Tennessee Department of Health

Communicable & Environmental Disease Services

2008 Annual Report

Communicable and Environmental Disease Services Section
Tennessee Department of Health
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Tennessee Department of Health
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Available electronically at the Tennessee Department of Health website. Click on Program Areas, and then click on Communicable and Environmental Disease Services.

http://health.state.tn.us

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

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Section I.

Introduction

Regional and Central Office staff enjoy some quality time together at the Wildhorse Saloon after one of the Regional Epidemiology Meetings in Nashville.

Source: Tennessee Department of Health.

A. Purpose of Report

Communicable and Environmental Disease Services (CEDS) is one of the thirteen divisions of the Bureau of Health Services within the Tennessee Department of Health. The twelve other divisions in the bureau include the following: 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 1999 through 2008 and builds upon the 1999, 2000, 2001, 2002, 2003, 2004-2005, 2006 and 2007 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
Tuberculosis – 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
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.

For UPS and Federal Express Items

Tennessee Department of Health

Laboratory Services

630 Hart Lane

Nashville Tennessee 37216-2006

Phone 615-262-6300

For U.S. Mail

Tennessee Department of Health

Laboratory Services

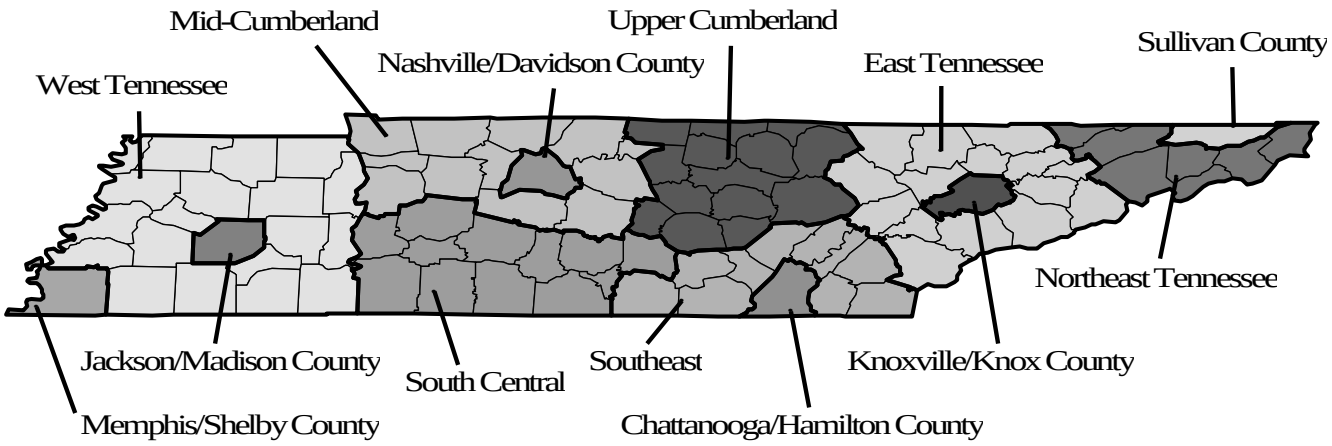
PO Box 305130

Nashville Tennessee 37230-5130

G. Tennessee Department of Health Regions

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

Tennessee's Department of Health Regions



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

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

State Contact's Name	Title	E-mail
Tim F. Jones, MD	State Epidemiologist	tim.f.jones@tn.gov
David Kirschke, MD	Deputy State Epidemiologist	david.kirschke@tn.gov
David Smalley, PhD, MSS, BCLD	Laboratory Services Director	david.smalley@tn.gov

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@tn.gov	Cathy Goff, MSN, RN	catherine.goff@tn.gov
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	anthony.otuka@shelbycountytn.gov
MCR	Lori MacDonald, MD	lorraine.macdonald@tn.gov	Vicki Schwark, RN	vicki.schwark@tn.gov
NDR	Bill Paul, MD	bill.paul@nashville.gov	Nancy Horner, RN	nancy.horner@nashville.gov
NER	Lawrence Moffett, MD	lawrence.moffatt@tn.gov	Jamie Swift, RN	jamie.swift@tn.gov
SCR	Langdon Smith, MD	lang.smith@tn.gov	Donna Gibbs, PHR	donna.j.gibbs@tn.gov
SER	Jan Beville, MD	jan.beville@tn.gov	Gayle Cross, RN	gayle.cross@tn.gov
SUL	Stephen May, MD	asmay@sullivanhealth.org	Jennifer Williams, RN	jwilliams@sullivanhealth.org
UCR	Fred Vossel, MD	fred.vossel@tn.gov	Debbie Hoy, RN	debbie.hoy@tn.gov
WTR	Shavetta Conner, MD	shavetta.conner@tn.gov	Susan Porter, RN	susan.porter@tn.gov

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.

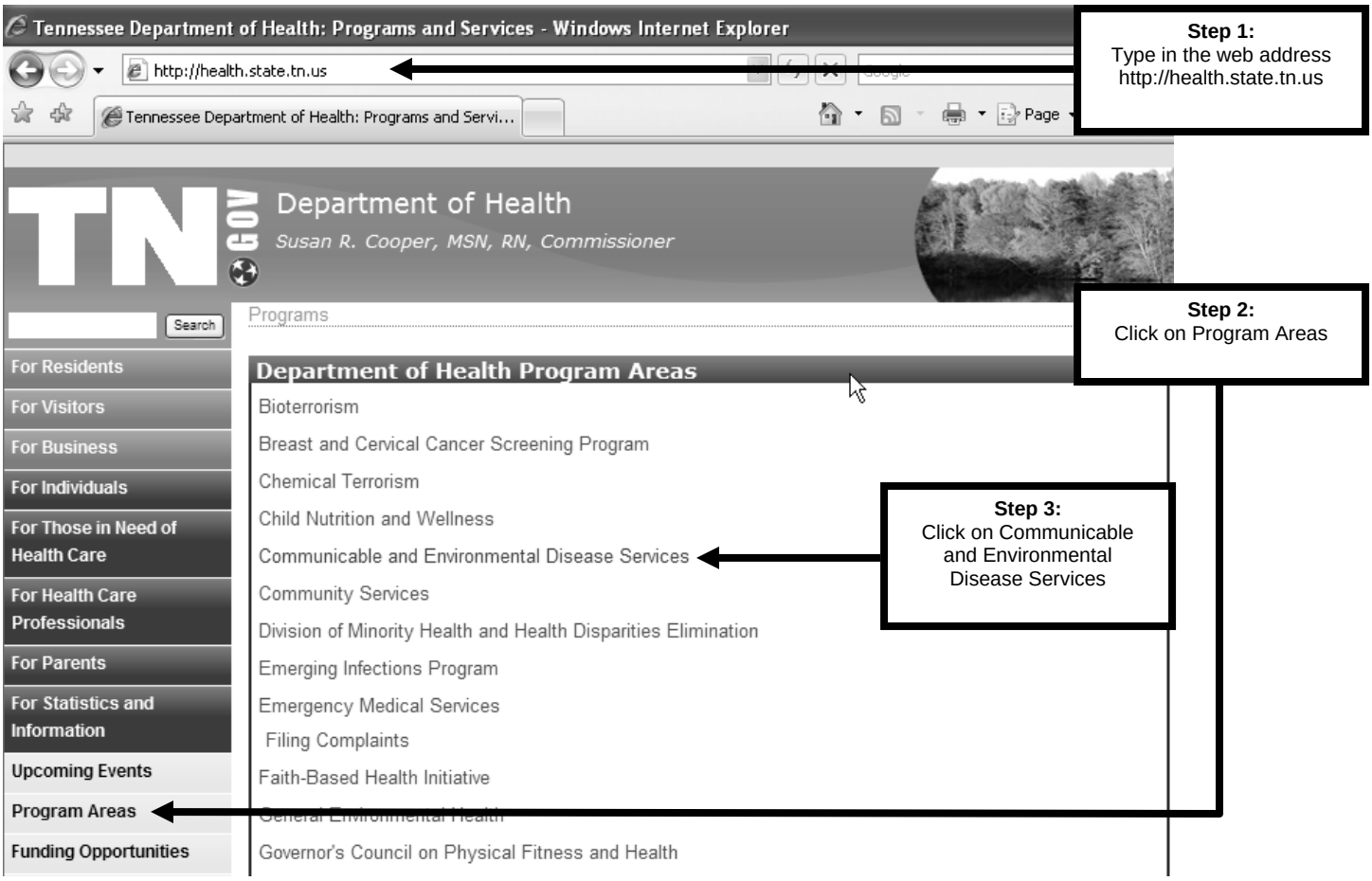
Currently, the EIP Network consists of ten sites: California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon and Tennessee.

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, 2008

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	2,984,563	<1	80,196	45-49	455,291
Female	3,123,632	1-4	321,823	50-54	434,321
RACE /SEX	**POPULATION**	5-9	406,855	55-59	384,206
White Male	2,436,930	10-14	414,433	60-64	319,039
White Female	2,514,838	15-19	422,633	65-69	244,562
Black Male	490,054	20-24	411,624	70-74	187,282
Black Female	549,285	25-29	405,948	75-79	144,909
Other Male	57,579	30-34	410,685	80-84	106,190
Other Female	59,509	35-39	420,911	85+	100,590
TOTAL	**6,108,195**	40-44	436,697		

L. Tennessee's Department of Health Regions: Counties and Population, 2008

East (Population 716,411)

County	Population	County	Population
Anderson	72, 246	Loudon	42,942
Blount	115,824	Monroe	43,256
Campbell	41,376	Morgan	20,890
Claiborne	31,563	Roane	54,014
Cocke	35,845	Scott	23,005
Grainger	22,467	Sevier	81,203
Hamblen	61,587	Union	20,338
Jefferson	49,855		

Mid-Cumberland (Population 968,577)

County	Population	County	Population
Cheatham	40,623	Rutherford	216,581
Dickson	47,346	Stewart	13,838
Houston	8,282	Sumner	146,742
Humphreys	18,771	Trousdale	7,866
Montgomery	150,265	Williamson	154,299
Robertson	62,501	Wilson	101,823

Northeast (Population 338,982)

County	Population	County	Population
Carter	57,859	Johnson	18,571
Greene	65,898	Unicoi	17,998
Hancock	6,885	Washington	114,617
Hawkins	57,154		

South Central (Population 376,051)

County	Population	County	Population
Bedford	43,126	Lincoln	33,185
Coffee	51,880	Marshall	29,395
Giles	30,521	Maury	76,673
Hickman	25,304	Moore	6,118
Lawrence	42,163	Perry	7,792
Lewis	12,183	Wayne	17,711

Southeast (Population 317,855)

County	Population	County	Population
Bledsoe	13,121	McMinn	52,520
Bradley	95,373	Meigs	12,075
Franklin	41,565	Polk	16,641
Grundy	14,968	Rhea	30,285
Marion	28,613	Sequatchie	12,694

Upper Cumberland (Population 329,561)

County	Population	County	Population
Cannon	13,814	Overton	20,990
Clay	8,179	Pickett	5,234
Cumberland	51,910	Putnam	68,250
DeKalb	18,841	Smith	19,477
Fentress	17,637	Van Buren	5,708
Jackson	11,708	Warren	41,030
Macon	22,306	White	24,477

West (Population 539,059)

County	Population	County	Population
Benton	16,983	Haywood	19,995
Carroll	30,422	Henderson	27,162
Chester	16,860	Henry	32,142
Crockett	15,448	Lake	7,938
Decatur	11,890	Lauderdale	29,286
Dyer	38,649	McNairy	25,459
Fayette	32,723	Obion	33,206
Gibson	48,934	Tipton	58,528
Hardeman	30,556	Weakley	35,932
Hardin	26,946		

Metropolitan Regions (Population 2,506,674)

County	Population	County	Population
Davidson	603,516	Madison	97,799
Hamilton	314,914	Shelby	946,098
Knox	404,692	Sullivan	154,680

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, 2007, MMWR 2009; 56, No.53. The 2008 Summary of Notifiable Diseases has not been released.

Section II.

Tennessee Reported Cases, 1999-2008

Friends, family and colleagues gather together to say their goodbyes to Dr. Allen S. Craig as he begins a new chapter in his career, a part of the U.S. President's Malaria Initiative.

Source: Tennessee Department of Health.

Reported Cases, by Year of Diagnosis, Tennessee, 1999-2008

DISEASE	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
AIDS	650	674	606	663	600	694	809	284	582	*
Botulism, Foodborne	2	0	0	0	0	0	0	0	1	0
Botulism, Infant	2	1	4	3	1	1	0	1	1	1
Brucellosis	0	0	1	0	0	1	0	1	2	1
California/LaCrosse Encephalitis	6	19	17	15	14	13	2	7	14	6
Campylobacteriosis	251	272	364	298	448	438	403	443	448	481
Chlamydia	14,216	15,073	15,556	16,042	21,034	22,513	23,041	25,303	26,969	28,001
Cryptosporidiosis	12	12	25	60	41	55	44	47	137	47
E. coli 0157:H7	53	59	50	51	35	48	45	88	54	54
Ehrlichiosis	19	46	20	26	31	20	24	35	39	91
Giardiasis	159	184	190	188	187	251	225	246	297	215
Gonorrhea	11,366	11,877	10,144	9,348	8,717	8,475	8,619	9,687	9,584	8,767
Group A *Streptococcus*	50	83	87	89	167	144	152	160	149	154
Group B *Streptococcus*	*	87	157	164	264	245	368	379	302	319
Haemophilus influenzae	36	26	48	37	58	53	93	72	92	101
Hepatitis B Surface Antigen Positive, Pregnant	3	36	104	103	109	115	104	121	133	140
Hepatitis A	190	154	187	122	202	96	149	69	59	35
Hepatitis B, Acute	228	213	272	128	212	221	153	173	149	155
Hepatitis C, Acute	96	97	64	26	23	35	28	28	38	33
Hemolytic Uremic Syndrome	8	12	10	7	14	16	10	24	21	19
HIV	803	1,127	805	833	549	586	665	697	792	*
HIV Disease	*	*	*	*	*	*	*	*	*	1,071
Legionellosis	23	14	30	20	37	44	40	50	40	45
Listeriosis	7	13	9	12	9	16	12	14	16	14
Lyme Disease	39	28	30	27	19	25	18	30	42	29
Malaria	7	13	14	4	7	13	14	9	19	17
Measles (indigenous)	0	0	0	0	0	0	1	0	1	0
Meningicoccal Disease	61	56	63	38	30	23	27	25	21	21
Meningitis, Other Bacterial	44	52	54	39	28	28	16	4	3	5
Methicillin-Resistant *Staphylococcus aureus*	*	*	*	*	*	946	1,972	2,005	1,973	1,990
Mumps	0	2	1	2	5	4	3	11	4	4
Penicillin-Resistant *Streptococcus pneumoniae*	291	266	226	125	133	153	163	154	199	234
Penicillin-Sensitive *Streptococcus pneumoniae*	*	353	500	471	493	534	807	837	722	874
Pertussis	40	41	72	119	82	179	213	179	75	120
Rocky Mountain Spotted Fever	55	57	87	81	74	99	139	260	186	233
Rubella	0	1	0	1	0	0	0	0	0	0
Salmonellosis, Non-Typhoidal	548	693	724	853	736	776	820	841	849	905
Shigellosis	622	344	124	175	396	570	507	198	363	968
Syphilis, Congenital	11	18	24	11	2	9	19	8	4	10
Syphilis, Early Latent	649	627	553	390	227	206	205	233	294	310
Syphilis, Late Latent	426	511	570	424	461	400	359	434	442	475
Syphilis, Neurological	12	14	10	17	6	7	8	0	0	0
Syphilis, Primary	223	162	89	40	43	24	62	80	109	123
Syphilis, Secondary	418	370	242	128	93	106	155	169	259	288
Tetanus	0	0	1	1	0	2	0	1	1	0
Toxic Shock *Staphylococcus*	3	3	1	2	1	2	1	4	0	6
Toxic Shock *Streptococcus*	5	1	0	0	1	0	0	0	0	0
Trichinosis	0	0	0	1	2	0	1	0	0	0
Tuberculosis	382	383	313	308	285	277	299	277	234	282
Tularemia	0	1	6	4	3	2	7	0	2	2
Typhoid Fever	1	2	1	1	3	4	3	1	1	4
Vancomycin Resistant *Enterococci*	447	524	711	649	802	406	278	388	287	310
Yersiniosis	*	7	14	19	24	26	18	29	13	21

Number of Reported Cases of Selected Notifiable Diseases with Rates per 100,000 Persons, by Age Group, Tennessee, 2008

DISEASE		<1Y	1-4	5-14	15-24	25-44	45-64	≥65
	Total population	80,196	321,823	821,288	834,257	1,674,241	1,592,857	783,533
Campylobacteriosis	Number	37	70	46	54	110	110	52
	Rate	46.1	21.8	5.6	6.5	6.6	6.9	6.6
Chlamydia	Number	18	*	375	20,543	6,669	347	14
	Rate	22.4	~	45.7	2462.4	398.3	21.8	1.8
Gonorrhea	Number	*	*	98	5,554	2,747	338	13
	Rate	~	~	11.9	665.7	164.1	21.2	1.7
Group A Streptococcus	Number	4	13	10	8	23	48	48
	Rate	5.0	4.0	1.2	1.0	1.4	3.0	6.1
Hepatitis A	Number	0	0	7	5	10	8	5
	Rate	0.0	0.0	0.9	0.6	0.6	0.5	0.6
HIV Disease	Number	0	*	5	221	591	246	11
	Rate	0.0	~	0.6	26.5	35.3	15.4	1.4
Meningococcal Disease	Number	4	3	1	6	3	2	2
	Rate	5.0	0.9	0.1	0.7	0.2	0.1	0.3
Pertussis	Number	38	9	39	10	13	6	3
	Rate	47.4	2.8	4.7	1.2	0.8	0.4	0.4
Rocky Mountain Spotted Fever	Number	1	12	19	31	66	73	33
	Rate	1.2	3.7	2.3	3.7	3.9	4.6	4.2
Salmonellosis, Non-Typhoid	Number	116	142	126	58	167	189	127
	Rate	144.6	44.1	15.3	7.0	10.0	11.9	16.2
Shigellosis	Number	26	310	422	41	104	51	12
	Rate	32.4	96.3	51.4	4.9	6.2	3.2	1.5
Syphilis, Early Latent	Number	0	0	0	93	162	54	2
	Rate	0.0	0.0	0.0	11.1	9.7	3.4	0.3
Syphilis, Late Latent	Number	0	0	0	65	235	149	30
	Rate	0.0	0.0	0.0	77.9	140.4	93.5	38.3
Syphilis, Neurological	Number	0	0	0	0	0	0	0
	Rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syphilis, Primary	Number	0	0	0	24	64	29	6
	Rate	0.0	0.0	0.0	2.9	3.8	1.8	0.8
Syphilis, Secondary	Number	0	0	0	84	161	44	0
	Rate	0.0	0.0	0.0	10.1	9.6	2.8	0.0

SECTION III.

