across the United States. This information is useful for prioritizing cluster investigations because it reveals whether certain PCR genotypes are widely distributed across the U.S., are unique to Tennessee, or are indicative of possible interstate TB transmission.

TB Treatment

Adequate treatment of TB cases is dependent upon the susceptibility of the organism to available therapies. Tuberculosis drug susceptibility and resistance can only be determined following the growth of viable *Mycobacterium tuberculosis* cultures and, therefore, data regarding resistance are only descriptive of culture-positive TB cases. "Multi-drug resistant TB" (MDR-TB) refers to M. *tuberculosis* organisms that are resistant to both Isoniazid (INH) and Rifampin (RIF), both first-line drugs in the treatment of TB disease. MDR-TB can be described as either "initial MDR," referring to patients whose TB strains were initially resistant to both INH and RIF, or "acquired MDR," referring to patients whose M. *tuberculosis* developed resistance to both INH and RIF during treatment. In 2007, Tennessee reported five initial MDR-TB cases, with no reported case of acquired MDR-TB. There were no MDR-TB cases reported in 2006. Although reports of MDR-TB are uncommon in Tennessee, eight cases since 2003 (1 case in 2003, 2 cases in 2005, and 5 cases in 2007) were reported as having initial

MDR-TB. Tennessee also reported two cases of acquired MDR-TB, one case in 2001 and one in 2002. Acquired MDR-TB may increase over time, especially for those cases whose treatment lasts more than 12 months or who are non-compliant with TB therapy.

Section IV.

Environmental Health

Demolished buildings were all that remained of the former Lenoir Car Works industry in Loudon County. From 1907 to 1985, railroad cars and parts were made at the site. Decades of lead dust and slag remained on-site. Although overgrown, the site was easily accessible to trespassers. In 2007, the Environmental Epidemiology Program worked with the Tennessee Department of Environment and Conservation on the site. Site access was restricted to prevent trespassers from being exposed to the lead. Residential yards were tested for lead contamination. High lead in soil concentrations were measured at some of the residential properties near the Lenoir Car Works Site.

Source: Tennessee Department of Health.

Environmental Epidemiology

The Environmental Epidemiology Program (EEP) within Communicable and Environmental Disease Services (CEDS) is charged with protecting the public from exposure to hazardous substances. Environmental Epidemiology works in all 95 counties in Tennessee. Regional Environmental Epidemiologists provide local support to environmental public health projects as part of their responsibility to protect the health of Tennesseans. It is common for the Regional Environmental Epidemiologists and the Central Office to team with other state agencies such as the Tennessee Department of Environment and Conservation (TDEC).

EEP has little state-appropriated funding. Federal funding for the investigation of hazardous waste sites comes through a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). Federal funding for environmental epidemiologic investigations comes from a Public Health Emergency Preparedness Cooperative Agreement.

EEP had a busy 2007 responding to environmental public health questions. EEP performed an exposure investigation as well as publishing seven health consultations that detailed investigations of hazardous substances. These reports, certified by ATSDR, provided public health conclusions and recommendations for each site investigated. Environmental Epidemiology also published several short reports documenting our smaller projects and responses. These are called technical assists.

In the fall of 2007, EEP welcomed a new staff member. Melissa Kranz is an Environmental Epidemiologist with an MPH from the University of Alabama – Birmingham. Melissa replaced one of the three staff members who transitioned from the program to other positions in state government.

Fact sheets, report summaries, public meetings, media releases, interviews, and Internet pages all supported our health consultations. For more information about specific public health projects visit the CEDS Internet site. Projects completed by EEP in 2007 are included.

Exposure Investigation

An exposure investigation (EI) involves the collection and analysis of site-specific information and biologic tests to find out if people have been exposed to hazardous substances.

Cypress Creek Sub-Area III, Shelby County

An exposure investigation (EI) was conducted in Cypress Creek Sub-Area III which included the North Hollywood, Hyde Park, and Springdale neighborhoods of north Memphis. The EI was conducted in May 2007 by EEP and the Memphis and Shelby County Health Department (MSCHD). The amount of dieldrin, aldrin, and endrin in house dust and the amount of dieldrin, aldrin, and endrin in the blood of community members was measured.

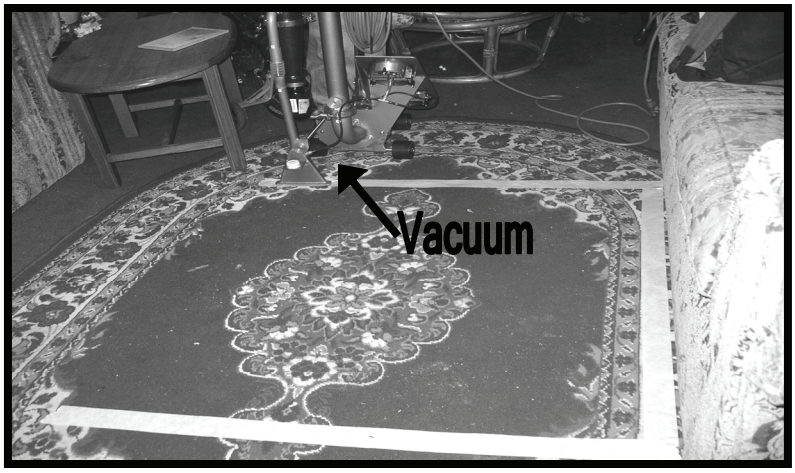
The EI was kicked off with a community meeting at the Hollywood Community Center. The meeting focused on the history of the area and the planned actions of the EI.

Cypress Creek Community Meeting, Hollywood Community Center, Memphis, TN. *Source: David Borowski, Tennessee Department of Health*

The community meeting was led by both the MSCHD and EEP.

Blood samples were collected from individuals who lived in a home where unsafe concentrations of dieldrin were detected in backyard soils. Dust samples were collected in the same home by EEP using a special vacuum cleaner.

Results of the house dust testing did not reveal any unsafe levels of dieldrin, aldrin, or endrin. The results of the blood testing and the final report are scheduled to be released in 2008.



Dust collection area and special vacuum cleaner. *Source: David Borowski, Tennessee Department of Health*

Environmental Public Health Consultations

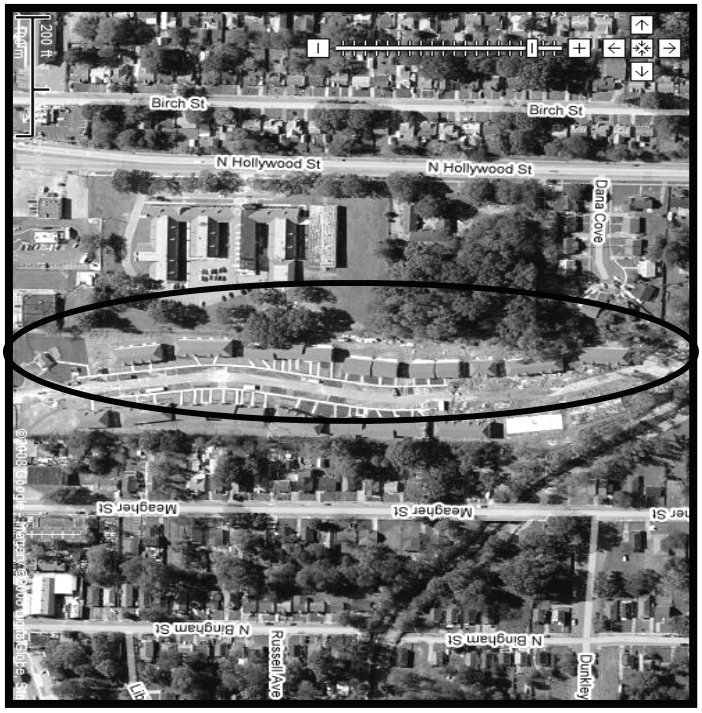
A health consultation (HC) is a report prepared after looking at a site's environmental data and making a professional judgement about the likelihood of public health hazards. A HC provides public health conclusions, recommendations, and outlines a plan of action plan for each site evaluated.