Disease Summaries

A. Foodborne Disease

Nupur Sashti, a FoodNet epidemiologist, teaches her children proper water safety while filling up water balloons at a going away function for Sapana Parikh, a CDC Public Health Prevention Service Fellow in the Immunization Program.

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 [statewide in 2003], Colorado in 2001, and New Mexico in 2004). The total population of the current catchment is 46.0 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 burden of foodborne illness in the United States
- To monitor trends in the burden of specific foodborne diseases over time
- To attribute the burden of foodborne illness to specific foods and settings
- To disseminate information that can lead to improvements in public health practice and the development of 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 out-

breaks 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, not only in the United States, but in Tennessee as well. The causative agent is primarily *Campylobacter jejuni*, followed by *Campylobacter coli* and other less common species. Most persons infected with the bacterium develop diarrhea, cramping, abdominal pain and fever within two to five days after exposure. Illness typically lasts one week.

Rates of disease from 1999-2002 averaged about 5.0 cases per 100,000 persons. Since 2003, however, rates of campylobacteriosis have been fairly steady at approximately 7.4 cases per 100,000 persons (**Figure 1**).

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

Figure 2 illustrates that those at greatest risk of developing infection are those under the age of five years. In 2008, the rate of disease in this population was 26.4 cases per 100,000 persons. The risk for those under the age of one is even greater (48.6 cases per 100,000 persons).

Figure 1. Incidence of Campylobacteriosis, by Year, Tennessee, 1999-2008.

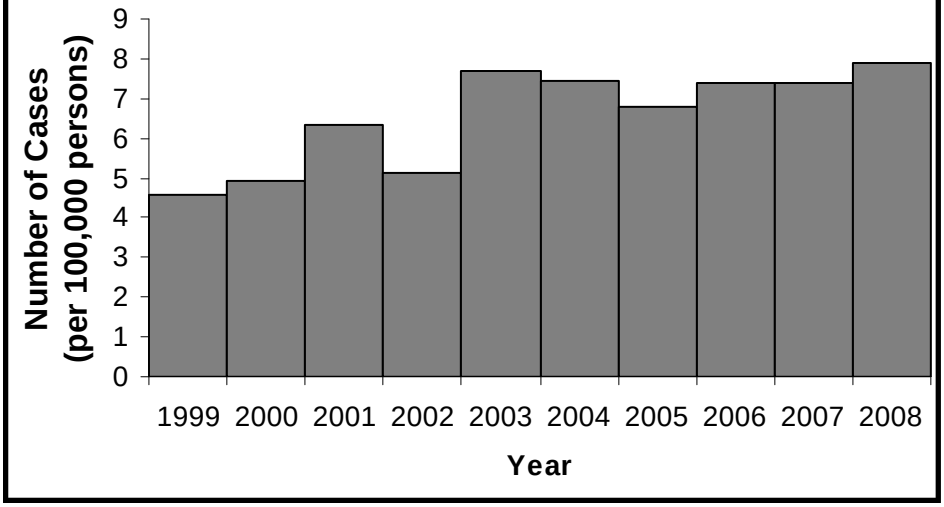
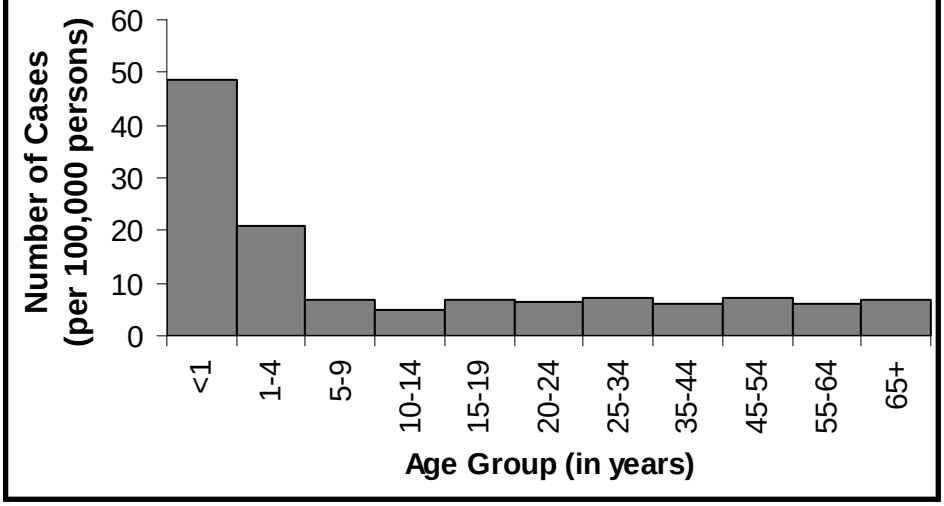


Figure 2. Incidence of Campylobacteriosis, by Age Group, Tennessee, 2008.

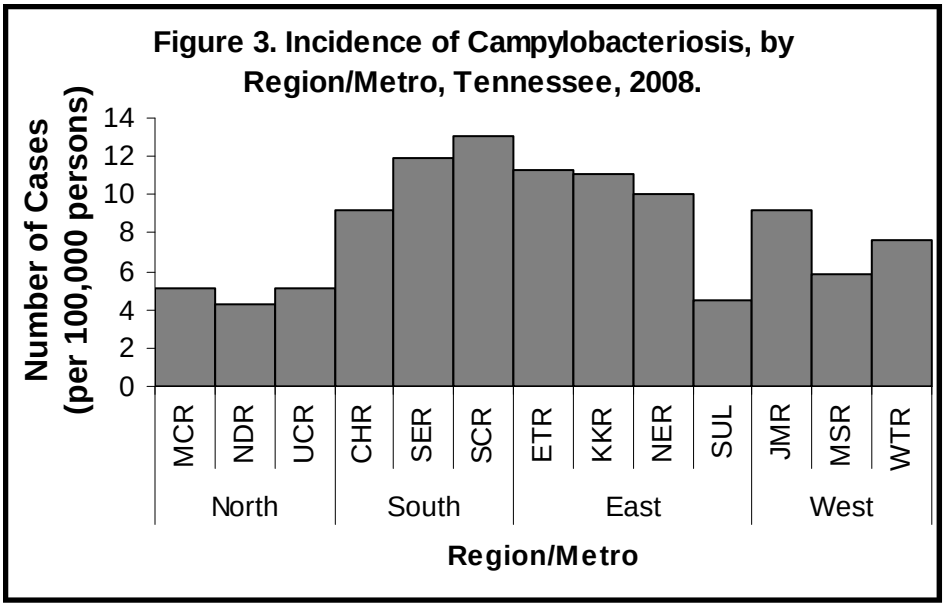


In 2008, the rate of disease varied region to region across the state (**Figure 3**), with the highest rates (per 100,000 persons) in South Central Region (13.0 cases), Southeast Region (12.0 cases), East Tennessee Region (11.3

cases) and Knoxville/Knox County metropolitan area (11.1 cases). Whereas, the lowest rates of the state were found in Nashville/Davidson County metropolitan area with 4.3 cases per 100,000 persons.

This regional variation is not just a Tennessee phenomenon, but a national one as well. In FoodNet sites alone, there is remarkable variation in rates of campylobacteriosis. According to 2008 preliminary FoodNet data, Maryland reported the lowest rate of disease, with 6.7 cases per 100,000 persons, while California reported a rate more than quadruple that (30.2 cases per 100,000 persons).

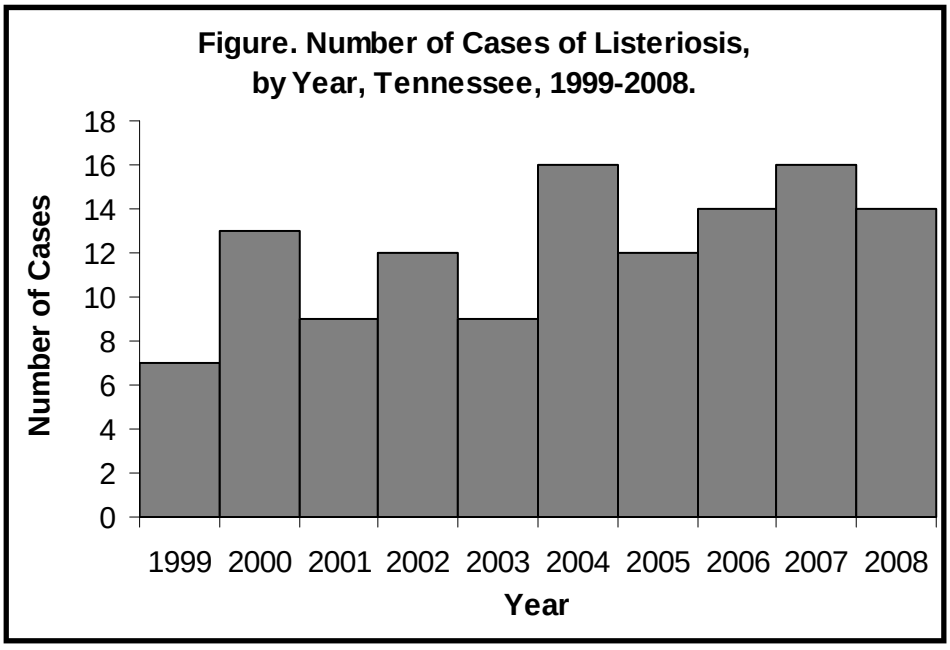
To better understand this variation, FoodNet has undertaken several studies – an analysis of hospitalization rates, a survey of laboratories, a survey of the general population, and a survey of physicians. None have fully explained the differences. Examination of the differences in food consumption preferences within those participating sites in FoodNet has been proposed. One hypothesis is that the consumption of previously frozen chicken (which may decrease the burden of *Campylobacter* contamination) may vary by region. In 2008, a study was launched to further evaluate these regional differences by comparing human *Campylobacter* incidence with the prevalence on chickens at processing plants and prevalence on chickens purchased at grocery stores. Ongoing efforts are needed to control campylobacteriosis.



Listeriosis

Listeria monocytogenes causes a rare but serious foodborne infection. Although listerisosis results in a small proportion of foodborne illness (about 2,500 of the estimated 76 million foodborne illnesses per year in the United States), it accounts for 500 deaths and 2,300 hospitalizations. Consequently, listeriosis has the highest rate of hospitalization of any foodborne illness. *Listeria* can cause meningitis, other severe neurological sequelae, spontaneous abortion, and infection in the newborn infant.

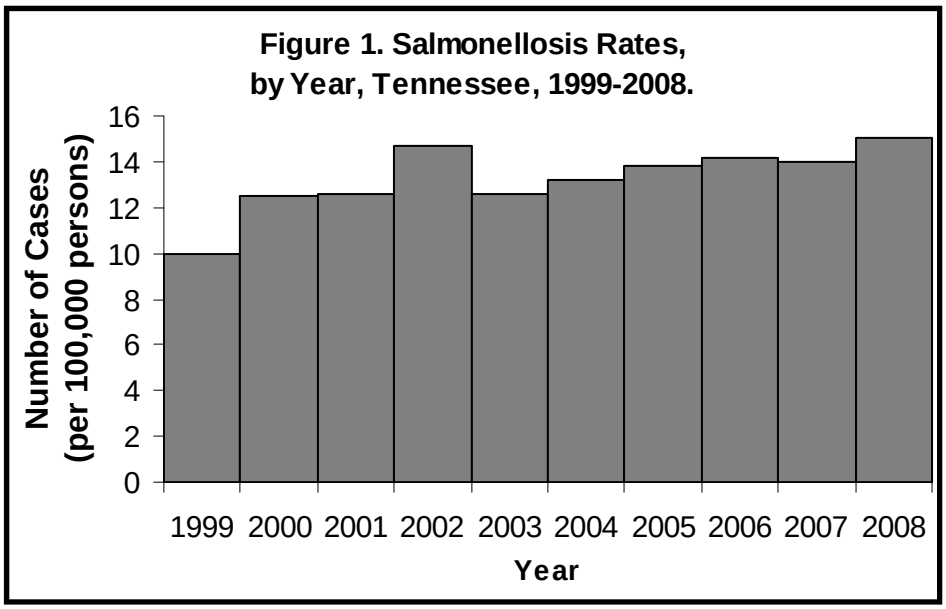
Listeriosis is primarily transmitted by contaminated food. Foods implicated as risk factors for infection with *Listeria monocytogenes* include non-pasteurized dairy products (e.g., queso fresco), frankfurters, and ready-to-eat deli meats. These food items are considered high-risk particularly for immunosuppressed persons or pregnant women.

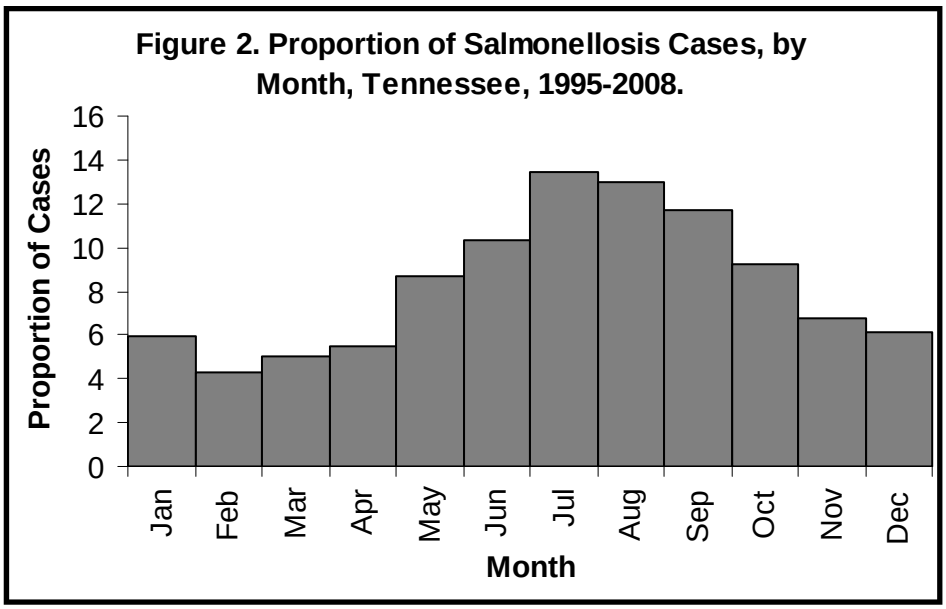


In Tennessee, listeriosis became a reportable disease in 1996. That year six cases were reported; the next year the number of cases jumped to 14. The number of cases reported in Tennessee has remained fairly constant since 1997 (**Figure**). Among FoodNet sites in 2008, the overall rate was 0.29 cases per 100,000 persons. Tennessee reported 14 cases in 2008 and the rate was 0.23 cases per 100,000 persons.

Salmonellosis

In Tennessee, salmonellosis is predominately caused by non-typhoidal *Salmonella*, a gram negative enteric bacterium. Symptoms include nausea, diarrhea, abdominal cramps, and sometimes vomiting. Although the illness is generally regarded as relatively mild, death can occur in some cases, especially among the very young, very old, or immunocompromised. Symptoms of salmonellosis usually appear 6 to 72 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 has been estimated to be thirty or more times greater.

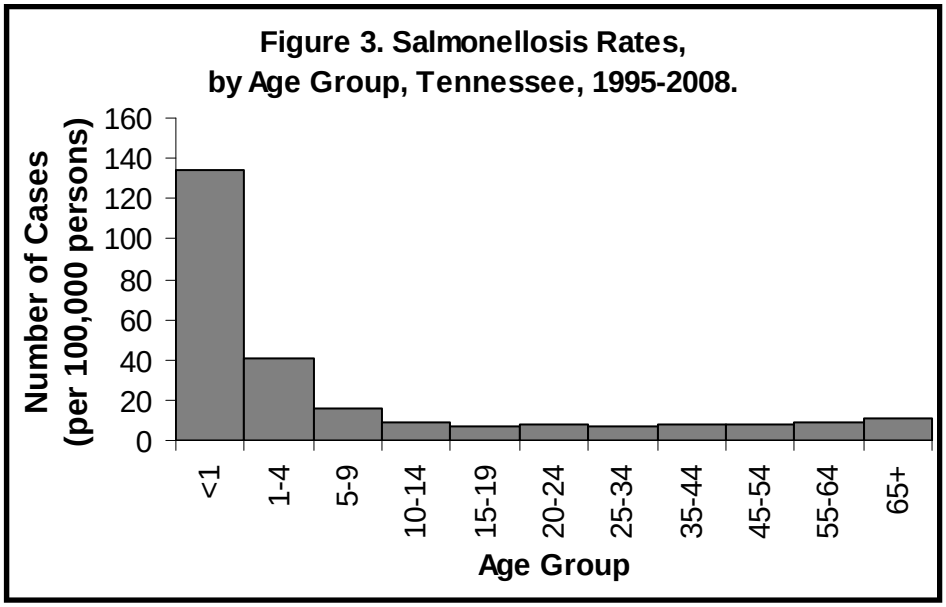




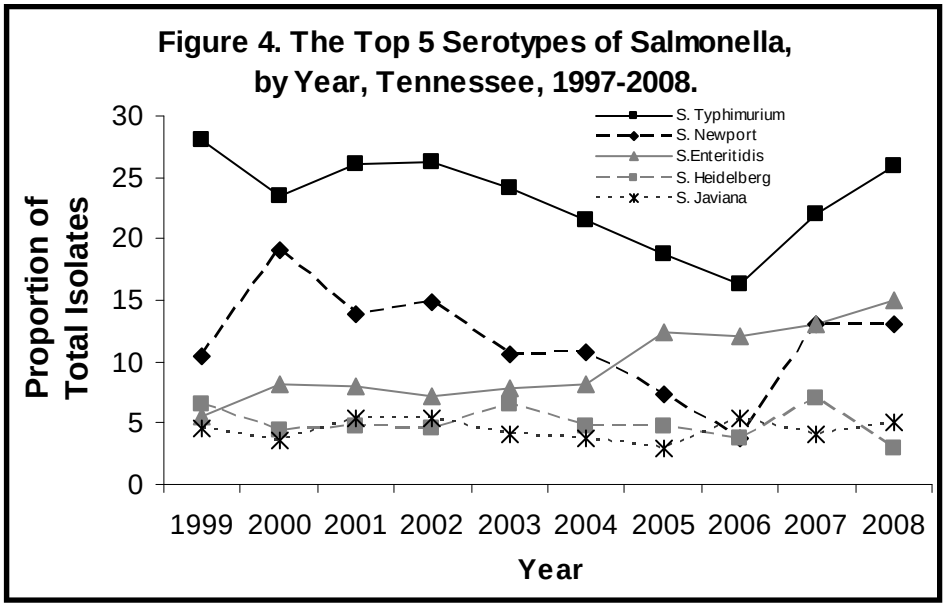
The incidence of salmonellosis in Tennessee has increased from 1999-2008 (**Figure 1**). A total of 923 cases were reported to the health department in 2008. The overall rate in 2008 was 15 cases per 100,000 persons, which was lower than the national rate (16 cases per 100,000 persons in 2007) but higher than the National Health People 2010 Objective for incidence of salmonellosis (6.8 per 100,000 persons).