Springdale Creek Apartments—North End, Shelby County

The Tennessee Department of Environment and Conservation (TDEC), Division of Remediation (DoR), asked EEP to review soil sampling results at the Springdale Creek Apartments in Memphis. EEP was asked to review the results to see if pesticides in soils could evaporate into the ambient air or the indoor air of the apartments. If they could, a health hazard from inhalation of the pesticides would exist. Springdale Creek Apartments is a State Superfund site. A major portion of the property surrounding the apartment complex is in the Cypress Creek Sub-Area III that is under investigation and clean-up under the authority of the Resource Conservation and Recovery Act (RCRA).

EEP concluded, by using mathematical modeling, that concentrations of pesticides in soil were high enough to possibly be an inhalation health hazard.

Additional soil sampling plus outdoor and indoor air sampling for pesticides was requested by EEP, the MSCHD, and TDEC to further evaluate the site. These tests were completed in late 2007. Indoor air results indicated the need for periodic monitoring to protect residents of the apartments. Additional preventive measures at the site involved stabilizing soils during the construction process to reduce blowing of soil particles throughout the apartment complex.



Arial view of the Springdale Creek Apartment Complex (outlined). *Source: Google Earth.*

Hardeman County Landfill, Hardeman County

About 40 years ago a chemical company buried approximately 130,000 drums of chemical wastes in Toone, Hardeman County. The chemical wastes included pesticides and volatile organic compounds (VOCs). In 1983, the site was added to EPA's National Priorities List (NPL) of Superfund sites in need of urgent cleanup. The site was remediated. Regular scheduled sampling indicated a possible problem from evaporation of solvents. Two health consultations were published for the Hardeman County Landfill in 2007.

Vapors of carbon tetrachloride and chloroform were found in soils approximately one mile from the landfill. Additional air tests were done inside the crawlspaces of nearby residential houses. Carbon tetrachloride and chloroform vapors in indoor air were determined to be a health hazard for two residential homes. Inside the effected homes, vapor mitigation systems were installed to reduce any risk to health.

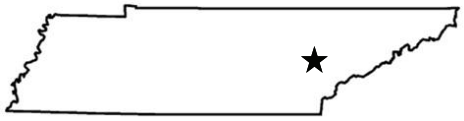
Entrance to Hardeman County Landfill. *Source: David Borowski, Tennessee Department of Health.*

Pesticide Contamination in a Home, Loudon County

In September 2006, a couple bought a house in Loudon County. After moving in, they noticed a strong pesticide-like smell in the basement. The man noted that his chest felt tight and his lips tingled when he spent time in the basement. The woman experienced fatigue. The couple contacted the Tennessee Department of Agriculture (TDA) who then tested the home for pesticides. Chlorpyrifos, diazinon, and malathion, which are all organophosphorous pesticides and cholinesterase inhibitors, were discovered in areas within the home. Additionally, bifenthrin, a pyrethroid pesticide, was also identified. These commercial-grade pesticides should not have been in the residential home.

The family was encouraged to consult with their primary care physician and sleep elsewhere until the situation was resolved. Together EEP and TDA called the National Response Center to request assistance for the family.

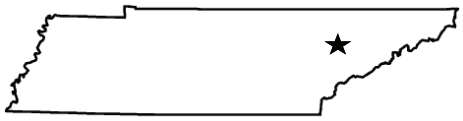
An Environmental Protection Agency (EPA) on-scene coordinator deployed from Atlanta to assess the situation. Testing inside the house found no pesticides in the upstairs living area. The basement, however, had high levels of pesticides in the air. The basement linoleum tile, shoe molding, and bottom twelve inches of drywall had to be removed. The bathroom shower, toilet, and sink had to be disassembled. The affected areas were painted with a sealant to encapsulate any remaining pesticides.



Removal of pesticide-contaminated drywall in basement of Loudon County home. *Source: David Borowski, Tennessee Department of Health.*

Follow-up air testing was done in December 2006. After this testing, the basement was determined to be clear of pesticides and safe for use. A health consultation was published soon after in 2007 to document the environmental emergency response.

Mr. Zip Convenience Store, Knox County

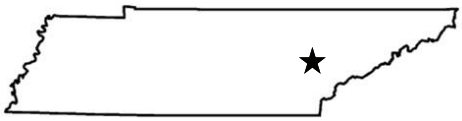


The resident of a rear duplex apartment reported strong gasoline odors. The duplex is 150 feet from a storm drain and a convenience store which sold gasoline. TDEC asked EEP if the gasoline vapors in the duplex were a health hazard for the resident.

Using SUMMA canisters, environmental sampling of the indoor air showed that 28 chemicals relating to gasoline were detected in the apartment. Benzene, xylene, and MTBE were the focus of the health consultation. The chemicals were at such low concentrations that no apparent health hazard existed.

TDEC worked with the convenience store owner to install an engineered solution to eliminate the odors coming from the storm drain. The engineering controls were installed and no further problems have been reported from the storm drain.

Lenoir Car Works, Loudon County

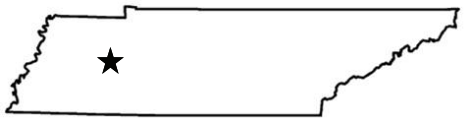


Lenoir City wanted to redevelop a 100-acre industrial property used as a railcar manufacturing site for eight decades. Environmental investigations found lead and arsenic contamination in site soils. A local resident asked if this pollution could have migrated offsite and contaminated nearby residential properties.

EEP reviewed reports from past environmental investigations and visited the site. The site was not secure. Fences were incomplete or broken allowing people to trespass across the site. EEP recommended testing residential yards and a neighborhood park near the site. The soil testing indicated lead contamination in several yards. To determine whether residents living nearby had been exposed to lead, an exposure investigation was planned for 2008.

View of the overgrown Lenoir Car Works industrial site. *Source: David Borowski, Tennessee Department of Health.*

H.O. Forgy, Madison County



From 1951 to 1977, H.O. Forgy operated an aluminum smelting operation in Jackson, Madison County. Lead remained in the soil from the industrial operations. The site is located in a residential neighborhood. The property made a great short cut for getting across the neighborhood. People were observed to frequently trespass on the site.

TDEC asked EEP to evaluate any health hazard from lead in site soils to trespassers.

Risk assessment methodology was used to determine the amount of lead a person might be exposed to while trespassing on the site. In a health consultation, EEP concluded that if the site was secured such that no one could enter the site then the site would not pose a hazard to public health. The site owner agreed to provide fence repair and perimeter security as a precaution. These institutional controls met public health and regulatory needs.

Technical Assists

A technical assist (TA) is a short report that documents our work on smaller projects or information requests.

Diesel Recon, Shelby County

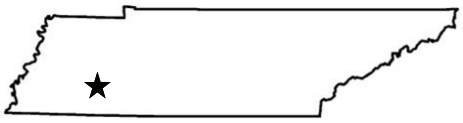
A spill had contaminated groundwater under the Diesel Recon site with 1,1-dichloroethylene (1,1-DCE), a volatile organic compound. Diesel Recon was a large industrial truck yard. The potential for employees to have an involuntary exposure from vapor intrusion of the groundwater contamination into building structures was likely.

According to TDEC, the responsible party had been slow to monitor the situation. EEP provided a letter stating that modeled indoor air vapor levels were too high compared to health guidance values and that real indoor air sampling was needed.

Afterward, the site operator responded appropriately to ensure their workers' health and safety.

Former Duran Industrial Drive Drum Storage Facility, McNairy County

TDEC asked EEP to review sampling data for polychlorinated biphenyls (PCBs) inside the former Duren Industrial Drive Drum Storage facility. The building had been cleaned and TDEC wanted to make sure that the building was safe for industrial reuse. EEP concluded that the building no longer presented a health hazard from PCBs.

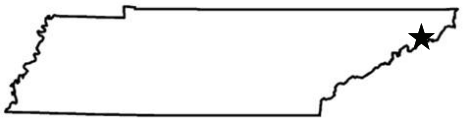


Former American Bemberg Plant, Carter County

Years ago, American Bemberg made rayon in Elizabethton. After the industry closed, the buildings and land area were left behind. The land area was rezoned for light industrial use and turned into the Cherokee Industrial Park. As Elizabethton grew, these areas were redeveloped. A day care facility started in a strip mall in the industrial park. For health and safety reasons, the day care was relocated.