Rates of infection varied by region in 2008. Jackson/Madison County and West Tennessee Region reported the highest rates of *Salmonella* infections with 24 and 29 cases per 100,000 persons, respectively. Eleven cases per 100,000 persons were reported in Hamilton County, Northeast Region, and Southeast Region. Sullivan County reported the lowest rate of 5 cases per 100,000 persons. Jackson/Madison County reported an outbreak of *Salmonella* Anatum associated with a local barbeque restaurant. Three large multistate outbreaks of *Salmonella* were reported by CDC in 2008 that included cases in Tennessee. These outbreaks were caused by S. Saintpaul associated with contaminated jalapeno and serrano peppers, S. Poona with an unknown vehicle, and S. Typhimurium associated with contaminated peanut butter and peanut butter-containing products.

Historically, salmonellosis follows a seasonal trend with two-thirds of cases occurring during the summer and fall (**Figure 2**). In 2008, September was the month with the greatest number of *Salmonella* infections, 146 (16%) of 923. As in previous years, Salmonella was isolated most frequently from children under 5 years of age in 2008. In 2008, the incidence rates of salmonellosis were 134 cases per 100,000 infants under the age of one and 41 cases per 100,000 children 1-4 years of age (**Figure 3**).



The five most common serotypes of *Salmonella* were *S.* Typhimurium (including S. I 4,[5],12:i:-, a monophasic variant of *S.* Typhimurium), *S.* Enteritidis, *S.* Newport, *S.* Heidelberg, and *S.* Javiana. These five serotypes accounted for 62% of all *Salmonella* isolates sent to the Tennessee Department of Health (TDH) laboratory in 2008 (**Figure 4**). Four cases of *S.* Typhi were reported in 2008 attributed to recent immigration or travel to endemic countries.



In 2008, TDH, the Tennessee Department of Agriculture, and the University of Tennessee's College of Veterinary Medicine began a pilot project to further analyze or sub-type non-typhoidal *Salmonella* isolates from animals in the state and to compare them to human isolates already being subtyped. The project should help determine the commonality of serotypes and genotypes for *Salmonella* spp. and whether antibiotic resistance patterns are similar for selected *Salmonella* serotypes. Over fifty animal-origin isolates were submitted and analyzed. Most isolates were from cattle and horses. Isolates from cats, dogs, pigs, sheep, and snakes were also submitted. Over twenty-five different serotypes were identified; the most common serotype was *S.* Typhimurium. Submitted isolates included serotypes isolated from humans that matched the patterns of some isolates found in the PulseNet database, including *S.* Typhimurium, *S.* Newport, and *S.* Meleagridis. Continuation of the pilot is planned for 2009.

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

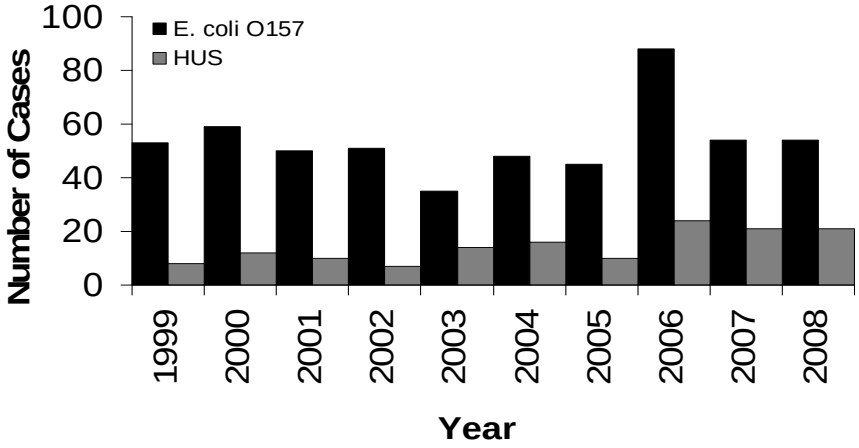
Escherichia coli are common gram-negative bacteria with many subtypes causing a range of clinical illnesses. Although most *E. coli* are non-pathogenic residents of the colon, various subtypes cause urinary tract infections and other extra-intestinal infections and are common causes of diarrhea worldwide.

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 2. Culture-confirmed *E. coli* O157 and HUS (< 18 years) cases, by Year, Tennessee, 1999-2008.



Although *E. coli* O157 is most commonly isolated, 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*. All positive STEC infections including *E. coli* O157 are reportable 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 2008, 114 cases of STEC were reported to the Tennessee Department of Health. Of these, 54 were culture confirmed *E. coli* 0157, 10 were culture-confirmed non-O157 STEC, and 47 were culture-confirmed STEC with O antigen undetermined. In 2008, 21 cases of HUS were reported in persons under 18 years of age **(Figure)** . Of these, laboratory evidence of a preceding STEC infection was obtained in 13 (62%).

As a FoodNet site, Tennessee is engaged in several studies to better characterize STEC infections and outcomes. In 2008, Tennessee continued participation in the largest study to date to address the effects of antimicrobial use on outcomes in persons infected with *E. coli* O157. Additionally, FoodNet initiated preliminary studies and planning for a case-control study of non-O157 STEC risk factors.

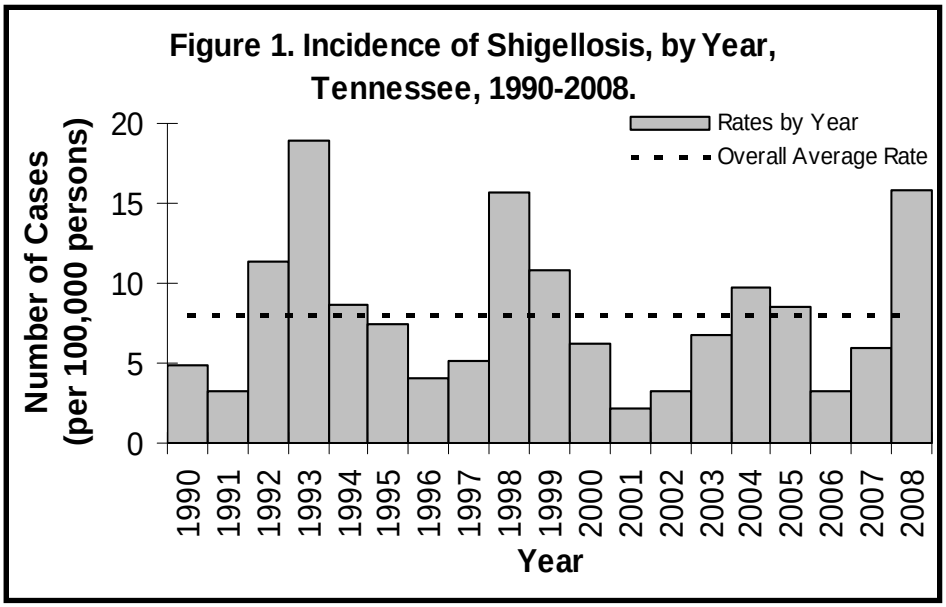
Shigellosis

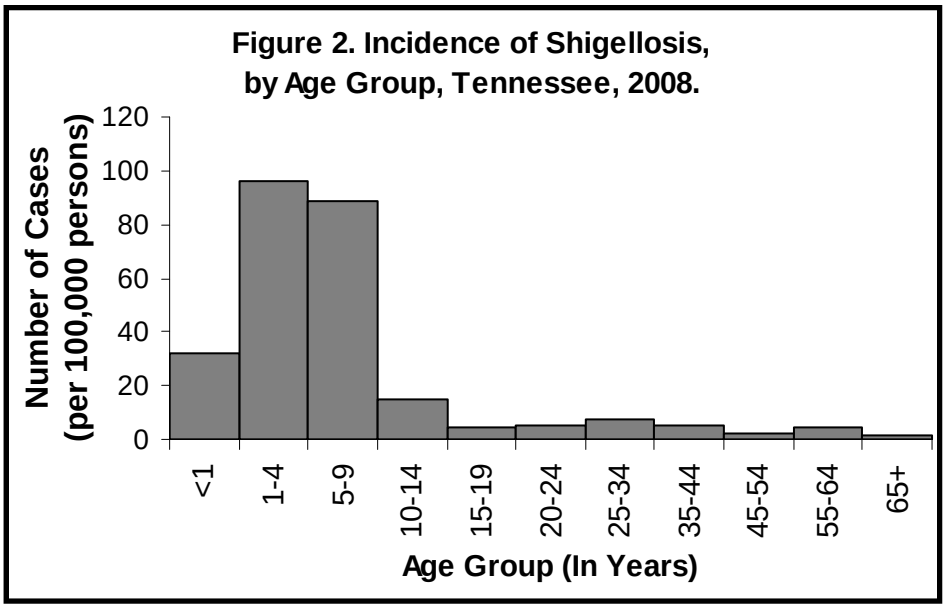
Shigellosis is an infectious disease caused by a group of bacteria called *Shigella*. Most persons infected with *Shigella* develop diarrhea, fever and stomach cramps within one or two days after they are exposed to the bacterium. The diarrhea is often bloody. However, illness usually resolves in five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

In some persons, especially young children and the elderly, diarrhea can be severe requiring hospitalization. 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 7.3 cases per 100,000 persons). However, major increases in incidence occurred 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) and are indicative of the cyclical nature of shigellosis in Tennessee. In 2008, it is apparent that shigellosis is continuing the four to six year cycle of increased incidence **(Figure 1)**.

In 2008, there were 968 cases of shigellosis reported in Tennessee (15.8 cases per 100,000 persons). This represents a significant increase in incidence, more than 260%, from the previous year. The majority of those cases were concentrated in Knoxville/Knox County (32.1%) metropolitan area, East Tennessee Region (21.9%), and Chattanooga/Hamilton County (16.4%) metropolitan area, 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, and the family members of either group. The highest rate of disease in 2008 was found in those under the age of 10 years (86 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 con-

tact with uninfected children. In day-care settings, exclusion of children until they are symptom free for twenty-four hours is a minimum requirement. Local requirements may include documentation of negative stool culture. In addition, people who have shigellosis should not prepare food for others until they have been symptom free for at least twenty-four hours and educated about basic food safety precautions.

Recommendations to reduce risks in childcare settings include disposal of diapers in a closed-lid garbage can and careful attention to hand washing. Hand hygiene should include use of soap and warm water immediately after changing diapers. After use, the diaper changing area should be wiped down with a disinfectant such as dilute household bleach, Lysol, or bactericidal wipes. In 2008, due to the increased incidence of *Shigella*, the Tennessee Department of Health provided infection control recommendations to all licensed child care facilities in the state.

Foodborne and Waterborne Parasitic Diseases

Parasites can cause a range of diseases, many with mild symptoms but some that lead to severe outcomes and even death. Many parasitic diseases have traditionally been considered exotic or at least foreign to the United States, and 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 among patients in Tennessee. Additionally, tourists returning to their own countries, immigrants from endemic areas, and immunocompromised persons are at risk for being diagnosed with 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 two species most commonly seen in humans, C. *parvum* and C. *hominis*, are mostly 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.

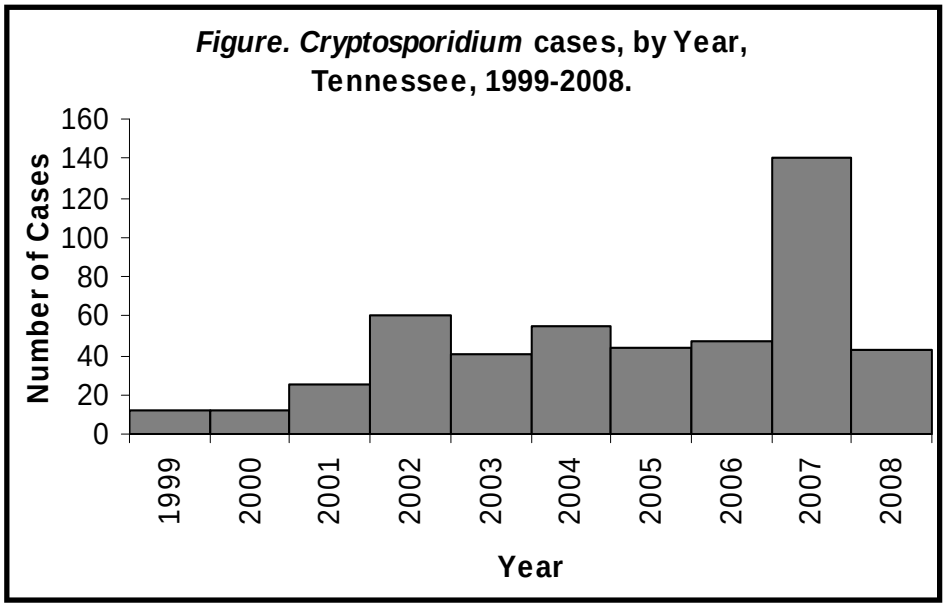


***Figure. Cryptosporidium* cases, by Year, Tennessee, 1999-2008.**

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 could enhance the spread of cryptosporidia, and a dramatic rise in cases has occurred both 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, a rise in the numbers of elderly people who live in institutions, and the growing numbers of immunocompromised persons. Water distribution issues may also contribute as water is increasingly piped long distances from source to point of use. The availability of the new anti-*Cryptosporidium* drug nitazoxanide, approved in 2005, is thought to have made patients and providers more aware of cryptosporidiosis and more likely to pursue diagnosis.

The number of cases of cryptosporidiosis reported in Tennessee has generally risen during recent years **(Figure)**.

In 1995 a single case was reported. During 2002–2007, a mean of 64 cases was reported each year. The 140 cases reported in 2007 included cases from at least 2 recreational water outbreaks, one of which was attributed to *C. hominis*. During 2008, 43 cases were reported, none associated with outbreaks.

Tennessee Department of Health (TDH) distributes information on recreational water safety each year in an effort to reduce *Cryptosporidium* risks. 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* and began using those capabilities in 2008.

Cyclosporiasis

Cyclosporiasis was first described in humans in New Guinea in 1977, but the causative organism was not taxonomically classified 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, and direct person-to-person transmission is considered common.

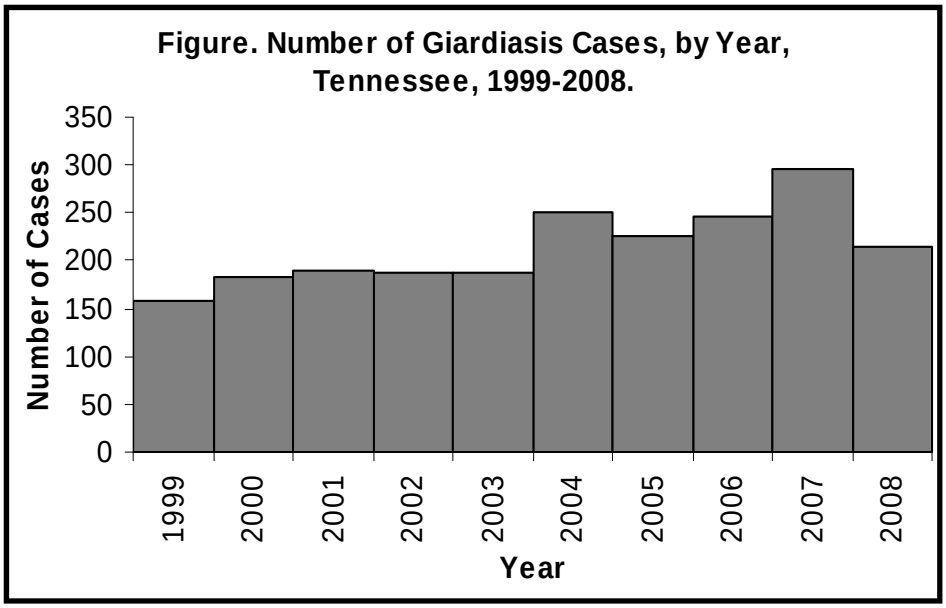
During 1995–2000, large outbreaks of cyclosporiasis in North America were associated with the consumption of fresh raspberries from Central America. These outbreaks prompted intensive study of Cyclospora in the United States. In April 2005, another large outbreak in Florida was attributed to consumption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

Despite these outbreaks, the overall US incidence of Cyclospora infections is thought to be low. A total of eight cases were reported in Tennessee during 2002–2007. In 2008, three cases were reported.

Giardiasis

Giardia is the most common cause of parasitic infection in the United States and Canada and is a common cause of endemic and epidemic diarrhea throughout the world. Nearly all children in the developing world become infected at some point in their lives. In Tennessee, children under five years of age accounted for 26% of giardiasis cases from 1995 through 2008. *Giardia* cases among foreign born and recent immigrants detected in health screening programs account for an increasing proportion of cases.

Figure. Number of Giardiasis Cases, by Year, Tennessee, 1999-2008.



Acquisition of the parasite requires oral ingestion of *Giardia* cysts. This can occur in one of three ways: ingestion of contaminated water (the most frequent), person-to-person transmission, and by eating contaminated food. Waterborne outbreaks often involved the use of untreated surface water or water that has been inadequately treated. Person-to-person transmission is due to fecal exposure and most frequently occurs among small children in daycare centers, persons in custodial living centers, and men who have sex with men.

The **figure** depicts the number of cases of giardiasis reported in Tennessee from 1999 through 2008; the numbers have remained fairly constant with a high of 295 in 2007. In 2008, 214 cases of giardiasis were reported in Tennessee. Giardiasis follows a seasonal trend with most cases occurring during the summer and fall.

Foodborne Outbreaks

A foodborne disease outbreak is defined as the occurrence of two or more cases of a similar illness resulting from the ingestion of a food in common. All suspected outbreaks and unusual patterns of diarrheal illness should be reported promptly to the local health department **(Figure 1)**.

In 2008, 25 foodborne disease outbreaks were reported **(Table)** in Tennessee. The increasing use of pulsed-field gel electrophoresis (PFGE) to determine relatedness of bacterial iso-

Figure 1. Reported Foodborne Disease Outbreaks, Tennessee, by Year, 1998-2008.