A greenway, a paved walking and biking trail, was built along the edge of the former American Bemberg Plant Site. A site visit was performed to check for possible completed exposure pathways. TDEC and EEP provided oversight to characterize the site. EEP provided suggestions for sampling that included additional testing near a large store and near the walking path — places where the public was more likely to be exposed. TDEC and EEP were satisfied with the ongoing actions to investigate and prevent any possible health hazards from the old American Bemberg Plant Site.

View of a remaining building at the former American Bemberg Plant Site. *Source: David Borowski, Tennessee Department of Health.*



Other Projects

Throughout the year, EEP is involved with various activities promoting public health throughout Tennessee, several of which are discussed below.

East Tennessee Environmental Conference

Regional Environmental Epidemiologists Toni Bounds, Robin Elolia, and La'Shan Taylor were all conference planners for the annual East Tennessee Environmental Conference held in March at Kingsport. Environmental Epidemiology Assistant Director David Borowski was a moderator for the Green Schools presentation.

Community Public Meetings

Throughout 2007, several public meetings were attended to brief community stakeholders on the effects of living near industrial or hazardous waste sites in Tennessee.

Earth Day

Environmental Epidemiology staff members participated in the annual Nashville Earth Day Festival held at Centennial Park in April. Informational pamphlets and brochures explaining mold, radon, second hand smoke, and other environmental hazards were given to people who stopped by the booth.

Environmental Epidemiology promotes environmental public health at the 2007 Nashville Earth Day Festival. *Source: David Borowski, Tennessee Department of Health.*

Mercury Thermometer Exchanges

A great partnership between the Tennessee Department of Health and the Tennessee Department of Environment and Conservation continues to get hazardous mercury out of Tennessee homes. In 2007, mercury thermometer exchanges continued in many counties. At the events, citizens brought their old mercury thermometers in for proper disposal and received a free replacement thermometer. Very successful events were held by Al Iannacone in Knox County and La'Shan Taylor in the Northeast Region. Hundreds of citizens were assisted thanks to the Environmental Protection Agency's Pollution Prevention grant funding. Several pounds of mercury were removed from Tennessee homes.

Above and at Left: Mercury thermometer swap in Nashville resulted in exchange of numerous old mercury thermometers (at left) for new mercury-free ones. *Source: David Borowski, Tennessee Department of Health.*

SECTION V.

Investigations and Outbreaks

Dr. Tim Jones puts his kids to work during an outbreak of E. coli O157. They were sent to their local grocery store to purchase as many frozen pepperoni-containing pizzas of Brand X and Brand Y as they could find. All pizzas purchased were then shipped to a private lab in Oregon for E. coli O157 testing.

Source: Tennessee Department of Health

Highlighted Investigations and Outbreaks in Tennessee in 2007

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 2007. 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 public health problems that place persons at risk for illness. Identification of risk factors can lead to different strategies to reduce risks and prevent illnesses. Publication of findings such as these can lead to the prevention of future outbreaks.

Multi-State Outbreak of *Salmonella* Serotype Tennessee Infections Associated with Consumption of Peanut Butter

Background: *Salmonella* serotype Tennessee is a rare cause of the estimated 1.4 million cases of salmonellosis occurring annually in the United States. In January 2007, CDC, FDA and public health officials in all states began investigating a large, multi-state outbreak of *Salmonella* Tennessee infections.

Methods: We defined a case as a patient whose *Salmonella* Tennessee isolate demonstrated one of three similar pulsed-field gel electrophoresis patterns and whose illness began on or after August 1, 2006. We developed hypotheses by comparing patient food histories from an extensive food item questionnaire to U.S. population food consumption survey data. We conducted a case-control study among adult residents of Tennessee and 21 other states. State and federal public health laboratories tested implicated product for *Salmonella*.

Results: 714 cases were identified in 48 states; 20% of patients were hospitalized and none died. Among those who reported the illness onset, 420 cases (79%) had symptom onset 12/1/2006 or later, 149 (28%) had symptom onset 2/15/2007 or later, and 43 (8%) had symptom onset 4/15/2007 or later. Among 65 cases and 124 controls, illness was associated with consuming peanut butter more than once a week (matched odds ratio [mOR] 3.5, 95% confidence interval [CI] 1.4 – 9.9), consuming Peter Pan brand peanut butter (mOR 12.1, CI 3.6 – 66.3), and consuming Great Valley brand peanut butter (mOR 9.1, CI 1.0 – 433). Both brands were produced in a single plant, which ceased production and recalled all products on February 14, 2007. Laboratories isolated outbreak strains of *Salmonella* Tennessee from 34 jars of both brands of peanut butter produced between July 2006 and January 2007 and from two plant environmental samples obtained in February 2007. Tennessee reported 37 (5%) of the 714 cases. The majority of cases resided in Middle and East Tennessee.

Conclusion: This is the first foodborne outbreak linked to peanut butter in the United States. Contamination of peanut butter continued for at least several months. Coordinated, multi-state epidemiologic and laboratory efforts identified the outbreak vehicle, resulting in a nationwide recall and control of the outbreak.

Multistate Investigation of *Escherichia coli* O157:H7 Infections Associated with Frozen Pizza

Background: *Escherichia coli* O157:H7 (O157) is an important cause of hemorrhagic colitis and hemolytic uremic syndrome (HUS). Recognition of multistate outbreaks has increased, as has the identification of unique sources of infection. We investigated a multistate cluster of *E coli* O157 cases to identify the vehicle and prevent additional cases.

Methods: We defined a case as culture-confirmed *E coli* O157 infection demonstrating the outbreak pulsed-field gel electrophoresis (PFGE) pattern with a two enzyme match occurring during July 20–October 19, 2007. In Tennessee, we performed a 3:1 case-control study, frequency matched on age and geography, using sequential digit-dialing. Fisher's exact 95% confidence intervals (CI) and odds ratios (OR) were computed using SAS®.

Results: In Tennessee, eight cases of *E coli* O157 were identified (median age: 14.5 years; range: 2–65 years). Illness onsets ranged from August 16 to September 19. Five patients were hospitalized; three experienced HUS. Six (75%) case-patients reported having eaten Brand X or Y frozen pizza (manufactured at the same plant),

compared with one (4.0%) control subject (OR: 144; CI, 5.8–22,000). Of these, five (63%) had eaten pepperoni-containing pizza (OR: undefined) ≤7 days before experiencing illness. Overall, 26 PFGE-matched *E coli* O157 infections were identified in 13 states with onset dates from July 20 to October 19. Median patient age was 8 years (range: 1–65 years). Ten case-patients were hospitalized; four experienced HUS. Of nine non-Tennessee case-patients interviewed, three reported having consumed pepperoni-containing Brand X or Y pizza.

Conclusions: This outbreak likely resulted from consumption of pepperoni-containing Brand X and Y pizza. Rapid epidemiologic investigation and prompt multiagency and industry collaboration resulted in voluntary recall of the implicated products, likely preventing additional cases.

Foodborne Outbreak of Norovirus Following Consumption of Contaminated Gulf Coast Oysters—Tennessee, 2007

Background: Norovirus is a common cause of gastroenteritis. Transmission of norovirus can be person-to-person and via food contaminated by ill food handlers. Oysters from contaminated harvest areas can result in Norovirus outbreaks. We describe a Norovirus outbreak from contaminated oysters and subsequent regulatory actions.

Methods: Public health surveillance and investigation were conducted to identify ill persons, assess exposures, collect food specimens, and identify factors contributing to transmission. Laboratory testing, including viral sequence analysis of stool specimens and oysters, was conducted. Findings were communicated to shellfish regulatory agencies.

Results: Surveillance identified 6 ill persons who had consumed raw oysters among a party of 8 who ate at Restaurant A. Records to identify additional patrons were unavailable. Among identified patrons and restaurant staff interviewed (n=25), 11 consumed raw oysters on December 13, and 8 (73%) of these reported gastrointestinal illness 34–46 hours after consumption. No restaurant employees reported illness on or before December 13. Submitted stool specimens from 2 ill patrons, and oysters were positive for Norovirus GII. Norovirus nucleic acid sequence analysis demonstrated 100% identity from oyster and stool specimens. Louisiana public health officials closed the implicated oyster harvest area December 21. On December 29, FDA issued a public warning about oysters from the implicated harvest area.

Conclusions: Rapid investigation by public health authorities identified an outbreak of Norovirus from contaminated oysters. Regulatory actions possibly prevented additional illnesses. Oyster exposure should be considered in Norovirus outbreaks.

SECTION VI.

Public Health Emergency Preparedness Program

West Tennessee Regional Preparedness Staff participate in the Tennessee Catastrophic Exercise (TNCAT) in 2007.

Source: Tennessee Department of Health

Public Health Emergency Preparedness (PHEP)

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 receipt and distribution of assets from the Strategic National Stockpile (SNS). The SNS is a national repository of antibiotics, vaccines, antitoxins, chemical antidotes, 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. From the beginning it was recognized that preparedness for bioterrorism in Tennessee was dependent upon the state public health system's ability to respond to all public health threats. The overall objective for the use of these funds is to supplement response capacity and continue to augment public health infrastructure. In 2007, PHEP received $16,285,844 from the Centers for Disease Control and Prevention (CDC) cooperative agreement grant.

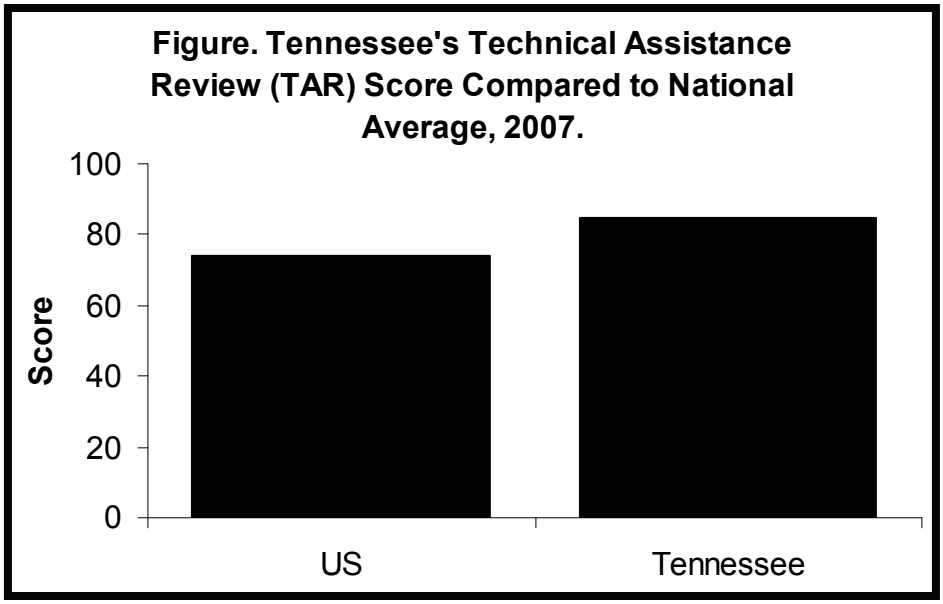
All-Hazard Planning

Tennessee has an all-hazard approach to preparedness and response. 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 by the Tennessee Emergency Management Agency (TEMA). The Pandemic Influenza Response Plan was also integrated into the ESF-8 section of the TEMP as part of the "all-hazard" plan.

Strategic National Stockpile (SNS)

A high priority in the development of these plans is the inclusion of detailed processes concerning the receiving, staging, storing and distributing assets from the SNS. In 2005, the PHEP received the highest rating from the CDC for its level of preparedness to receive the Strategic National Stockpile (SNS) during an act of bioterrorism or a mass casualty event. The CDC now grades a state's preparedness using the newly developed 100 point scale termed the Technical Assistance Review (TAR) tool. This numerical scale allows the CDC to compare all 62 preparedness project areas and identify best practices across the country. The Tennessee Department of Health received a score of 85 points from the CDC in 2007 **(Figure)**.

Figure. Tennessee's Technical Assistance Review (TAR) Score Compared to National Average, 2007.



Trust for America's Health Report

Tennessee achieved a score of 10 out of 10 for preparedness to respond to public health emergencies, according to "Ready or Not? Protecting the Public's Health from Disease, Disasters and Bioterrorism," a report issued December 18, 2007 from the Trust for America's Health. Tennessee was one of only seven states with a top score in this national assessment The 10 items addressed were SNS plans, antiviral stockpiles, laboratory capacity, laboratory staffing, communicable disease surveillance, volunteer liability protection, exercises, volunteer recruitment,

influenza vaccination rates, and public health preparedness funding.

Medical Reserve Corps (MRC)

PHEP is making progress in changing the department's volunteer organizational structure to that of a Medical Reserve Corps (MRC). When fully implemented, all of our 30,000 volunteers will be MRC volunteers. These volunteers are recruited to support the Tennessee Department of Health, hospitals, and medical care providers in a public health emergency. Also, in order to better coordinate the mobilization of these community volunteers, regional health departments have filled the volunteer coordinator positions across the state.

Public Health Laboratory

The Tennessee Department of Health (TDH) Laboratory Services have worked to improve networks among the state's clinical and hospital laboratories. A database of contact information of hospital and clinical labs has been developed, and information is shared with them as necessary. Training continues to be provided to hospital and sentinel laboratories across the state in isolation and diagnosis of potential bioterrorist agents. The Chemical Terrorism Laboratory is fully operational and has successfully completed validations for urine heavy metals and blood cyanide. Laboratory services have utilized grant funds to develop and equip four (4) Laboratory Response Network (LRN) Laboratories to test for bioterrorism agents. These regional laboratories are located in Nashville, Knoxville, Jackson, and Memphis to provide 24/7 response and testing.

Syndromic Surveillance

The regional health department epidemiologists continue to enhance regional disease surveillance activities, particularly by implementing continuous monitoring of data regarding syndromes that might signal a large-scale exposure to bioterrorist agents or other possible outbreaks. 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, and work or school absenteeism.

BioSense

A hospital system in Memphis is now part of the CDC BioSense network. BioSense is a national program intended to improve the nation's capabilities for conducting real-time biosurveillance and enabling health situational awareness through access to existing data from healthcare organizations across the country. This is accomplished by supporting real-time delivery of healthcare data to CDC from hospitals, laboratories, ambulatory settings and other health data sources.

Biohazard Detection System (BDS)

Since 2004, PHEP has participated in implementation of the Biohazard Detection System (BDS), which was developed under contract with the U.S. Postal Service (USPS) specifically to detect aerosolized *Bacillus anthracis* spores. USPS installed BDS units in approximately 300 mail processing and distribution centers (PDCs) across the United States. PDCs have high-speed mail-handling equipment that can aerosolize *B. anthracis* spores sent through the mail, as demonstrated during the 2001 anthrax attacks. USPS installed BDS devices on or near key equipment that processes incoming mail. Identification of aerosolized *B. anthracis* spores in an air sample would prompt on-site decontamination of workers and subsequent post-exposure prophylaxis (PEP) before the onset of symptoms and interruption of the flow of contaminated letters or packages into the postal stream.

Communications

Redundant communications systems were further enhanced to augment public health personnel's ability to communicate with each other and to improve communications with hospitals, Emergency Medical Services (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 (T-HAN) has been implemented. This system contains two separate applications. The T-HAN application is specific to contacting public health employees and key responders. The Volunteer Mobilizer application is for statewide volunteer contact and is being developed as the method for credentialing medical professionals during emergency deployment.

PHEP continues to focus on emergency response plans that incorporate risk communication and health information dissemination strategies. Traditionally underserved groups, including minorities, non-English speakers and the homeless population, will be the targets of future refinements of this plan.