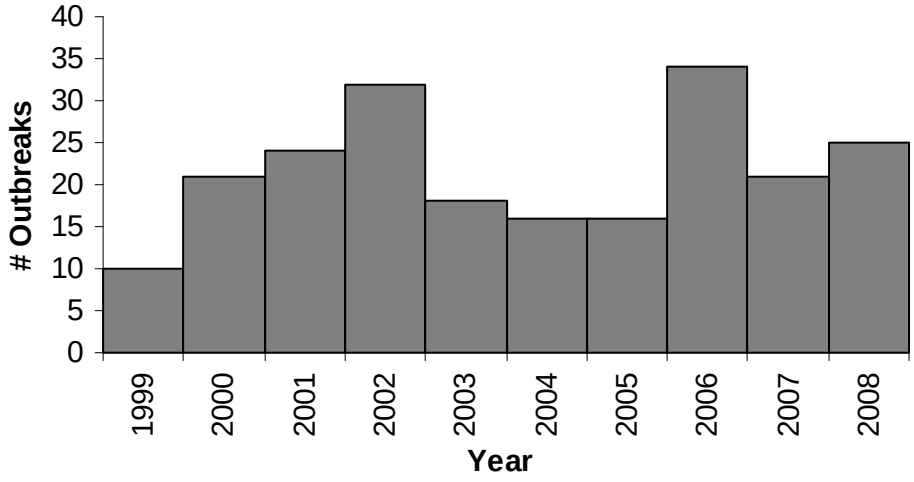
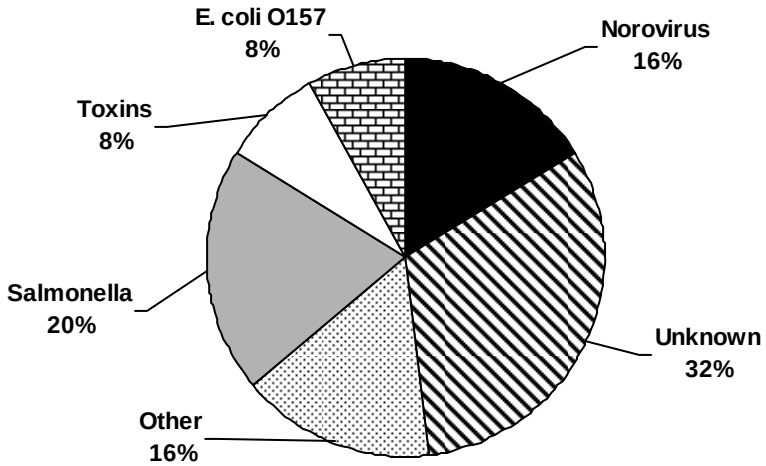


Table. Reported Foodborne Disease Outbreaks, Tennessee, 2008.

ONSET	COUNTY	# ILL	ETIOLOGY	SITE	SUSPECTED VEHICLE
01/15/2008	Hamilton	39	Selenium	Commercial	Dietary Supplement
01/16/2008	Putnam	20	Norovirus	Restaurant	Sushi
01/23/2008	Washington	4	Unknown	Restaurant	Tacos
01/20/2008	Knox	1	*Salmonella*	Commercial	Melons
02/22/2008	Hamilton	5	Unknown	Restaurant	Unknown
03/02/2008	Sumner	6	Ciguatera Toxin	Restaurant	Amber Jack
03/15/2008	Davidson	59	Norovirus	Catered Event	Fruit Tea/ White Cake
03/29/2008	Sullivan	3	Norovirus	Restaurant	Salad Bar
04/06/2008	Hamilton	2	Norovirus	Restaurant	Unknown
04/06/2008	Hamilton	2	Unknown	Restaurant	Hamburger
04/10/2008	Hamilton	4	Unknown	Restaurant	Milkshake
04/18/2008	Hamilton	2	Unknown	Restaurant	Chicken Sandwich
04/21/2008	Hamilton	13	Unknown	Restaurant	Rice
04/24/2008	Polk	4	Campylobacter	Private Home	Raw Milk
04/27/2008	Overton	19	Clostridium Perfringes	Private Home	Soup
04/30/2008	Multi-county	10	*Salmonella*	Commercial	Tomatoes/Peppers
05/23/2008	Davidson	6	*E. coli* O157:H7	Jail	Bagged Lettuce
07/04/2008	Hamilton	4	Unknown	Restaurant	Lemons
07/22/2008	Montgomery, Madison, Sullivan	3	Cyclospora	Conference Center	Berries
09/01/2008	Shelby	14	Unknown	Restaurant	Cesar Salad
09/04/2008	Multi-county	8	Salmonella	Commercial	Unknown
10/11/2008	Gibson, Madison, Hardeman	50	Salmonella	Restaurant	BBQ Pork
10/25/2008	Franklin	12	*E.coli* O157:H7	Charity Event	Buffalo
11/06/2008	Multi-county	14	Salmonella	Commercial	Peanut Butter
12/25/2008	Sumner	25	Staph Enterotoxin	Private Home	Pozole

lates has improved the recognition and investigation of suspected outbreaks. A cluster of *E.coli* O157:H7 among inmates in a local jail with matching PFGE patterns implicated bagged lettuce. Another useful tool in outbreak investigations is the polymerase chain reaction (PCR) test. This test has markedly improved our ability to confirm norovirus as a common etiology in foodborne disease outbreaks. In 2008, 68% of reported foodborne disease outbreaks had a laboratory-confirmed etiology (**Figure 2**).

Figure 2. Etiology of Reported Foodborne Disease Outbreaks, Tennessee, 2008.



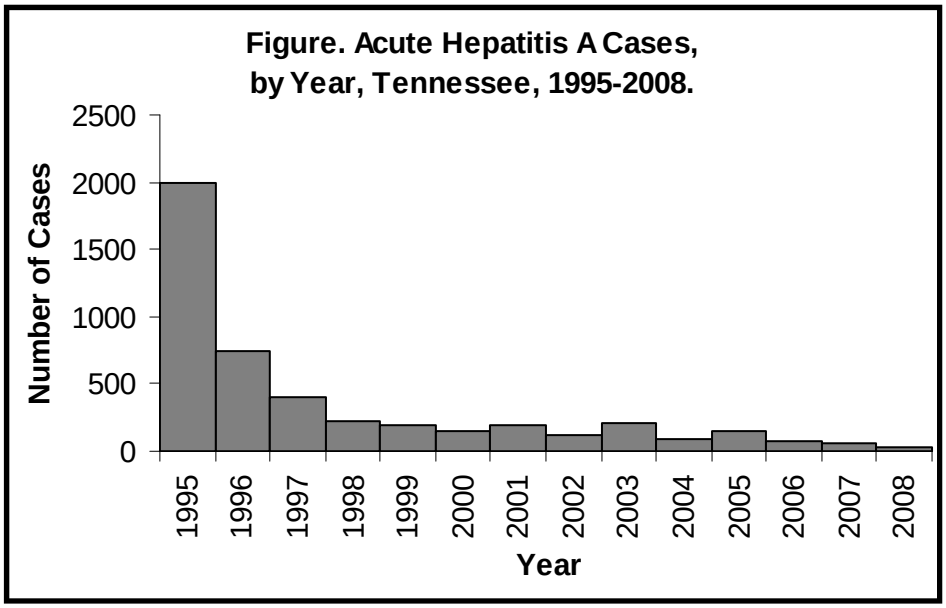
B. Hepatitis

Kimberly Glenn, a fellow assigned to Tennessee for the Council of State and Territorial Epidemiologists (CSTE), entertains Marcy McMillian's son Elijah at a celebration for Dr. Allen S. Craig.

Source: Tennessee Department of Health.

Hepatitis A

Hepatitis A, caused by infection with the hepatitis A virus (HAV), has an incubation period of approximately 28 days (range: 15–50 days). HAV replicates in the liver and is shed in high concentrations in feces from 2 weeks before to 1 week after the onset of clinical illness. HAV infection produces a self-limited disease that does not result in chronic infection or chronic liver disease. However, 10%–15% of patients might experience a relapse of symptoms during the 6 months after acute illness. Acute liver failure from hepatitis A is rare (overall case-fatality rate: 0.5%). The risk for symptomatic infection is directly related to age, with >80% of adults having symptoms compatible with acute viral hepatitis and the majority of young children having either asymptomatic or unrecognized infection. Antibody produced in response to HAV infection persists for life and confers protection against reinfection.



HAV infection is primarily transmitted by the fecal-oral route, by either person-to-person contact or consumption of contaminated food or water. Although viremia occurs early in infection and can persist for several weeks after onset of symptoms, bloodborne transmission of HAV is uncommon. HAV occasionally might be detected in saliva in experimentally infected animals, but transmission by saliva has not been demonstrated.

In the United States, nearly half of all reported hepatitis A cases have no specific risk factor identified. Among adults with identified risk factors, the majority of cases are among men who have sex with other men, persons who use illegal drugs, and international travelers. Because transmission of HAV during sexual activity probably occurs because of fecal-oral contact, measures typically used to prevent the transmission of other STDs (e.g., use of condoms) do not prevent HAV transmission. Vaccination is the most effective means of preventing HAV transmission among persons at risk for infection. Hepatitis A vaccination is recommended for all children at age 1 year, for persons who are at increased risk for infection, for persons who are at increased risk for complications from hepatitis A, and for any person wishing to obtain immunity.

In Tennessee, an epidemic of acute 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 35 cases (0.6 per 100,000 persons) were reported in 2008 in Tennessee, the lowest number to date.

Hepatitis B

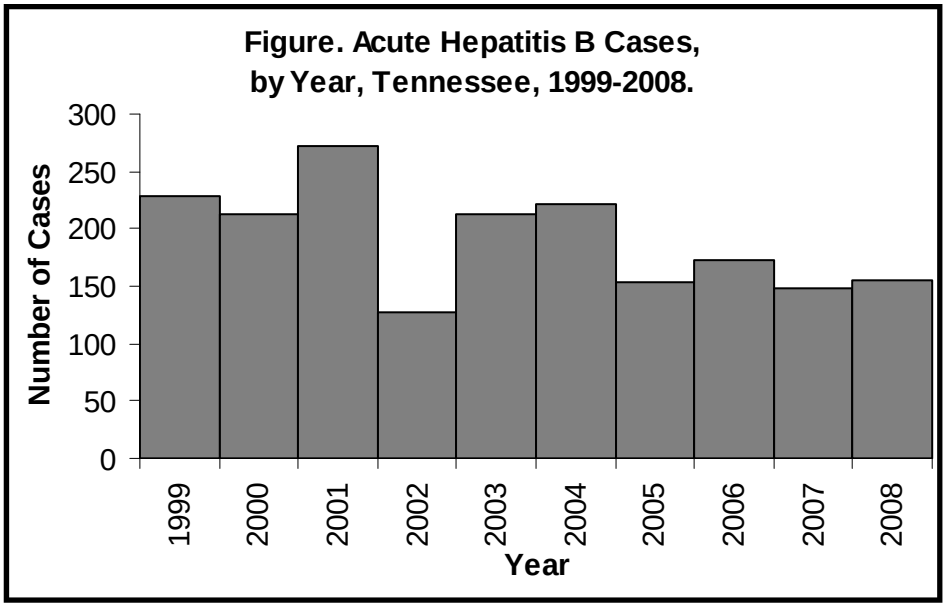
Hepatitis B is caused by infection with the hepatitis B virus (HBV). The incubation period (the time of exposure to onset of symptoms) is 6 weeks to 6 months. HBV is found in highest concentrations in blood and in lower concentrations in other body fluids (e.g., semen, vaginal secretions, and wound exudates). HBV infection can be self-limited or chronic.

In adults, only about half of newly acquired HBV infections are symptomatic, and approximately 1% of reported cases result in acute liver failure and death. Risk for chronic infection is inversely related to age at infection:

approximately 90% of infected infants and 30% of infected children aged <5 years become chronically infected, compared with 2%–6% of adults. Among persons with chronic HBV infection, the risk for premature death from cirrhosis or hepatocellular carcinoma is 15%–25%. HBV is efficiently transmitted by percutaneous or mucous membrane exposure to infectious blood or body fluids that contain blood. The primary risk factors that have been associated with infection are unprotected sex with an infected partner, infected mother at birth, unprotected sex with more than one partner, men who have sex with other men (MSM), history of other STDs, and illegal injection drug use.

CDC's national strategy to eliminate transmission of HBV infection includes:

- Prevention of perinatal infection through routine screening of all pregnant women for HBsAg and immunoprophylaxis of infants born to HBsAg-positive mothers and infants born to mothers with unknown HBsAg status
- Routine infant vaccination
- Vaccination of previously unvaccinated children and adolescents through age 18 years
- Vaccination of previously unvaccinated adults at increased risk for infection



High vaccination coverage rates, with subsequent declines in acute hepatitis B incidence, have been achieved among infants and adolescents. In contrast, vaccination coverage among the majority of high-risk adult groups (e.g., persons with more than one sex partner in the previous 6 months, MSM, and injection drug users) have remained low, and the majority of new infections occur in these high-risk groups. STD clinics and other settings that provide services targeted to high-risk adults are ideal sites in which to provide hepatitis B vaccination to adults at risk for HBV infection. CDC has recommended that unvaccinated adults seeking services in these settings should be assumed to be at risk for hepatitis B and should receive hepatitis B vaccination. With the reception of grant funds, Tennessee will initiate hepatitis B vaccination of these individuals in the metropolitan regions in 2009.

Hepatitis B case reports in Tennessee have decreased over time (**Figure**). A total of 155 cases were reported in 2008 (2.6 cases per 100,000 persons).

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.

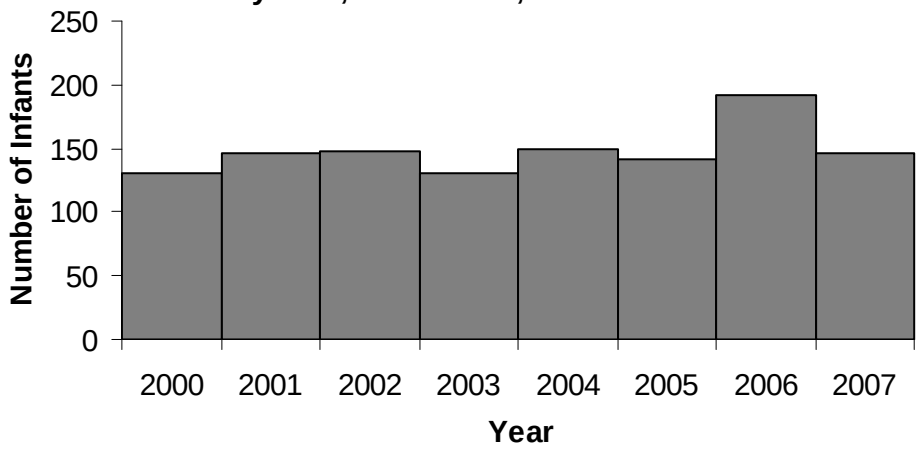
Tennessee Code Annotated 68-5-602 (a) requires that all women in Tennessee be tested for hepatitis B during the prenatal period, and that positive test results be passed on to the delivering hospital and the health department. A woman with no test results at delivery is to be tested at that time. The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

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

cords, ensures that the delivering hospital has a record of the mother's status, and verifies that it has HBIG and vaccine available.

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

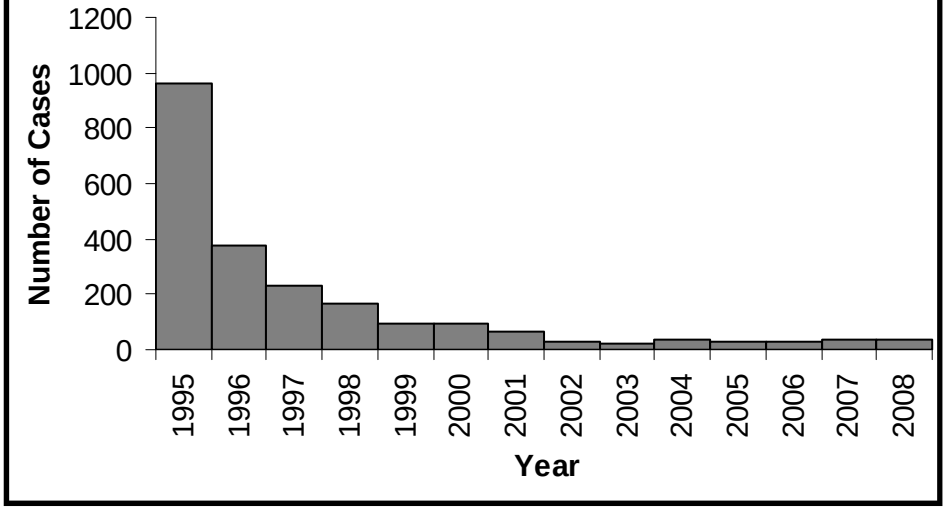
Figure. Reported Number of Infants Born to Hepatitis B Surface Antigen Positive Women, by Year, Tennessee, 2000-2007.



Hepatitis C

Hepatitis C virus (HCV) infection is the most common chronic bloodborne infection in the United States; approximately 3.2 million persons are chronically infected. Sixty to 70% of persons newly infected with HCV are asymptomatic or have a mild clinical illness. HCV RNA can be detected in blood within 1–3 weeks after exposure. The average time from exposure to development of antibodies to HCV (seroconversion) is 8–9 weeks, and anti-HCV antibody can be detected in >97% of persons by 6 months after exposure. Chronic HCV infection develops in 70%–85% of HCV-infected persons; 60%–70% of chronically infected persons have evidence of active liver disease. The majority of infected persons might not be aware of their infection because they are not clinically ill. However, infected persons serve as a source of transmission to others and are at risk for chronic liver disease or other HCV-related chronic diseases decades after infection.

Figure. Acute Hepatitis C, by Year, Tennessee, 1995-2008.



HCV is most efficiently transmitted through large or repeated percutaneous exposure to infected blood (e.g., through transfusion of blood from unscreened donors or through use of injecting drugs). Although much less frequent, occupational, perinatal, and sexual exposures also can result in transmission of HCV.

The exact role of sexual activity in the transmission of HCV is unclear. Case-control studies have reported an association between acquiring HCV infection and exposure to a sex contact with HCV infection or exposure to multiple sex partners. Surveillance data also indicate that 15%–20% of persons reported with acute HCV infection have a history of sexual exposure in the absence of other risk factors. Case reports of acute HCV infection among HIV-positive MSM who deny injecting-drug use have indicated that this occurrence is frequently associated with other STDs (e.g., syphilis). In contrast, a low prevalence (1.5% on average) of HCV infection has been

demonstrated in studies of long-term spouses of patients with chronic HCV infection who had no other risk factors for infection. Multiple published studies have demonstrated that the prevalence of HCV infection among MSM who have not reported a history of injecting-drug use is no higher than that of heterosexuals. Overall, these findings indicate that sexual transmission of HCV is possible but inefficient.