Training

TDH is developing and participating in conferences and meetings focusing on educating and informing health professionals and the public about threats and preparedness. PHEP continues to facilitate the delivery of education and training to key public health professionals utilizing the Tennessee Training-finder Real-time Affiliate Integrated Network (TN TRAIN). The PHEP was integral in coordinating and presenting a series of three Avian Influenza Response Trainings across the state which presented information from TDH, the Tennessee Department of Agriculture, and the poultry industry. In addition, PHEP provided pandemic influenza preparedness planning handbooks for all TDH and Department of Education employees. Also, recognizing a need for training to address the mental health needs of the public and of emergency response personnel, over 2000 Public Health Employees participated in Psychological First Aid training developed by TDH personnel in collaboration with the University of North Carolina Chapel Hill.

Exercise Program

In 2007, PHEP staff continued with the joint terrorism education and exercise program with the Office of Homeland Security and TEMA. The Hospital 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 has been conducted over a three-year period in the 11 Tennessee Office of Homeland Security Jurisdictional Districts. The goal is to foster multi-agency collaboration through combined, comprehensive, scenario-driven tabletop and full-scale terrorism exercises and to simulate intensity similar to what would be expected during an actual terrorism incident. Over a year in planning, the preparedness program participated with other state agencies and numerous local governments to conduct the first-ever test of the revised Tennessee catastrophic emergency plan. Known by the acronym TNCAT, this exercise covered a three day period and called for a no-notice event, which was a massive 7.7 magnitude earthquake in the New Madrid Seismic Zone along West Tennessee. Three areas of the catastrophic plans were tested extensively as part of TNCAT: emergency communications, logistics, and mass casualty surge capacity of the hospital system. Hundreds of volunteers participated in TNCAT to simulate a mass casualty event.

Legal Preparedness

The Tennessee Uniform Emergency Volunteer Health Practitioners Act of 2007 was passed by the General Assembly of the State of Tennessee. This bill authorizes the Tennessee emergency management agency (TEMA) to exercise emergency regulatory authority over volunteer health care practitioners and veterinary service providers. This bill also authorizes the creation of volunteer health provider registration systems. While an emergency declaration is in effect, this bill authorizes any volunteer health practitioner who is registered with a volunteer health provider registration system and licensed and in good standing in another state to practice in Tennessee to the same extent as if the practitioner was licensed in Tennessee. Any out-of-state volunteer would be required to adhere to the scope of practice for a similarly licensed practitioner in Tennessee.

Healthcare Preparedness Program

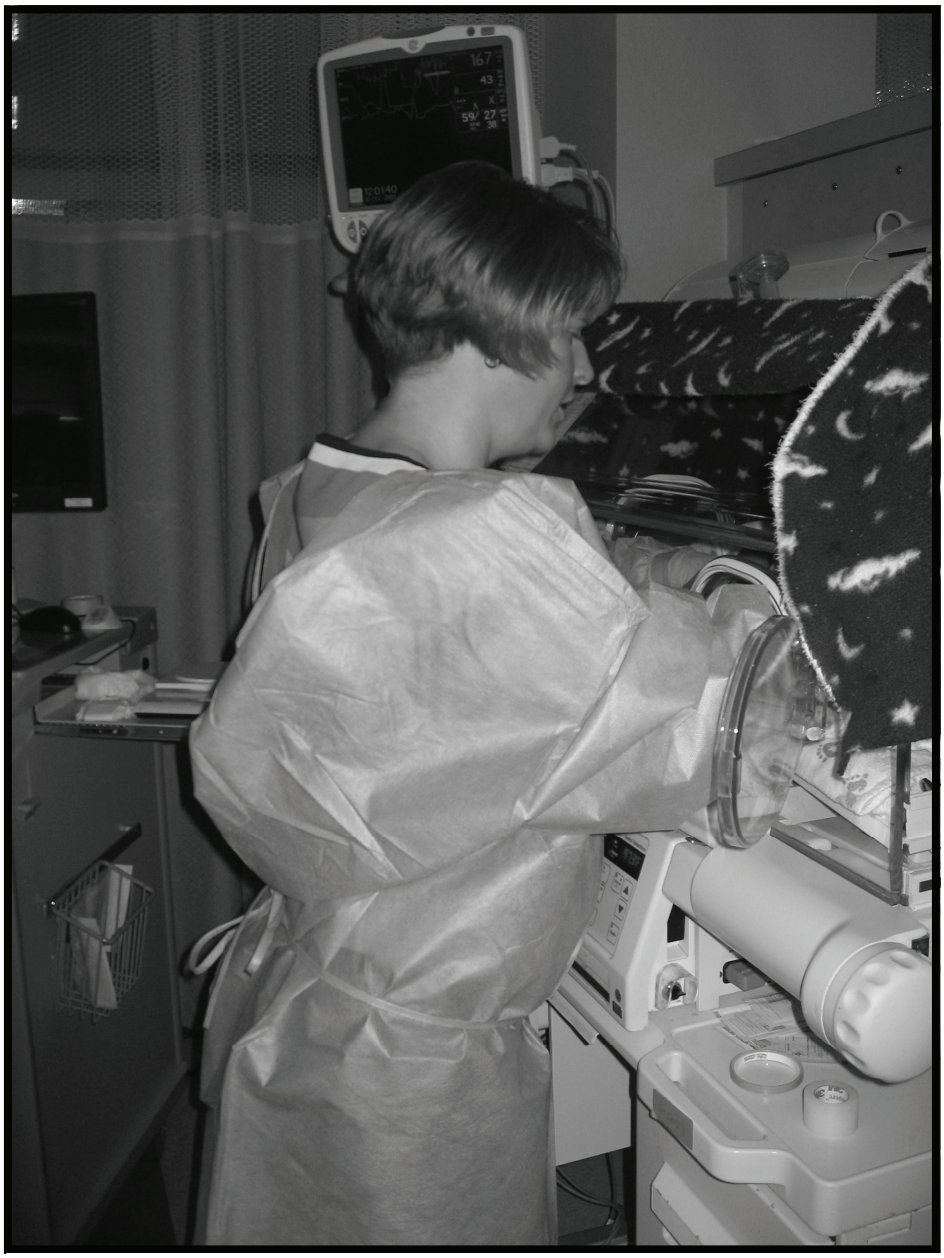
The Tennessee Healthcare Preparedness Program (THPP), previously the Hospital Preparedness Program, reports through the Office of the Assistant Secretary for Preparedness and Response (ASPR). THPP is authorized

through the Pandemic and All-Hazards Preparedness Act (PAHPA) (P.L. 109-417). In fiscal year 2007, THPP received $8,155,520 in grant funding. The Preparedness Goals for the use of this funding by hospitals were as follows: integrating public and private medical capabilities with public health and other first responder systems; increasing the preparedness, response capabilities, and surge capacity of health care facilities and emergency medical services systems; preparing for the medical needs of at-risk individuals in the community; coordinating Federal, State and local planning, preparedness, response, and recovery activities; and continuing to focus on interoperable communication systems, bed-tracking systems, volunteer registration systems, fatality management plans, and hospital evacuation plans.

THPP must also use funds to develop and sustain the statewide and national all-hazards electronic and communication response tools that are needed by hospitals for a regional and statewide disaster medical response and recovery. The disaster response tools include such programs as the Hospital Available Beds for Emergencies and Disaster (HAvBED) system, Emergency System for the Advance Registration of Volunteer Health Professionals (ESAR-VHP) and the Regional Medical Communication Centers that serve as the statewide medical interoperable communication system.

SECTION VII.

Epidemic Intelligence Service



Jennifer MacFarquhar, Tennessee's newest EIS Officer, investigates an outbreak of late-onset neonatal Group B *Streptococcus* in a neonatal ICU.

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 investigating and controlling major epidemics. EIS has been central in many high profile public health activities, including travelling to the farthest reaches of the world to achieve the eradication of smallpox,; 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 into the United States; assisting with the response to bioterrorism-related anthrax; 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. Rand Carpenter, DVM completed his assignment in Tennessee in June 2007 and joined CEDS as a full-time staff member. Jennifer MacFarquhar, RN, MPH began her EIS assignment in Tennessee in July 2007.