The number of reported cases of acute hepatitis C illness in Tennessee has remained low since chronic infections were excluded in 1999; the number of reported cases in 2008 was 33 (0.6 per 100,000 persons) **(Figure)**. Underreporting of acute hepatitis C infection is likely due in part to the high proportion of cases that have asymptomatic or mild initial infections.

C. Meningitis/Encephalitis and Septicemia

Deborah Wojnarek and Karen Brady, both Nurse Consultants for the FoodNet and Public Health Emergency Preparedness programs, respectively, take time out of their busy days for a photo opportunity.

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

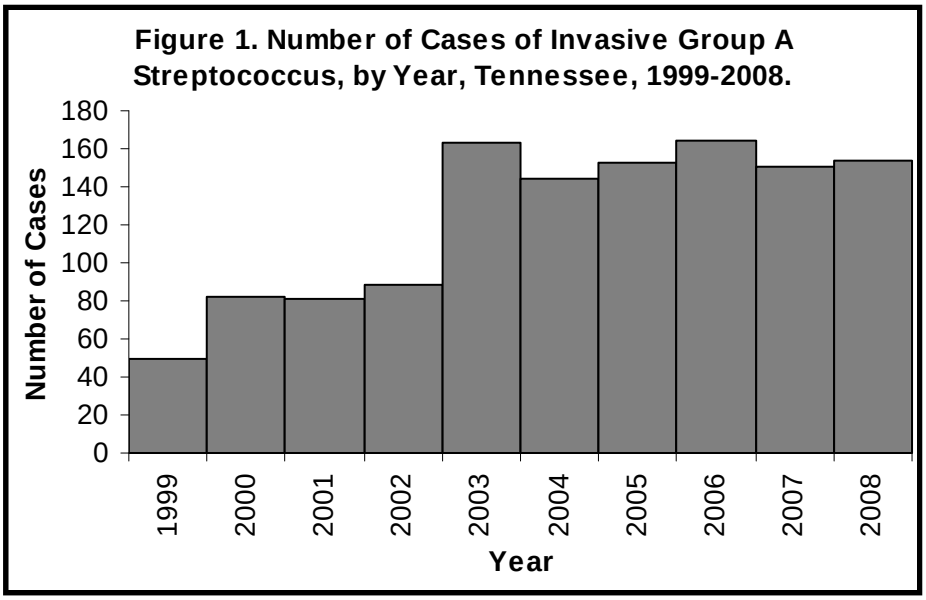
- To track emerging antimicrobial resistance in pneumococcal isolates.
- To evaluate the impact and effectiveness of pneumococcal conjugate vaccines for infants on disease burden.
- To evaluate prevention among the elderly through pneumococcal polysaccharide vaccine use.

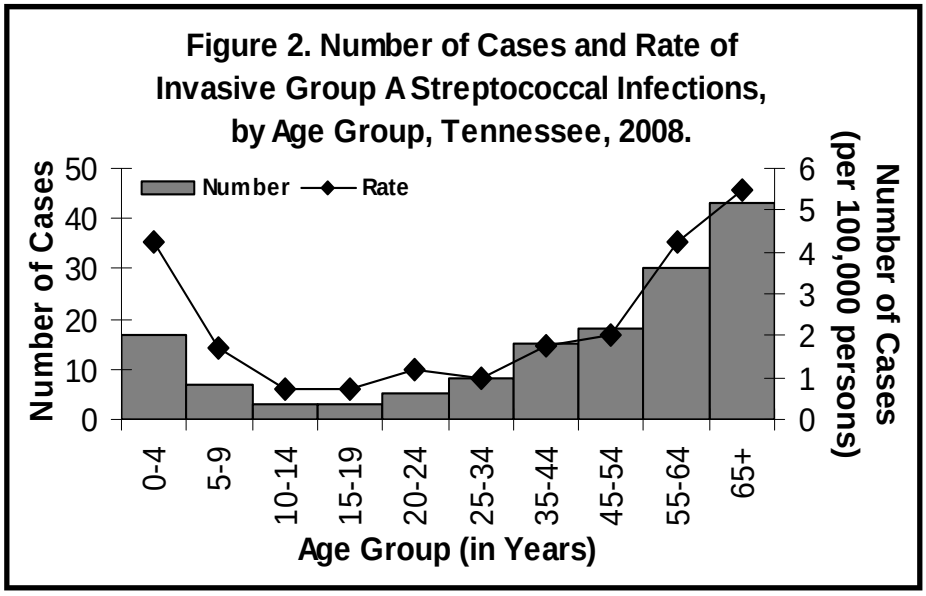
Under the auspices of ABCs, a number of studies have been undertaken to reach some of the objectives listed above. An assessment of the effective-

ness of current prenatal group B streptococcus 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 infection occurs when the bacteria invade normal sterile sites such as blood 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.





National passive surveillance for GAS invasive infection and STSS began in 1995. Active laboratory-based surveillance for invasive GAS is currently conducted within the ten states that are participating in the Centers for Disease Control and Prevention (CDC) Emerging Infections Program, which include Tennessee. The average number of cases reported per year in Tennessee more than doubled for the period 2003-2008 compared to the period 1999-2002 (**Figure 1**). The rate of invasive GAS in Tennessee in 2008 (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 2008 occurred in Sullivan County, Nashville/Davidson County, and Memphis/Shelby County with rates of 5.2, 5.0, 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 (4.2 cases per 100,000 persons) and persons aged 65 years and over (5.5 cases per 100,000 persons) (**Figure 2**). This is the same trend as seen in the latest published data for the United States for the period 2000-2004. Invasive GAS infection occurs more frequently among the elderly, young children, the immunosuppressed, and persons with chronic cardiac, respiratory, or metabolic disease (diabetes). Persons with skin lesions

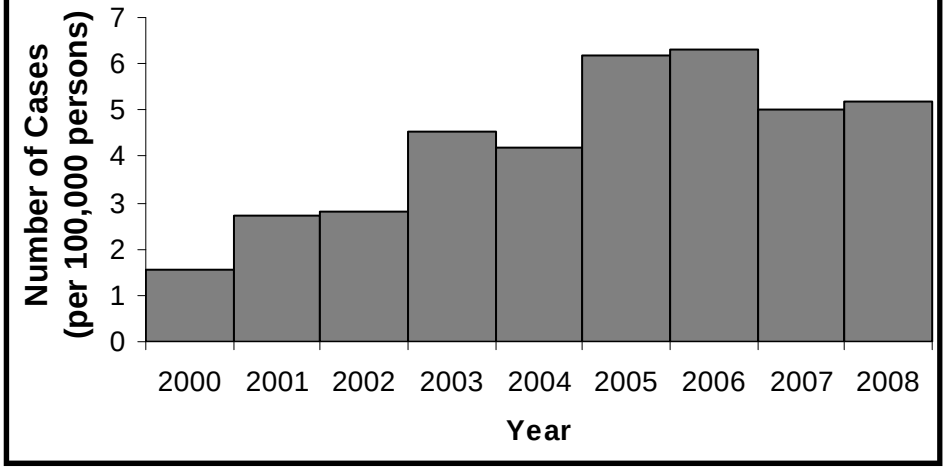
(e.g., children with varicella) and intravenous drug users are other groups at higher risk for invasive GAS infection. Nationally, African-Americans are reported to be disproportionately affected. The rates among African-Americans were also higher compared to whites in Tennessee during 2008 (3.0 vs. 1.9 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 CDC allows for better strain identification. Investigating clusters of disease will help identify interventions that can lead to prevention of transmission.

Group B Streptococcal Disease

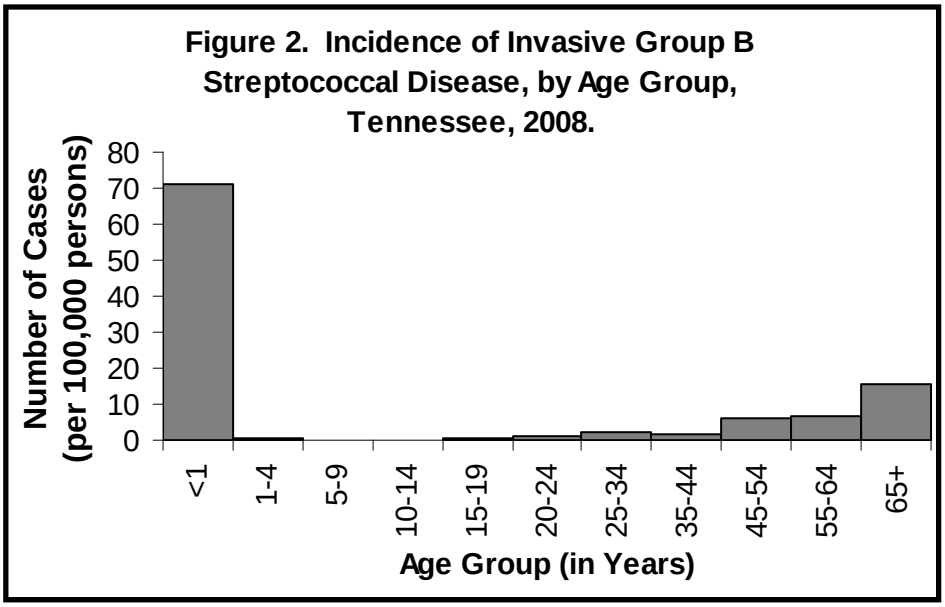
Group B Streptococcus (GBS) infection is caused by the bacteria *Streptococcus agalactiae*. It emerged as the leading infectious cause of neonatal morbidity and mortality in the United States during the 1970s. Required reporting of cases of invasive GBS infection in Tennessee began in 2000 when only 87 were reported. In 2008, 319 cases were reported, which is a rate of 5.2 per 100,000 population **(Figure 1)**.

Figure 1. Incidence of Invasive Group B Streptococcal Infections, by Year, Tennessee, 2000-2008.



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 (aged <1 year) (71.1 cases per 100,000 persons) followed by persons aged 65 years or older (15.8 per 100,000 persons) **(Figure 2).**

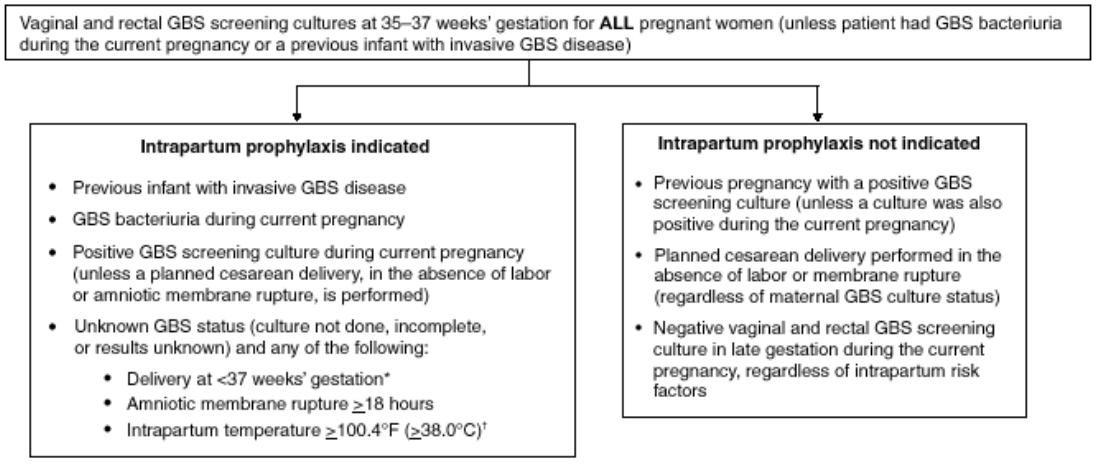
Figure 2. Incidence of Invasive Group B Streptococcal Disease, by Age Group, Tennessee, 2008.



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. About 4% of infants with early- and late-onset infections die from their illness. A

total of 47 GBS cases were reported among infants age 0-89 days in Tennessee in 2008. Among the 47 cases, 20 (43%) were classified as early-onset disease and 27 (57%) were classified as late-onset disease.

Figure 3. Indications for intrapartum antibiotic prophylaxis to prevent perinatal GBS disease under a universal prenatal screening strategy based on combined vaginal and rectal cultures collected at 35-37 weeks' gestation from all pregnant women.



* If onset of labor or rupture of amniotic membranes occurs at <37 weeks' gestation and there is a significant risk for preterm delivery (as assessed by the clinician), a suggested algorithm for GBS prophylaxis management is provided (Figure 3).
† If amnionitis is suspected, broad-spectrum antibiotic therapy that includes an agent known to be active against GBS should replace GBS prophylaxis.

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 peri-rectal GBS culture between 35 and 37 weeks gestation. Colonized women are then offered antibiotics at the time of labor. Increased surveillance and awareness may be partly responsible for the increase in incidence in 2006. Efforts have been made over the past several years to improve physician awareness of the new guidelines statewide and to target areas with a history of lower screening rates **(Figure 3)**. This effort to decrease GBS disease in infants complements the Department of Health campaign to lower infant mortality.

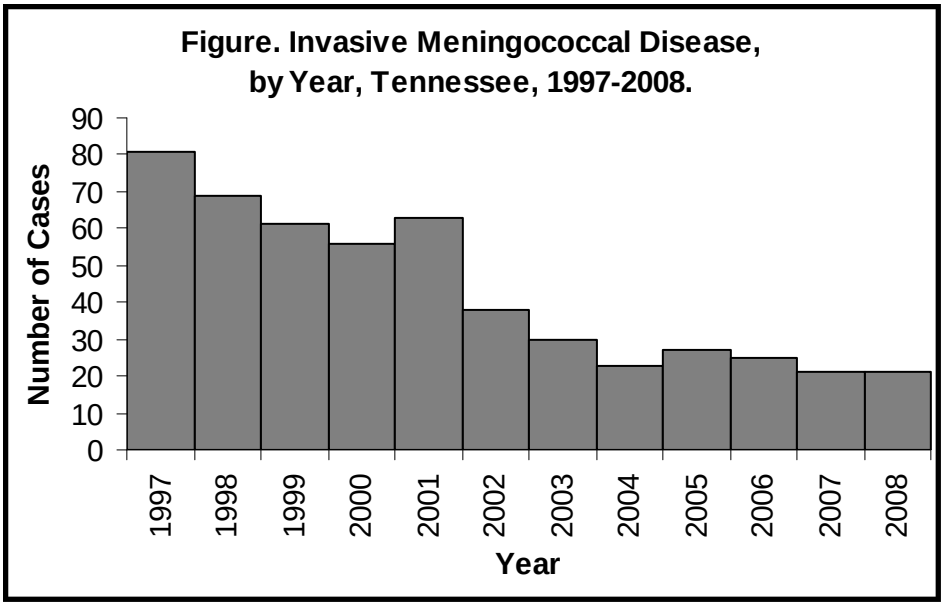
To examine rates of neonatal GBS disease after the revised guidelines were issued, CDC analyzed surveillance data from the Active Bacterial Core surveillance (ABCs) system, which conducts active, laboratory- and population-based surveillance in selected counties of 10 states (including Tennessee) for 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%–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 U.S. Transmission occurs from person to person through droplets from the respiratory tract. The incubation period is 1–10 days and often less than 4 days. Disease most often occurs in children aged less than 5 years; the peak attack

rates occur in children younger than 1 year of age or 15–18 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.

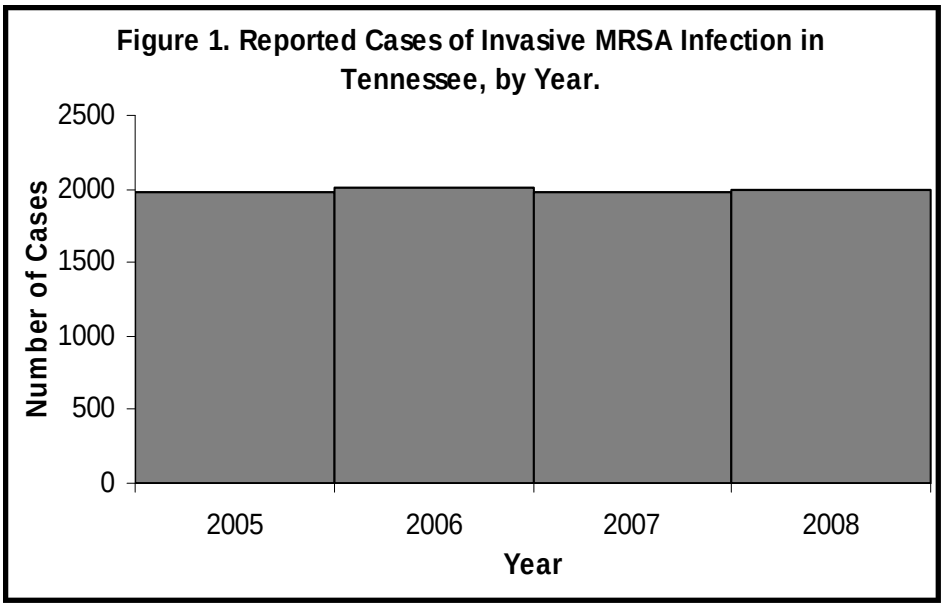


Surveillance in Tennessee is conducted statewide through the National Electronic Disease Surveillance System (NEDSS) and the Emerging Infection Program's Active Bacterial Core Surveillance (ABCs). Immediate reporting via telephone is required in Tennessee followed by a written report within one week. Serogrouping of meningococcal isolates is 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 2008 (**Figure**).

Methicillin-Resistant *Staphylococcus aureus*

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 who had a medical procedure (such as dialysis, surgery, catheters) are known as community associated (CA-MRSA) infections. Staphylococcal or MRSA infections in the community are usually manifested as skin infections, such as pimples and boils, and occur in otherwise healthy people. CA-MRSA infections have been frequently mistaken for "spider-bites". Incision and drainage is very important in the management of skin and soft tissue infections.

Invasive MRSA disease was made reportable in Tennessee in June 2004 and is defined as isolation of MRSA from a normally sterile site (i.e., speci-

men source is blood, cerebrospinal fluid (CSF), pleural, pericardial, peritoneal or joint fluid or bone). Skin infections and isolates from sputum, wound, urine, and catheter tips are not counted; repeat isolates within 30 days are not counted.

From July to December of 2004, there were 882 cases (30 cases per 100,000 persons) of MRSA reported. In 2005, the first complete year of reporting, the number of cases was 1,978 cases (**Figure**). The number of cases reported and rate have remained relatively stable (2,005 cases in 2006; 1,973 cases in 2007; 1,997 cases in 2008).