Examples of recent EIS investigations in Tennessee include:

- Norovirus outbreak following a baby shower
- Hepatitis A among travelers to Mexico
- *Chlamydophila psittaci* illness in pet birds and two human contacts
- Post-endoscopy febrile reactions
- *Acanthamoeba* keratitis investigation
- Evaluation of waterborne disease surveillance systems
- Outbreak of late-onset Group B *Streptococcus* in a neonatal ICU
- Multi-state *E. coli* O157 outbreak associated with frozen pizza
- Cryptosporidiosis among pool party attendees

Epidemic Intelligence Service Officers, 1970-2007
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	2007-	Jennifer MacFarquhar, RN, MPH, CIC

Section VIII.

Publications by CEDS and Tennessee EIP Authors, 2007

Darryl Edmisson, Drs. John Dunn and L. Rand Carpenter present information regarding judicious antibiotic use at the 2007 Tennessee Cattlemens Association meeting.

Source: Tennessee Department of Health

Publication/Articles

Bialek SR, George P, Xia GL, Glatzer MB, Motes ML, Veazey JE, Hammond RM, **Jones T**, et.al. Use of molecular epidemiology to confirm a multi-state outbreak of hepatitis A caused by consumption of oysters. Clin Infect Dis 2007;44:838-840.

Bemis DA, Craig LE, **Dunn JR**. *Salmonella* transmission through splash exposure during a bovine necropsy. *Foodborne Pathog Dis*, 2007; 4(3):387-90.

Cain KP, **Haley CA**, Armstrong LR, **Garman KN**, Wells CD, Iademarco MF, Castro KG, Laserson KF. Tuberculosis among foreign-born persons in the United States: achieving tuberculosis elimination. *Am J Respir Crit Care Med*. 2007 Jan 1;175(1):75-9.

Carpenter LR, Lott J, Lawson BM, Hall S, **Craig AS, Schaffner W, Jones TJ**. Mass Distribution of Free Intranasal Influenza Vaccine in a Public School System. *Pediatrics* 2007; e172-e178.

Carrara AS, Coffey LL, Aguilar PV, **Moncayo AC**, Da Rosa AP, Nunes MR, Tesh RB, Weaver SC. Venezuelan equine encephalitis virus infection of sympatric and allopatric populations of cotton rats. *Emerg Infect Dis*. 2007; 13(8):1158-65.

Fullerton KE, **Ingram LA, Jones TF**, Anderson BJ, McCarthy PV, Hurd S, Shiferaw B, Vugia D, Haubert N, Hayes T, Wedel S, Scallan E, Henao O, Angulo FJ. Sporadic Campylobacter infection in infants: a population-based surveillance case-control study in eight FoodNet sites. *Pediatr Infect Dis J* 2007;26: 19–24.

Gaba PD, **Haley C**, Griffin MR, Mitchel E, **Warkentin J**, **Holt E**, Baggett P, Sterling TR. Increasing outpatient fluoroquinolone exposure before tuberculosis diagnosis and impact on culture-negative disease. Arch Intern Med. 2007 Nov 26;167(21):2317-22.

Jones TF, **McMillian MB**, Scallan E, Frenzen PD, Cronquist AB, Thomas S, Angulo FJ. A population-based estimate of the substantial burden of diarrheal disease in the United States; FoodNet, 1996-2003. Epi Infect 2007;135:293-301.

Jones TF, Angulo FJ, Scallan E. FoodNet; review of a decade of achievement. Foodborne Path Dis 2007;4:60-66.

Kainer MA, **Devasia RA, Jones TF**, Simmons BP, Melton K, Chow S, et al Response to Emerging Infection Leading to Outbreak of Linezolid-Resistant Enterococci. Emerg Infect Dis 2007; 13:1024-1030.

Kutty PK, Moody B, Smartt Gullion J, Zervos M, Ajluni M, Washburn R, Sanderson R, **Kainer MA**, Powell TA, Clarke CF, Powell RJ, Pascoe N, Shams A, Lipuma JJ, Jensen B, Noble-Wang J, Arduino MJ, McDonald LC. Multi-state Outbreak of *Burkholderia cenocepacia* Colonization and Infection Associated with the Use of Intrinsically Contaminated Alcohol-free Mouthwash. Chest, 2007;132(6):1825-31.

Lederman ER, **Dunn JR**, *et. al.* Orf virus infection in children: clinical characteristics, transmission, diagnostic methods and future therapeutics. *Ped Infect Dis J*, 2007; 26: 740-744.

McMillian M, Dunn JR, Keen JE, Brady KL, Jones TF. Risk behaviors for disease transmission among petting zoo attendees. J Am Vet Med Assoc. 2007; Oct 1;231(7):1036-8.

Majowicz SE, Hall G, Scallan E, Adak GK, Gauci C, **Jones TF**, et.al. A common, symptom-based definition for gastroenteritis. Epi Infect 2007 Aug. 9;:1-9 [ePub ahead of print].

Varma J, Samuel MC, Marcus R, Hoekstra M, Medus C, Segler S, Anderson BJ, **Jones TF**, et. al. *Listeria monocytogenes* infection from foods prepared in a commercial establishment: a case-control study of potential sources of sporadic illness in the United States. Clin Infect Dis 2007;44:521-528.

Voetsch AC, Angulo FJ, **Jones TF**, McCarthy P, Nadon C, Moore MR, et. al. Reduction in the incidence of invasive listeriosis in Foodborne Diseases Active Surveillance Network sites, 1996-2003. Clin Infect Dis 2007;44:513-20.

Morbidity and Mortality Weekly Report (MMWR) Contributions

MMWR Centers for Disease Control and Prevention . Outbreaks of Respiratory Illness Mistakenly Attributed to Pertussis—New Hampshire, Massachusetts, and Tennessee, 2004-2006. 2007; 56:837-842.

MMWR Centers for Disease Control and Prevention. Preliminary FoodNet Data on the Incidence of Infection with Pathogens Transmitted Commonly Through Food — 10 States, 2006. 2007;56:336-339.

MMWR National Association of State Public Health Veterinarians. Compendium of Measures to Prevent Disease Associated with Animals in Public Health Settings, 2007.

2007;56:RR-5.

MMWR. Scombroid Fish Poisoning Associated with Tuna Steaks — Louisiana and Tennessee, 2006, Weekly Report, 8/17/2007; 56 (32); 817–819. (appeared in JAMA 2007, 298, 1269–1270)

MMWR. *Acanthamoeba* Keratitis — Multiple States, 2005—2007. Weekly Report, 6/1/2007; 532.

MMWR. *Acanthamoeba* Keratitis — Multiple States, 2005—2007. Dispatch, 5/26/2007/56(Dispatch) 1-3.

MMWR. Turtle-Associated Salmonellosis in Humans—United States, 2006-2007. July 6, 2007 / 56 (26); 649-652.

MMWR. Compendium of Measures To Prevent Disease Associated with Animals in Public Settings, 2005. National Association of State Public Health Veterinarians, Inc. Recommendations and Reports. June 6, 2007 / Vol. 56 / No. RR-5.

Abstracts/Posters

Carpenter LR, Pont S, Cooper W, Griffin M, Schaffner W, **Jones TF**. Rates of stool culture and antimicrobial use for diarrhea- Tennessee, 1995-2004. 2007 Epidemic Intelligence Service Conference, CDC, Atlanta, GA, April 2007.

Carpenter LR, **Kainer M, Woron A**, Baker S, Schaffner W, **Jones TF**. Community-associated methicillin-resistant *Staphylococcus aureus* (MRSA) among personnel at a pediatric clinic. 2007 Epidemic Intelligence Service Conference, CDC, Atlanta, GA, April 2007.

Carpenter LR. Trends in Provider Practice Patterns Related to Diarrhea-Tennessee,1995–2004. 2007 Epidemic Intelligence Service Conference, CDC, Atlanta, GA, April 2007.

Durso L, **Dunn JR** et al., Assessment of three remediation strategies for reduction of Shiga-toxigenic Escherichia coli (STEC) O157 in naturally contaminated soil. Institute of Food Technologists Meeting, July 20, 2007.