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 healthcare-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

Human rabies occurs infrequently in the United States and in Tennessee. However, rabies risk assessment remains a important responsibility of the Tennessee Department of Health. In 2008, no documented human rabies cases occurred in Tennessee. The last confirmed Tennessee rabies case occurred in 2002 following a bite from a rabid bat. Although the total number of rabies positive animals has remained relatively stable since 2006, the proportion of raccoon-variant rabies cases continues to increase, particularly in east Tennessee. The Tennessee Department of Health (TDH) Communicable and Environmental Disease Services section continues to work 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 USDA-WS program consists of enhanced surveillance and the oral rabies vaccination (ORV) campaign. ORV baiting was conducted in the fall of 2008.

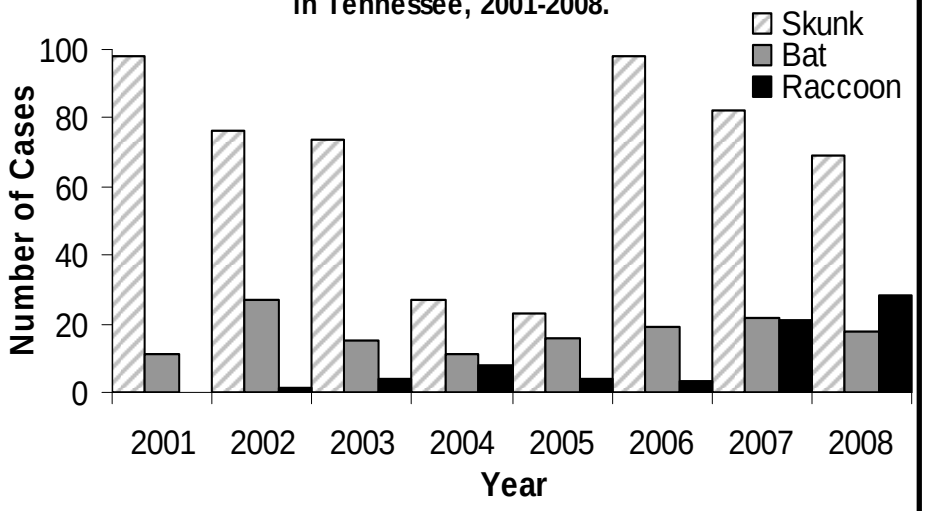
There were 1,917 animals tested in state laboratories in 2008, a decline from 2007. Species tested included 767 dogs and 489 cats. The majority of domestic dog and cat submissions were from metropolitan areas. Among animals tested by TDH laboratories, the percent-positive for domestic dogs and cats was 0.4% and 0.4%, respectively. The Tennessee Department of Health continues to emphasize methods to assess rabies risk, such as a 10-day observation period for dogs and cats that bite humans, to minimize unnecessary rabies submissions of low-risk domestic species. In 2008, 128 cases of animal rabies were confirmed statewide (**Table**). Tennessee has three rabies vector species (RVS) typically infected by a host-adapted rabies virus variant: bat, skunk, and raccoon. There were 18 rabies-positive bats dis-

Table. Animals Testing Positive for Rabies by Species, Tennessee, 1999-2008.

Species	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Skunk	79	88	98	76	74	27	23	98	82	69
Bat	10	15	11	27	15	11	16	19	22	18
Dog	5	3	2	2	3	1	1	2	5	3
Raccoon	0	0	0	1	4	8	4	3	21	28
Fox	1	0	0	1	2	1	3	4	0	7
Horse	0	0	0	0	4	0	1	0	0	1
Cattle	0	0	0	1	0	0	0	2	1	0
Cat	0	1	0	0	1	0	0	3	1	2
Goat	0	0	0	0	0	0	0	0	0	0
Opossum	0	0	0	0	0	1	0	0	0	0
Total	**95**	**107**	**111**	**108**	**103**	**49**	**48**	**131**	**132**	**128**

tributed across the state. A total of six cases of animal rabies occurred among domestic animals in 2008. These included three dogs infected with north central skunk-variant rabies in Lincoln, Marshall, and Warren counties. Two cats were infected, including a raccoon-variant rabies case from Sullivan County and a bat-variant case from Claiborne County. The remaining domestic animal was a horse from Trousdale County infected with north central skunk variant rabies.

Figure 1. Rabies Cases Among Wildlife Vector Species in Tennessee, 2001-2008.



Raccoon-variant rabies cases continued to increase in 2008 and spill over into other species. Monoclonal subtyping of animal rabies cases indicated that 43 raccoon-variant rabies cases occurred in seven east Tennessee counties: Carter (11), Hamilton (1), Johnson (7), Polk (5), Sullivan (15), Unicoi (1), and Washington (3). Of note, raccoon-variant rabies infections were documented in 5 foxes, 11 skunks, and a domestic cat. **Figure 1** depicts the number of rabid animals by species rather than the variant the animal was infected with. It is important to note that raccoon-variant infection occurred in 11 skunks as mentioned above. Since raccoon-variant rabies was first documented in Tennessee in 2003, 10 counties have had laboratory-confirmed animal cases.

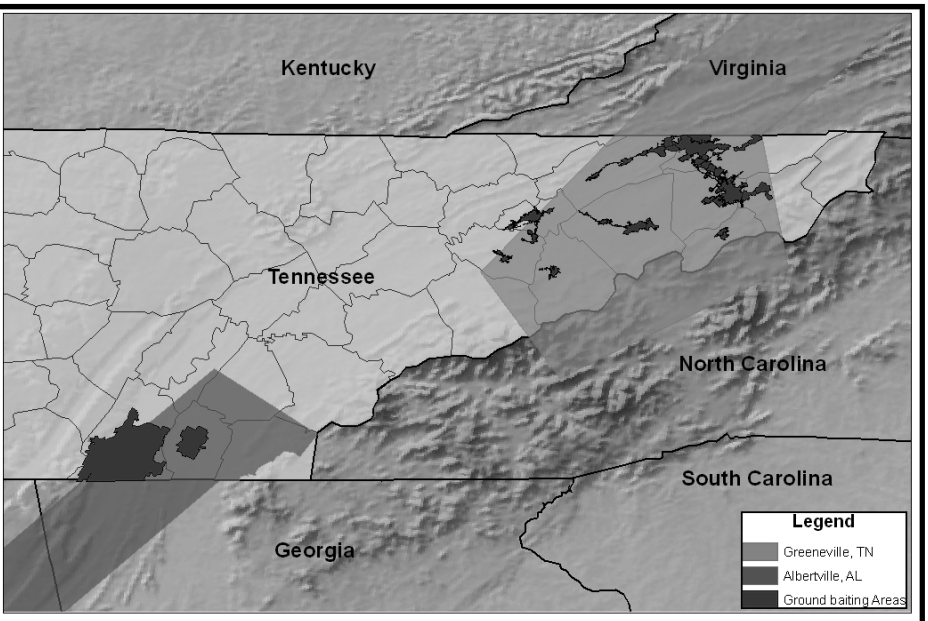


Figure 2. 2008 Bait Zones — Tennessee.

The USDA-WS program to prevent the spread of raccoon-variant rabies continued in 2008 (**Figure 2**). As part of the ongoing ORV campaign, twelve counties were baited in northeast Tennessee: Carter, Cocke, Grainger, Greene, Hamblen, Hancock, Hawkins, Sevier, Sullivan, Unicoi, and Washington. Almost 500, 000 baits were dispersed over 2, 731 square miles by ground and aerial crews. The ORV campaign in southeast Tennessee included Bledsoe, Bradley, Hamilton, Marion, McMinn, Meigs, Monroe, Polk, Rhea, and Sequatchie counties. Over 340, 000 baits were dispersed over 1,736 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. Raccoon rabies remains as an emerging threat to Tennesseans.

Streptococcus pneumoniae Invasive Disease

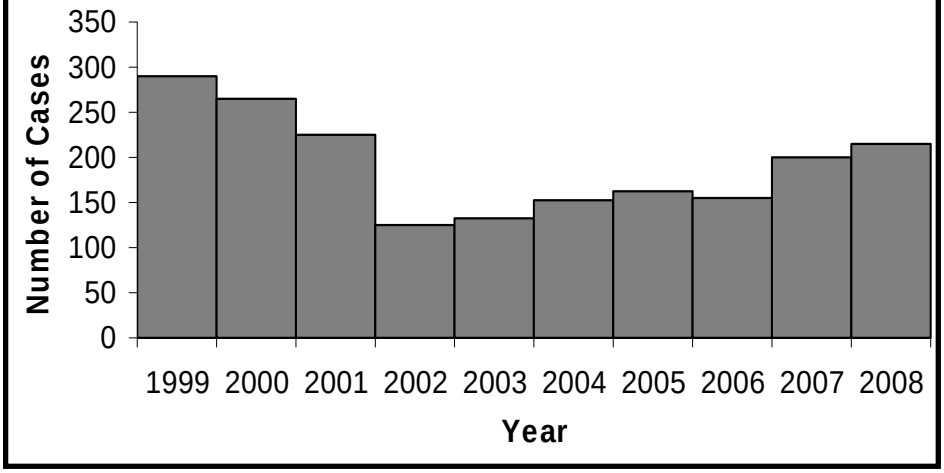
Streptococcus pneumoniae is the leading cause of meningitis and pneumonia in hospitalized patients and is the second

leading cause of bacteremia in the very young and very old, causing serious invasive disease. In 2008, 867 cases of *Streptococcus pneumoniae* (14.1 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.

Figure. Penicillin Non-susceptible Invasive *Streptococcus pneumonia* Infections, Tennessee, 1999-2008.



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. Since 1997, penicillin non-susceptible invasive pneumococcal infections have been reportable in Tennessee with 215 cases reported during 2008 (3.5 cases per 100,000 persons) (**Figure**). 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.

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 2008, 598 patients meeting study criteria were enrolled, and specimens tested. Among the 598 patients, 304 (51%) were determined to have an infectious etiology, 70 (12%) a noninfectious etiology, and 224 (38%) remained unexplained (**Table**). The most commonly recovered microbes from patients with previously unexplained encephalitis

Table. Tennessee Unexplained Encephalitis Study Cases with Confirmed or Probable Infectious Etiology, by Pathogen, 2000-2008.

	Species	Number		Species	Number
Virus	Enterovirus	7	**Bacteria**	*Bartonella* spp.	36
	Epstein-Barr Virus	21		*Chlamydia pneumoniae*	0
	Herpes Simplex Virus (not typed)	2		*Coxiella burnetti*	1
	Herpes Simplex Virus-1	25		*Ehrlichia chaffeensis*	12
	Herpes Simplex Virus-2	10		*Mycobacterium tuberculosis*	2
	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*	2
	Rotavirus	1		*Histoplasma capsulatum*	1
	Vaccinia Virus	1	**Other**	*Acanthamoeba* spp.	1
	Varicella Zoster Virus	18		Bacterial inf (CNS & non-CNS)	6
	West Nile Virus	12		Creutzfeld Jakob	2

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.

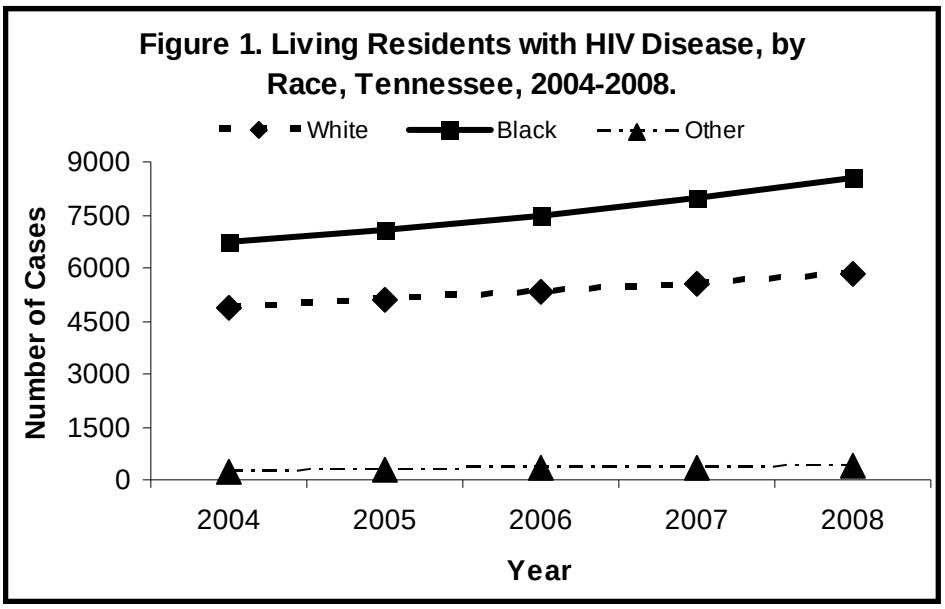
D. Sexually Transmitted Diseases

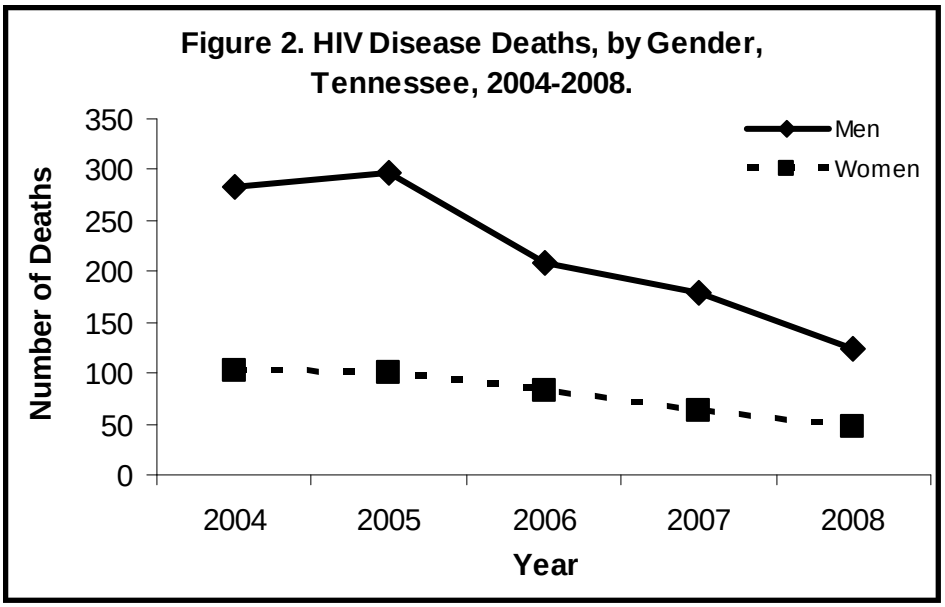
Dr. William Schaffner, co-Principal Investigator of the Emerging Infections Program (EIP), presents at the 9th Annual Scientific Presentation Day at the Airport Marriott in Nashville.

Source: Tennessee Department of Health.

Human Immunodeficiency Virus (HIV) Disease

Acquired Immunodeficiency Disease (AIDS) and the Human Immunodeficiency Virus (HIV) have been reportable diseases in Tennessee since 1982 and 1992, respectively. Through the year ending December 31, 2008, 20,305 HIV and/or AIDS cases have been reported to the State of Tennessee Health Department's Communicable and Environmental Disease Section. This number includes those persons currently living with HIV Disease, as well as those who are now deceased.





For the context of this report, HIV Disease refers to all HIV-infected patients regardless of whether they have been diagnosed with AIDS. Thus, the entire population of persons with HIV Disease contains: (1) persons who are HIV-infected (non-AIDS), (2) persons who have progressed from HIV to AIDS, and (3) persons initially diagnosed with AIDS due to either reported clinical manifestations such as Kaposi's sarcoma or PCP (*Pneumocystis carinii* pneumonia), or due to the presence of an absolute CD4 count less than 200 or 14%. Those patients diagnosed and/or living with AIDS will be discussed further in a subsequent portion of this report.

In 2008, there were 1,071 reported new diagnoses of HIV Disease among Tennessee residents. Of these cases, males and females represented 73% and 27%, respectively. African-Americans represented the largest proportion of new diagnoses (64%), followed by Whites (31%), and persons of Hispanic Origin (5%). The largest proportion of new cases of HIV Disease was between 25-44 years old at time of diagnosis (54%) for both males and females. Similarly, among both genders, the majority of remaining HIV Disease cases was among 15-24 year olds (21%) and 45-54 year olds (18%).

Among males, men who have sex with other men (MSM) was the most frequently reported exposure category for HIV Disease (55%). Heterosexual contact with partners infected with HIV/AIDS was the second leading exposure category (11%), followed by perinatal exposure (2%) and Injection Drug Use (1%). At the end of 2008, 32% of all newly reported HIV Disease cases among men had no discernable exposure category. Females acquired HIV Disease primarily through Heterosexual Contact with an infected partner (51%), Injection Drug Use (6%), and perinatal exposure (1%). At the end of 2008, 42% of all newly reported HIV Disease cases among women who had an unidentified expo-

sure category.

As of 12/31/08, there were 14,901 persons living in Tennessee with HIV Disease (11,016 males and 3,885 females). Of this total, African-Americans comprise 57%, Whites 39%, and persons of Hispanic origin, 3%. The largest proportion of persons living with HIV Disease in Tennessee are between 35-44 years of age (35%), followed by those 45-54 years of age (30%), and 25-34 years of age (18%). The numbers of males living with HIV Disease has increased 24% from 2004-2008; females living with HIV Disease has increased 27% during the same period (**Figure 1**).

While HIV Disease has affected every county in Tennessee, metropolitan areas within our state have traditionally endured the greatest challenges. Of the 1,071 new diagnoses of HIV Disease among Tennessee residents, 41% were among residents of Memphis/Shelby County, and 21% were from Nashville/Davidson County. Other metropolitan areas include Chattanooga/Hamilton County (6%), Knoxville/Knox County (6%), Jackson/Madison County (1%), and Sullivan County (<1%).

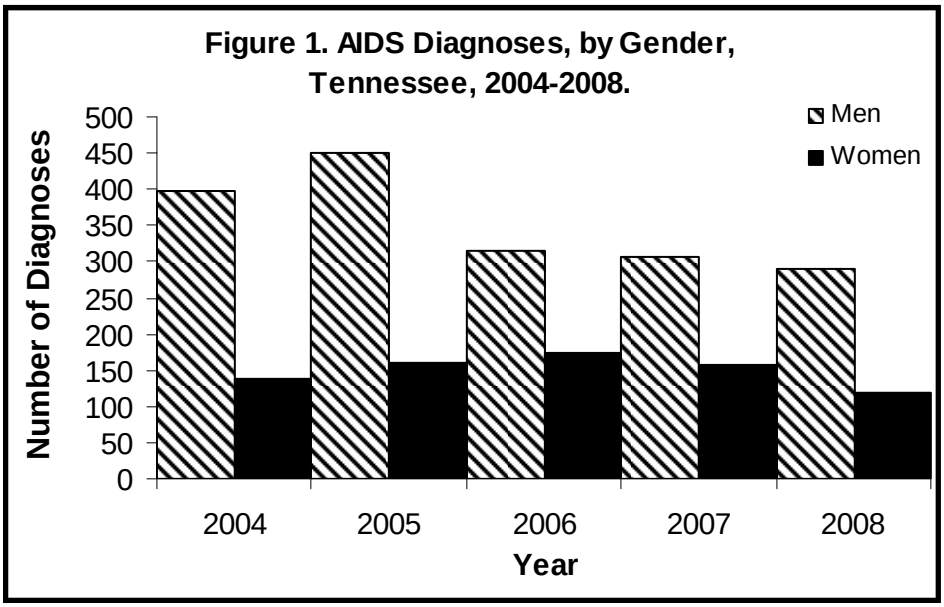
In 2008, there were 171 reported deaths among persons infected with HIV Disease. Over the past five years, reported deaths among persons diagnosed with HIV Disease have decreased 56% (**Figure 2**). This decrease is directly attributable to the early identification of persons with HIV Disease through new testing initiatives, the wide availability of highly active antiretroviral treatment regimens (HAART), and the creation of Tennessee AIDS Centers of Excellence, in 2001. These specialized clinics focus on caring for HIV infected patients, and Tennessee law mandated their creation in 2001 in response to the increasing impact of the HIV epidemic in Tennessee, the United States, and the world.

Acquired Immunodeficiency Syndrome (AIDS)

Through the year ending December 31, 2008, 7,536 AIDS diagnoses have been reported to the State of Tennessee Health Department's Communicable and Environmental Disease Section. Over the past five years (2004-2008), reported AIDS diagnoses among Tennessee residents have decreased 24% (**Figure 1**).

Of the total reported AIDS cases, males and females represented 71% and 29%, respectively. African-Americans represented the largest proportion of new AIDS diagnoses (60%), followed by Whites (33%), and persons of Hispanic origin (4%). The largest proportion of new diagnoses of AIDS was between 35-54 years old at time of diagnosis (59%) for both males and females. The remaining AIDS diagnoses were reported among 25-34 year olds (23%) and 55-64 year olds (9%), and 15-24 year olds (9%).

Figure 1. AIDS Diagnoses, by Gender, Tennessee, 2004-2008.



Of all reported AIDS diagnoses in 2008, men who have sex with other men (MSM) was the most frequently reported exposure category (28%). Heterosexual contact with partners infected with HIV/AIDS was the second leading exposure category (11%), followed by Injection Drug Use (8%). At the end of 2008, 25% of all newly reported AIDS diagnoses among men who had no discernable exposure category.

As is the case with HIV Disease, AIDS diagnoses also tend to be concentrated within the metropolitan areas of our state. Of the 408 new diagnoses of HIV Disease among Tennessee residents, 31% were among residents of Memphis/Shelby County, and 28% were from Nashville/Davidson

County. Other metropolitan areas include Chattanooga/Hamilton County (9%), Knoxville/Knox County (8%), Jackson/Madison County (2%), and Sullivan County (<1%).

Chlamydia

Chlamydia is a sexually transmitted disease (STD) caused by the bacteria Chlamydia trachomatis, and is the most frequently reported bacterial sexually transmitted disease in the United States. 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 2008 increased to 27,987.

Figure 1. Number of Cases of *Chlamydia trachomatis*, by Gender, Tennessee, 2004-2008.

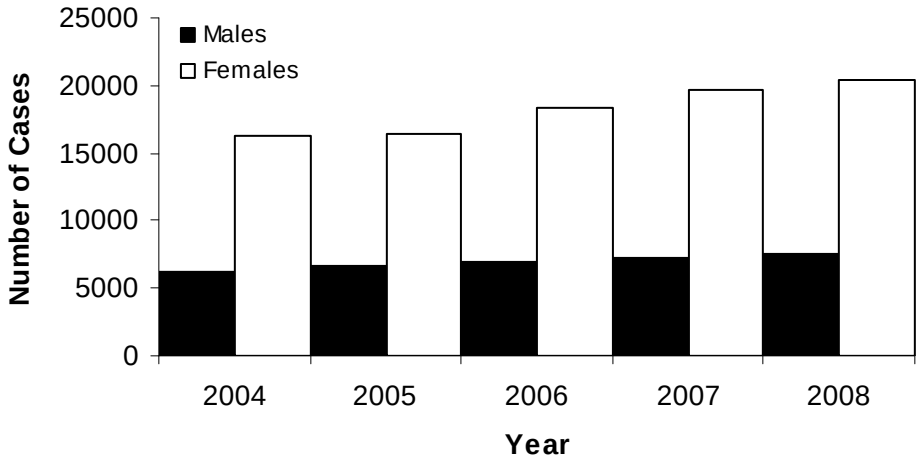
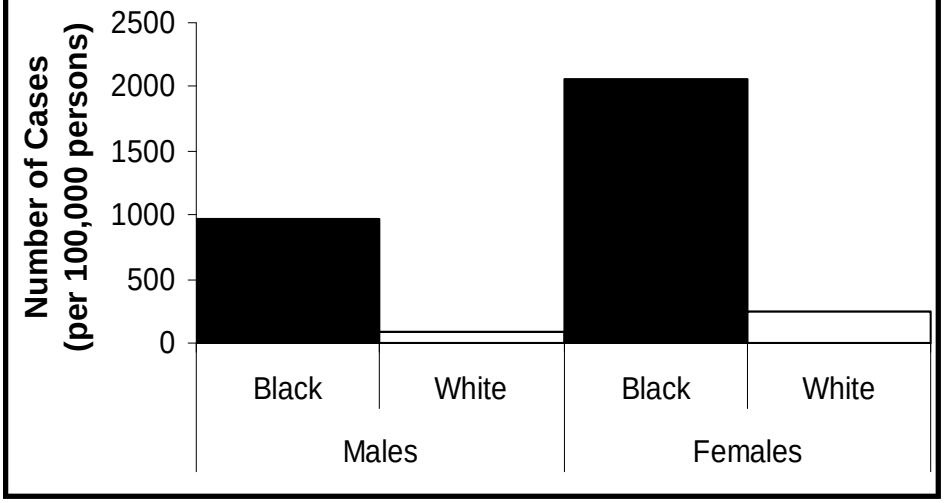


Figure 2. Incidence of *Chlamydia trachomatis*, by Gender and Race, Tennessee, 2008.



In 2008, 88% of Chlamydia morbidity occurred among patients aged 15-19 years (10,394) and 20-29 years (14,146). Females represented 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 31% among whites, while 11% had no race category identified. There were 971 cases per 100,000 population among black males and 84 cases per 100,000 population among white males with Chlamydia in 2008. There were also 2,068 cases per 100,000 population among black females and 255 cases per 100,000 population among white females with Chlamydia (**Figure 2**). Black females aged 15-19 years have the highest rate of infection with 11,030 cases per 100,000 persons. Moreover, screenings of 117,859 patients for Chlamydia in health department STD, prenatal and family planning clinics, in 2008, resulted in a range of 6% to 15% positivity rates* in metropolitan areas and 5% to 9% positivity rates in rural areas. The overall statewide screening positivity rate for Chlamydia increased

from 7% in 2002 to 9% in 2008. The increase can be attributed to more sensitive laboratory testing methods implemented in February 2003.

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

Gonorrhea

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

Figure 1. Number of Cases of *Neisseria gonorrhoeae*, by Gender, Tennessee, 2004-2008.

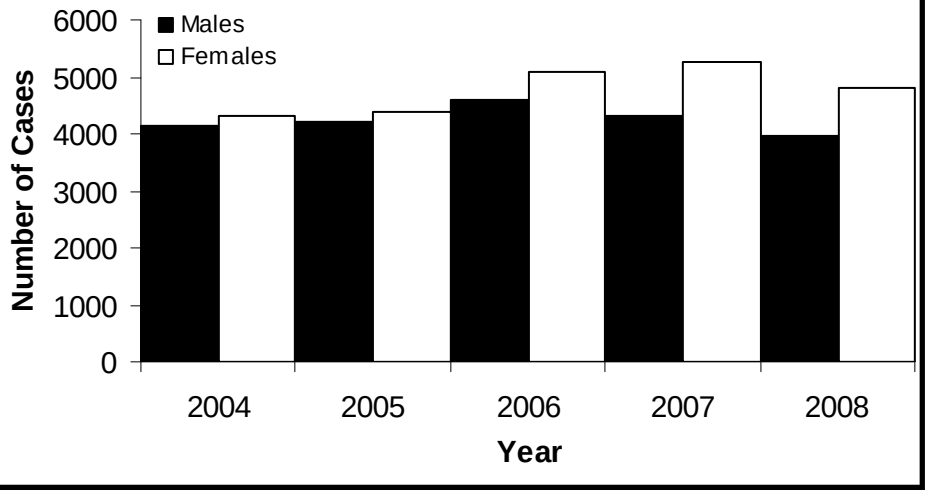
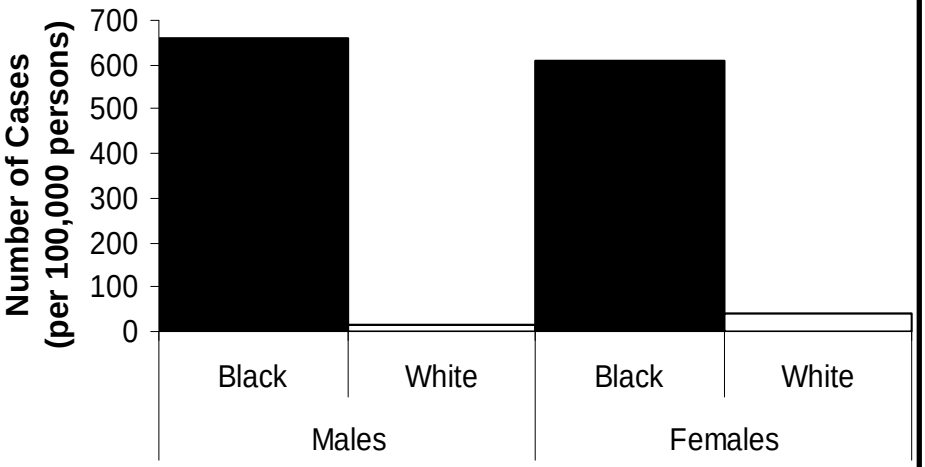


Figure 2. Incidence of *Neisseria gonorrhoeae*, by Gender and Race, Tennessee, 2008.



Following a record high of 35,362 Gonorrhea cases reported in 1976 (rate=817 cases per 100,000 persons), the number decreased by 75% to 8,758 cases in 2008 (rate=143 cases per 100,000 persons). In 2008, there were 3,966 reported cases of Gonorrhea among males and 4,792 reported cases among females (**Figure 1**). The metropolitan regions of the state have consistently accounted for 76% of the state's morbidity during this time period. In 2008, 75% of all reported cases of Gonorrhea in Tennessee were among blacks. There were 658 cases per 100,000 population among black males and 17 cases per 100,000 population among white males with Gonorrhea in 2008. There were also 607 cases per 100,000 population among black females and 41 cases per 100,000 population among white females with Gonorrhea (**Figure 2**). This is in contrast to the first half of the 1990s, when cases decreased dramatically. The decrease in reported cases has been less striking in the past few years. The overall rate of 143 per 100,000 persons was well above the *Healthy People 2010* national goal of 19.

In 2008, women aged 15-19 had higher rates of Gonorrhea (885 cases per 100,000 persons) than women aged 20-29 (564 cases per 100,000 persons). The rate of Gonorrhea in men

aged 20-29 was 478 cases per 100,000 persons in 2008. Additionally, screening approximately 117,859 patients for Gonorrhea in health department STD, prenatal and family planning clinics in 2008 detected a range of 1-9% positivity rates in metropolitan areas and 0.5-3% positivity rates in the rural areas of the state. These screening activities are directed primarily at women, particularly those aged 15-19 years.

Syphilis

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

Figure 1. Number of Cases of Early Syphilis, Tennessee, 2005-2008.

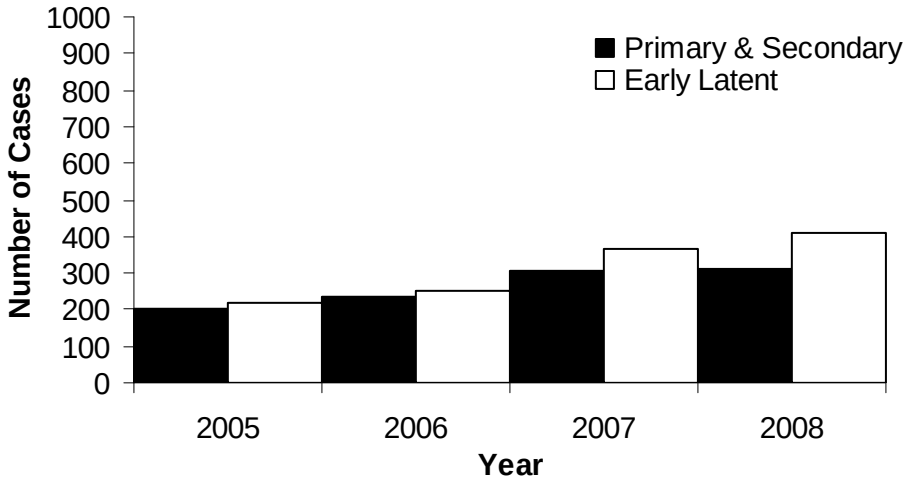
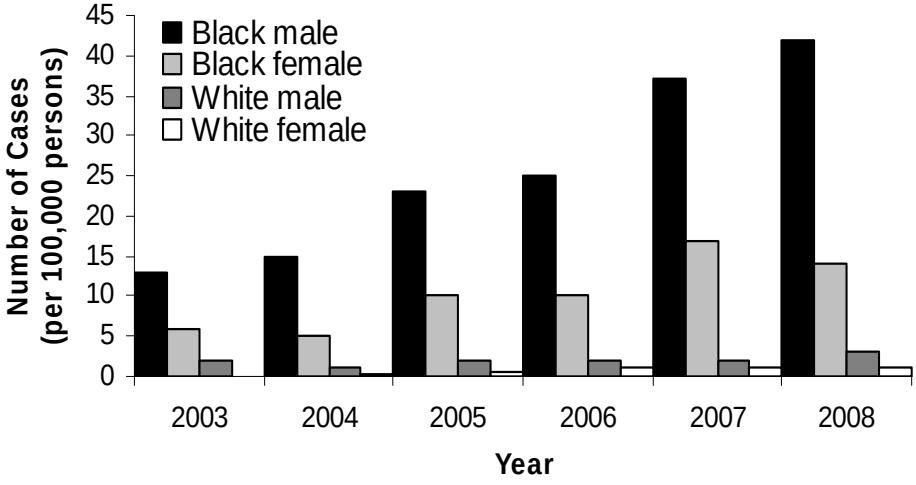


Figure 2. Incidence of Primary and Secondary Syphilis, Tennessee, 2003-2008.



Historically, most Syphilis cases in Tennessee occur in the larger metropolitan areas. The six Tennessee metropolitan regions collectively represent 41% of the state's population; however, they account for 88% of 723 cases of early Syphilis (primary, secondary and early latent) in 2008. 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 2008, two metropolitan areas, Shelby County and Davidson County, reported 379 and 121 cases, respectively, or 69% of the state's early Syphilis cases. The seven remaining rural regions comprise 59% of the state's population but accounted for only 12% of the early Syphilis cases in 2008.

In 2008, there were 723 cases of Early Syphilis (**Figure 1**).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 71% of reported early *Syphilis* cases. In 2008, the

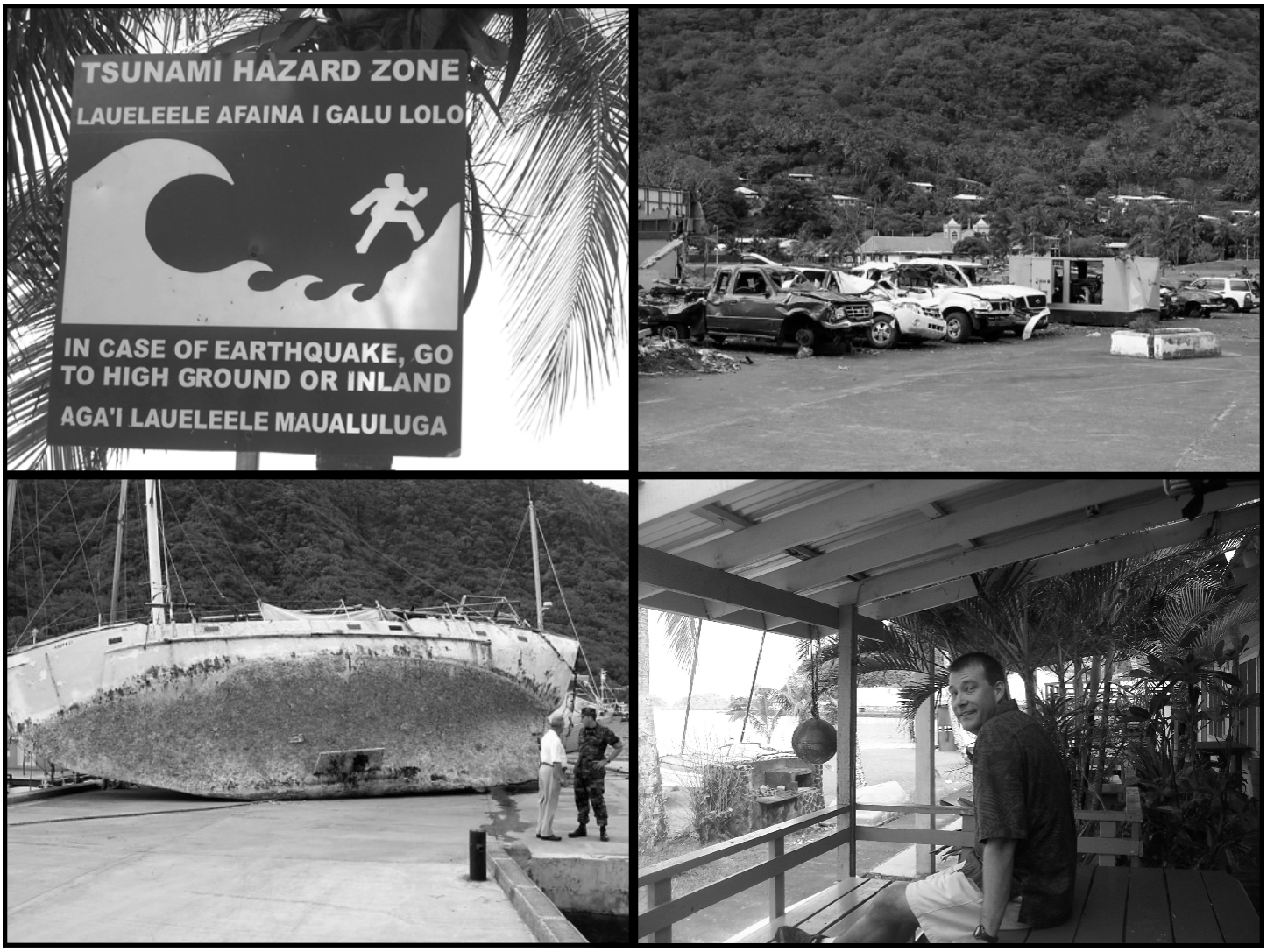
rate for early *Syphilis* within Tennessee was 12 cases per 100,000 persons; the rate for blacks was 49. When considering primary and secondary *Syphilis* only, the rate among white males was 3 cases per 100,000 population, and the rate among white females was 1 case per 100,000 population. Furthermore, the rate was 42 cases per 100,000 population among black males and 14 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 2008, the overall *Syphilis* rate was 21 cases per 100,000 persons. This represents a 30% decrease during this time frame. Among blacks, the overall *Syphilis* rate was 152 cases per 100,000 persons in 2000, and 86 cases per 100,000 persons in 2008. 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 2008, the rate for blacks aged 20-29 years had fallen to 185 cases per 100,000 persons, representing a 35% decrease. Additionally, the rate for blacks aged 30-39 years had fallen to 126 cases per 100,000 persons, representing a 60% decrease in 2008.