Ewald G, et.al- Multi-state outbreak of *Salmonella* serotypes Wandsworth and Typhimurium infections associated with consumption of a puffed vegetable snack food – United States, 2007. IDSA Conference, San Diego, 10/07. Submitted.

Gould LH, **Jones TF**, Canter J, et.al. Genetic predictors of hemolytic uremic syndrome among persons infected with *Escherichia coli* O157. CDC Genomics Conference, Atlanta, GA, 10/07.

Henao O, Demma L, Tong X, Vugia D, Hurd S, Thomas S, Mickelson S, Smith K, Spina N, Keene W, **Jones TF,** Dunn J, Angulo FJ. Trends in the Incidence of Shiga-toxin Producing *E. coli* O157 Infections, FoodNet, 1996-2006. IDSA Annual Conference, San Diego, CA, October 2007.

Holt EL, Kainer MA. Steps towards Implementation of the Outbreak Management System: an Epidemiologists Guide. Health Information Network (PHIN) Conference, Atlanta, GA August 27-29, 2007 (poster)

Kainer MA, Recalled human tissue for transplantation: what are the risks of infection to recipients? Council of State and Territorial Epidemiologist (CSTE) annual meeting, Atlantic City, NJ, June 24-28, 2007.

Kainer MA, Holt E, Fine A. Data-management in Outbreaks (round-

table discussion). Council of State and Territorial Epidemiologist (CSTE) annual meeting, Atlantic City, NJ, June 24-28, 2007.

Kainer MA. Mandatory Reporting of Hospital Acquired Infections in Tennessee (TN): Legislation & Proposed Rule Changes. 17th Annual Scientific Meeting of SHEA (Society for Healthcare Epidemiology of America), Baltimore, MD, April 14-17 2007 (poster)

Kainer MA, **Omohundro E,** Increase in Burden of Skin and Soft Tissue Infections (SSTI) as measured by Emergency Department (ED) Visits, 23 Hour Observations and Ambulatory Surgical Center Visits, Tennessee (TN) 2000-2004. 17th Annual Scientific Meeting of SHEA (Society for Healthcare Epidemiology of America), Baltimore, MD, April 14-17 2007 (poster)

Kainer MA, Holt E, Use of the Centers for Disease Control and Prevention (CDC) Outbreak Management System (OMS) for Investigation and Management of Outbreaks and Pre-Pandemic Response Options for the Control of Influenza VI (Options) conference, Toronto, Ontario, Canada, June 17-23, 2007 (poster)

Limbago BM, Long CM, Thompson AD, Killgore GE, Hannett G, Havill N, Mickelson S, Lathrop S, **Jones TF,** Park M, Cronquist A, Harriman KH, McDonald LC, Angulo FJ. Isolation and characterization of *Clostridium difficile* responsible for community-associated disease. ASM 107th Annual Conference, Ontario, Canada, May 21, 2007.

Long C, **Jones TF**, Shin S, Cronquist A, Marcus R, Hayes T, Ryan P, Scheftel J, Edge K, Zansky SM, Shiferaw B, Demma L. Decline in *Yersinia enterocolitica* infections in FoodNet, 1996-2006. IDSA Annual Conference, San Diego, CA, October 2007. Submitted.

Mukherjee S, Huddleston B, Moody E, Lewoczko K, **Dunn J**, Wilson R, **Jones TF**, Moncayo AC. Characterizing species diversity of vectors implicated in non-traditional EEE transmission in Tennessee. American Society of Tropical Medicine and Hygiene, 56th Annual Meeting, Philadelphia, PA, November 2007.

Mukherjee S, Huddleston B, Moody E, Lewockzo K, Dunn J, Wilson R, **Jones TF**, Moncayo AC. Case for a non-traditional EEE virus focus in Tennessee. 81st Annual Mtg., SE Branch Entomol. Soc. of Amer., Knoxville, TN, March 5, 2007.

Patrick M, Tong X, Vugia D, Cronquist A, Hurd S, Tobin-D'Angelo M, Larson K, Zansky S, **Jones TF**, Scallan E. Age and gender on trends in incidence of sporadic *Campylobacter* infection, FoodNet, 1996-2006. IDSA Annual Conference, San Diego, CA, October 2007.

Scallan E, Norton D, Cronquist A, Marcus R, Segler S, Ryan PA, Fuller C, Zansky S,Shiferaw B, **Jones TF**, et.al. Burden of Acute Gastrointestinal Illness among Immunocompromised Persons. IDSA Annual Conference, San Diego, CA, October 2007.

Teates K, **Jones TF**, Vugia D, Hurd S, Anderson BJ, Cronquist A, Farley MM, Plantenga M, Henao OL. High incidence of laboratory-confirmed *Listeria* infections in persons ≥ 65 years of age, Foodborne Diseases Active Surveillance Network (FoodNet), 1996-2005. International Symposium on Problems of Listeriosis XVI, Atlanta, GA, March 20-23, 2007.

Presentations

Carpenter LR. CDC Get Smart, Partnership Meeting, Atlanta, GA-- Tennessee update, oral presentation. May 2007.

Carpenter LR. Society for Healthcare Epidemiology of America, 17th Annual Scientific Meeting, Baltimore, MD, Community-Associated Methicillin-Resistant *Staphylococcus aureus* Among Personnel at a Pediatric Clinic, Tennessee, 2006, Oral presentation. April 2007.

Carpenter LR. EIS Conference, 56th Annual Meeting, Atlanta, GA, Community-Associated Methicillin-Resistant *Staphylococcus aureus* Among Personnel at a Pediatric Clinic, Tennessee, 2006, Oral presentation. April 2007.

Chang DC, Grant GB, O'Donnell K, Wannemuehler KA, Noble-Wang J, Rao CY, Jacobson LM, Crow CS, Sneed RS, Lewis FM, Schaffzin JK, **Kainer MA**, Genese CA, Alfonso EC, Jones DB, Srinivasan A, Fridkin SK, Park BJ for the Fusarium Keratitis In-

vestigation Team. Multistate Outbreak of Fusarium Keratitis Associated With Use of a Contact Lens Solution — United States, 2005-2006 Epidemic Intelligence Service Conference, Atlanta, GA April 16-20, 2007 (oral, Mackel finalist)

Dunn JR. Interagency Approach to Avian Influenza Surveillance and Response in Tennessee. NACCHO Public Health Preparedness Summit, Washington DC. February 23, 2007.

Hanna S, Jones TF, Dunn J. Evaluation of Tennessee Dept Response to Legislation Calling for Looser Regulations of Unpasteurized Milk Sales. Southeast Public Health Leadership Institute, School of Public Health, University of North Carolina, December 10-11, 2007.

Jones TF. The Environmental Health Specialist Network (EHS-Net): An Epidemiologists' Perspective. 2006 National Environmental Public Health Conference, Atlanta, November 4, 2006.

Jones TF. Epidemiology of Cholera, *Shigella*, and Typhoid. Global SalmSurv Training, Bangkok, Thailand, January 15, 2007.

Jones TF. Questionnaire Design and Analysis in Outbreaks. Global SalmSurv Training, Bangkok, Thailand, January 16, 2007.

Jones TF. An Asian Foodborne Disease Epidemiology Communication Network. Global SalmSurv Training, Bangkok, Thailand, January 18, 2007.

Jones TF. Foodborne Disease Attribution Studies- State and Local Perspective. USDA/FSIS Meeting on Attributing Illness to Food, Arlington, VA, April 5, 2007.

Jones TF. Foodborne Disease: Lessons from Recent US Experience. 3rd Annual Canadian Summit on Food Safety, Toronto, April 25, 2007.

Jones TF. Fractured Fairytales: Peter Pan, the Taco Bell Dog, and Popeye; Lessons from US Foodborne Disease Outbreaks. Plenary speaker, American Association of Bioanalysts Annual Conference, Orlando, May 18, 2007.

Jones TF. CIFOR Activities to Improve Foodborne Outbreak Response. Council of State and Territorial Epidemiologists Annual Conference, Atlantic City, NJ, June 24, 07.

Kainer MA. Recalled human tissue for transplantation: what are the risks of infection to recipients? Council of State and Territorial Epidemiologist (CSTE) annual meeting, Atlantic City, NJ, June 24-28, 2007.

Kainer MA, **Holt E**, Fine A. Datamanagement in Outbreaks (roundtable discussion). Council of State and Territorial Epidemiologist (CSTE) annual meeting, Atlantic City, NJ, June 24-28, 2007.

Kainer MA, Klevens M. Implementation of Mandatory Reporting of Hospital Acquired Infections in Tennessee and use of the NHSN for data collection and reporting Council of State and Territorial Epidemiologist (CSTE) annual meeting, Atlantic City, NJ, June 24-28, 2007. (oral presentation)

Kainer MA, Hillis S, Smith RJ Reduction in Methicillin-resistant *Staphylococcus aureus* (MRSA) Infections Through Active Surveillance & Empiric Contact Precautions (ECP) Targeting Admissions From Long Term Care Facilities (LTCF). 17th Annual Scientific Meeting of SHEA (Society for Healthcare Epidemiology of America), Baltimore, MD, April 14-17 2007 (oral presentation)

Kainer MA, **Holt E**. Use of the Centers for Disease Control and Prevention (CDC)'s Outbreak Management System (OMS) for Investigation and Management of Outbreaks and Pre-Pandemic Response, Public Health Information Network (PHIN) Conference, Atlanta, GA August 27-29 2007. (oral presentation)

Kainer MA. Outbreak and Case Management: A State Perspective, American Health Information Community Population Health and Clinical Care Connections Workgroup, Washington DC, March 29, 2007 (oral presentation by phone)

Moncayo AC. Mosquito diversity and seasonality at an EEE swamp focus in Tennessee. Amercian Mosquito Control Association, Orlando, FL, April 2007.

Moncayo AC. Vectorborne Diseases in the Southeastern United States, Southeast Center for Emerging Bio-

logic Threats Conference, Duke University, Durham, NC, May 2007.

Moncayo AC. Interactions between Environmental Conditions and Vector-Borne Disease in the Cumberlands. Conference of the Scientific Foundations of Conservation Planning in the Cumberland Plateau and Mountains, Knoxville, TN, November, 2007.

Moncayo AC. Interactions between Environmental Conditions and Vector-Borne Disease in the Cumberlands. Conference of the Scientific Foundations of Conservation Planning in the Cumberland Plateau and Mountains, Knoxville, TN, November, 2007.

Moncayo AC. Occurrence and Distribution of Arboviruses in Tennessee, Southeast Center for Emerging Biologic Threats Conference, Emory Conference Center, Atlanta, GA May 2007.

Moncayo AC. Interactions between Environmental Conditions and Vector-Borne Disease in the Cumberlands. Conference of the Scientific Foundations of Conservation Planning in the Cumberland Plateau and Mountains, Knoxville, TN, November, 2007.

Mukherjee S, **Huddleston DB**, , Wilson R,. Case for a non-traditional EEE virus focus in Tennessee. Southeast Regional Entomological Society of America, Knoxville, TN, March 2007.

Mukherjee, S, **Huddleston B**, Moody E., Kenneth L, **Dunn J**, Wilson R, **Jones TF**, **Moncayo AC**. Characterizing species diversity of vectors implicated in non-traditional EEE transmission in Tennessee. American Society of Tropical Medicine and Hygiene, 56th Annual Meeting, Philadelphia, PA, November 2007.

Mukherjee S, **Huddleston B**, Mendenhall L., Byrd J, McMillen L, **Moncayo AC**. Characterizing hybridization of *Culex* complex mosquitoes implicated in West Nile transmission in Tennessee. Entomological Society of America 25th Annual Meeting, San Diego, CA, December 2007.

Petersen P. Emergency Preparedness Volunteerism and Readiness Planning Meeting, Centers for Disease Control and Prevention (CDC) Region IV, Tallahassee, FL, February, 2007.

Shavor TJ. HIV/STD Surveillance in Tennessee: A Fully Integrated Model, presented at the National HIV/AIDS Surveillance Conference, Atlanta, GA, December 6, 2007.

ATSDR Documents

Bashor BS. Exposure Investigation Protocol - Cypress Creek Sub-Area III, Memphis, Shelby County, Tennessee. Agency for Toxic Substances and Disease Registry, Atlanta, GA, January 2007.

Bashor BS. Pesticide Contamination in a Home, Tennessee Department of Agriculture, Loudon, Loudon County, Tennessee. Agency for Toxic Substances and Disease Registry, Atlanta, GA, April 19, 2007.

Bashor BS. Springdale Creek Apartments, North End, 2510 Jackson Avenue, Memphis, Shelby County, Tennessee, EPA Facility ID: TND007024664. Agency for Toxic Substances and Disease Registry, Atlanta, GA, September 5, 2007.

Bashor BS. Tedford Road Landfill, Knoxville, Knox County, Tennessee. Agency for Toxic Substances and Disease Registry, Atlanta, GA, in *process*.

Bashor BS. Final Report - Exposure Investigation, Cypress Creek Sub-Area III, Memphis, Shelby County, Tennessee. Agency for Toxic Substances and Disease Registry, Atlanta, GA, in *process*.

Borowski DM. H.O. Forgy, Jackson, Madison County, Tennessee, EPA Facility ID: TN0001923945. Agency for Toxic Substances and Disease Registry, Atlanta, GA, August 1, 2007.

Borowski DM. Hardeman County Landfill Update (a/k/a Velsicol Chemical Corporation), Toone, Hardeman County, Tennessee, EPA Facility ID: TND980559033. Agency for Toxic Substances and Disease Registry, Atlanta, GA, September 28, 2007.

Borowski DM. Former Fashion Cleaners, Shelbyville, Bedford County, Tennessee. Agency for Toxic Sub-

stances and Disease Registry, Atlanta, GA, in *process*.

Borowski DM. Bunny / Progressive Cleaners, Memphis, Shelby County, Tennessee. Agency for Toxic Substances and Disease Registry, Atlanta, GA, in *process*.

Borowski DM. Downtown School Update #3, Memphis, Shelby County, Tennessee. Agency for Toxic Substances and Disease Registry, Atlanta, GA, in *process*.

Borowski DM, Weiss M. Lebanon Road Landfill, Nashville, Davidson County, Tennessee, EPA Facility ID: TND980848204. Agency for Toxic Substances and Disease Registry, Atlanta, GA, in *process*.

Clendening R. Hardeman County Landfill (a/k/a Velsicol Chemical Corporation), Toone, Hardeman County, Tennessee, EPA Facility ID: TND980559033. Agency for Toxic Substances and Disease Registry, Atlanta, GA, April 16, 2007.

Clendening R, **Borowski DM**. Mr. Zip Convenience Store, Knoxville, Knox County, Tennessee. Agency for Toxic Substances and Disease Registry, Atlanta, GA, March 14, 2007.

George J. Cookeville Dry Cleaner, Cookeville, Putman County, Tennessee. Agency for Toxic Substances and Disease Registry, Atlanta, GA, *in process*.

George J. Green Hills Cleaners, Nashville, Davidson County, Tennessee. Agency for Toxic Substances and Disease Registry, Atlanta, GA, *in process*.

Kranz MK. May Oil Company, Pulaski, Giles County, Tennessee, TDEC - DUST Site 6-280074. Agency for Toxic Substances and Disease Registry, Atlanta, GA, in *process*.

Kranz MK. Former Charles A. Bell School Site, Chattanooga, Hamilton County, Tennessee. Agency for Toxic Substances and Disease Registry, Atlanta, GA, *in process*.

Miller SM, **Omohundro E**, **Bashor BS**, **Borowski DM**. Recommendations for Off-Site Sampling, Lenoir Car Works, Lenoir City, Loudon County, Tennessee, EPA Facility ID: TDD003384666. Agency for Toxic Substances and Disease Registry, Atlanta, GA, November 9, 2007.

Department of Health. Authorization No. 343341, No. of Copies 650. This public document was promulgated at a cost of $4.53 per copy. 04/09