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 2008, the rate of *Syphilis* in Memphis among males was 92 cases per 100,000 population and for females the rate was 54 cases per 100,000 population.

In 2008, 412 cases were diagnosed with primary or secondary *Syphilis*, 311 with early latent (less than one year) *Syphilis*, 479 with late latent cases and 10 were congenital cases. Statewide, the 412 primary and secondary cases combined represent a rate of 6.7 cases per 100,000 persons. This is greater than the Healthy People 2010 national objective of 0.2 cases per 100,000 persons.

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

E. Vaccine-Preventable Diseases



Jay Roth, one of CDC's Career Epidemiology Field Officers assigned to Tennessee, was sent to American Samoa to help administer a needs assessment tool and reestablish public health surveillance following the tsunami disaster.

Source: Tennessee Department of Health.

Vaccine-Preventable Disease

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 2008.

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. The on-time

Table 1. Vaccine-Preventable Disease Morbidity, Tennessee, 2003-2008.

Disease	Pertussis	Diphtheria	Tetanus	Polio	Measles	Mumps	Rubella	Hepatitis B	*H. influenza* type b *<5 yo*
2002	82	0	0	0	0	5	0	213	8
2003	179	0	2	0	0	4	0	221	0
2004	213	0	0	0	1	3	0	153	4
2005	179	0	1	0	1	11	0	173	0
2006	75	0	1	0	1	4	0	149	0
2007	120	0	0	0	0	4	0	155	1

Table 2. Immunization Survey Results, Tennessee, 2007.

Survey	Immunization Level
24-Month-Old Children*	82.32%
Day Care Center Enrollees**	94.71%
Public Kindergarten Survey**	96.94%
Private Kindergarten Survey**	85.35%

* "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) is also reported. 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 2008 surveys are presented below (**Figures 1-3**).

Findings from the 2008 Survey

The 2008 survey identifies certain characteristics of children at increased risk of not completing immunizations.

Principally, those are:

1. Beginning immunizations at greater than 120 days of life;
2. Having two or more living siblings at birth; and
3. Being identified as African-American.

The key findings of the 2008 survey include:

The 4:3:1:3:3:1 on-time level remained stable at 82.3%.

A. 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 86%.

B. The patient population vaccinated at health departments versus those

Figure 1. 2008 Tennessee Immunization Status Survey of 24-Month-Old Children: Percent with Age-Appropriate Immunization Levels by Vaccine.

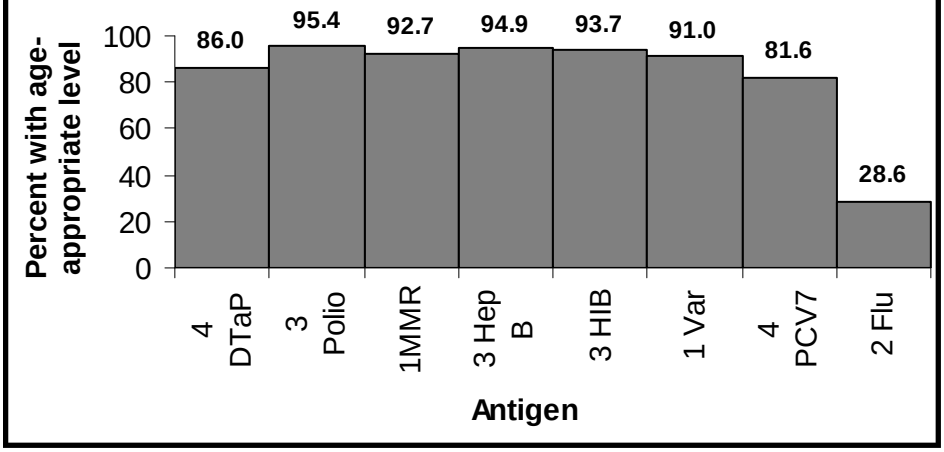


Figure 2. 2008 Tennessee Immunization Status Survey of 24-Month-Old Children: "4:3:1" and "4:3:1:3:3:1" Percent Immunized on Time: 2000 to 2008.

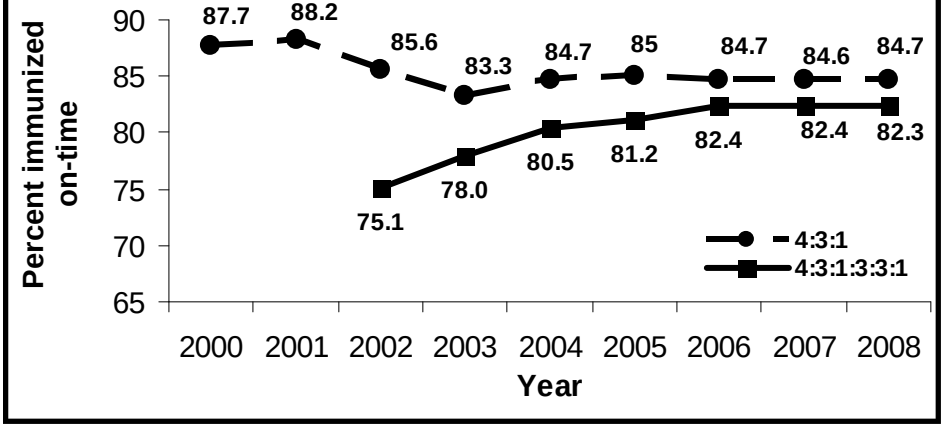
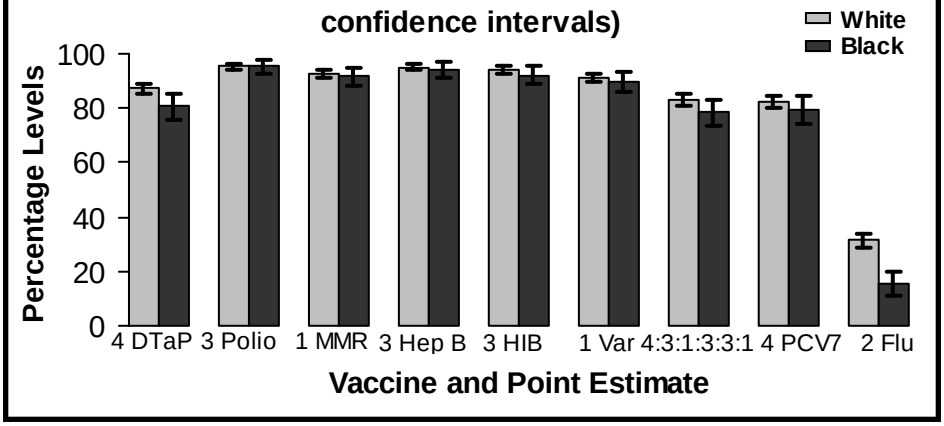


Figure 3. 2008 Immunization Status of 24-Month-Old Children in Tennessee: Statewide percentage of children with age-appropriate immunization levels by vaccine and race (point estimates and 95% confidence intervals)



vaccinated by private providers 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.

C. Although both TennCare and WIC children surveyed were less likely to be immunized on time than counterparts who were never enrolled, these estimates did not reach statistical significance. A large and significant difference was detected in immunization against influenza: children in both TennCare and WIC were less well immunized against influenza.

D. The disparity measured between black and white children in on-time immunization for the 4:3:1:3:3:1 series, which has fluctuated over the last decade, narrowed from 8.3 percentage points in 2007 to 4.9 percentage points in 2008, and was no longer statistically significant. Among the individual vaccines in the series, the greatest difference measured was in completion of the 4th DTaP, consistent with 2007 results; however the difference in 2008 fell short of statistical significance.

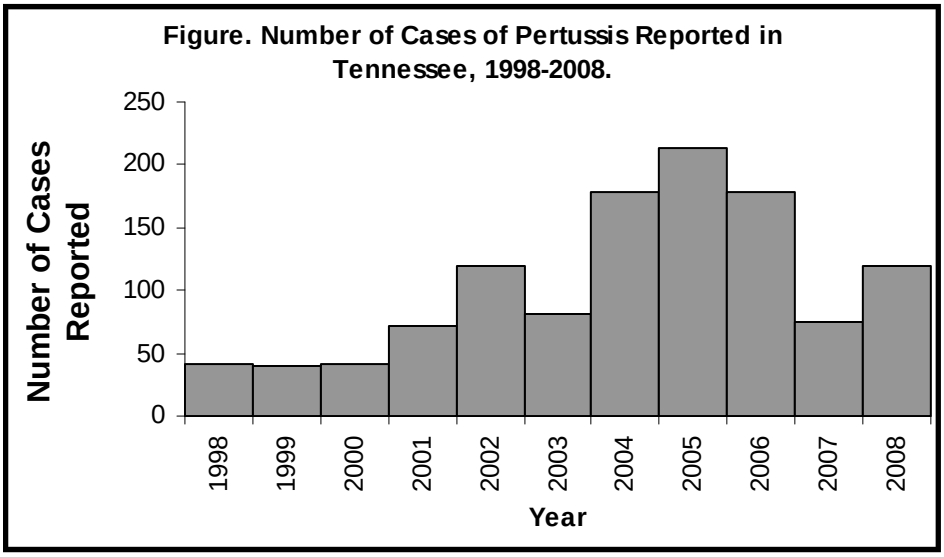
E. Although on-time vaccination with at least two doses of influenza showed a 55% increase in one year (18.4% in 2007 to 28.6% in 2008), it was the lowest measured. A pronounced racial disparity in uptake of this vaccine persists and large regional disparities in coverage were measured (range, 52.1% coverage in Sullivan County to 9.2% coverage in West Tennessee Region). The flu and PCV7 vaccines 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 http://www.cdc.gov/vaccines/recs/schedules/child-schedule.htm. 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.

Figure. Number of Cases of Pertussis Reported in Tennessee, 1998-2008.



Infants are at greatest risk for 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, and 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 1998 to 2008 in Tennessee.

In recent years, studies of outbreaks of pertussis have identified older children, adolescents and adults as sources of pertussis infection. In the adolescent and adult populations, diagnosis may be more difficult as the symptoms of the disease are milder and not necessarily recognized as pertussis. 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 the bacterium *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.

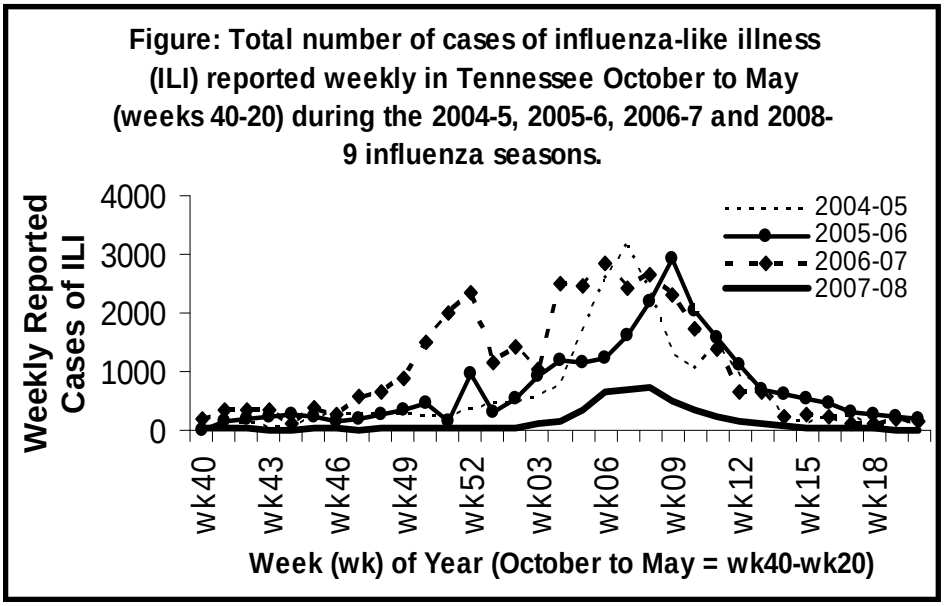
Complications of tetanus include the following: laryngospasms; fractures of the long bones; hyperactivity of the autonomic nervous system; secondary infections, such as sepsis, pneumonia, decubitus ulcers (due to long hospitalizations, in-dwelling catheters, etc.) and aspiration pneumonias. The fatality 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 4 tetanus cases have been reported since 2003. 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 2004-5, 2005-6, 2006-7 and 2008-9 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 2003 through spring 2008. The timing and height of the peak week of influenza activity varies; influenza typically peaks in late January or early February in Tennessee.

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	

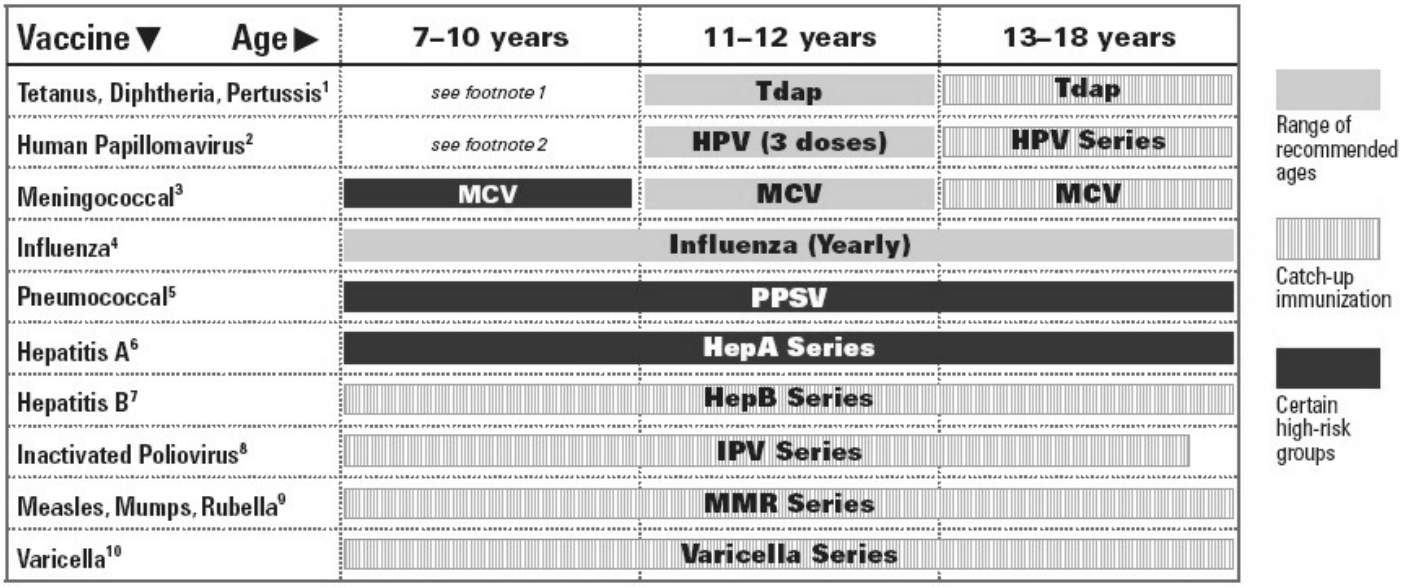
Range of recommended ages

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

Drs. Abelardo Moncayo and L. Rand Carpenter enjoy some downtime before competing in the Columbia Cycling Club's Annual 15K Trail Run at Chickasaw Trace Park in Columbia.

Source: Tennessee Department of Health.

Arboviral Diseases

La Crosse Encephalitis (LAC)

La Crosse encephalitis (LAC) virus is the most medically significant of all the California sero-group viruses reported in the United States. The virus was initially discovered in 1963 in La Crosse, Wisconsin. The traditional endemic foci of the disease have been in the Great-Lake states, but an increase in case incidence has been detected in the Mid-Atlantic States in recent years. **Figure 1** depicts the states that reported cases with case counts from 1964-2008. Five of the eight states bordering Tennessee typically report La Crosse encephalitis cases. These include: Kentucky, Virginia, North Carolina, Georgia, and Mississippi. La Crosse encephalitis is the leading cause of pediatric arboviral encephalitis and is considered an emerging disease in Tennessee.

In 2002, 164 cases of La Crosse encephalitis were reported from 16 states, representing the most reported to CDC in any year since 1964. Due to the similarity of symptoms between LAC and West Nile virus, this increase in cases is likely due to increased encephalitis surveillance in the United States (MMWR 2003, 51:53). In Tennessee from 1998-2008, there have been 127 cases reported with a median of 13 cases per year (average: 12; range: 2-19) (**Table 1**). Six cases were reported in 2008. Incidence rates have ranged from 0.02-0.06 per 100,000 population in the United States (1998-2008) and 0.03-0.33 per 100,000 population in Tennessee (1998-2008). Since it has been reportable, the mildest years for the disease have been in 1999 and in 2005 nationwide and in Tennessee. The incidence rates among Tennesseans are higher than the incidence rates of the US population (**Table 1**). Incidence rates in Tennessee have remained relatively consistent since 1998, 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**).

Traditionally, *Ochlerotatus triseriatus* (eastern treehole mosquito) is the primary vector of LAC but in recent years *Aedes albopictus* (Asian tiger mosquito) have been associated with LAC en-

Figure 1. Human California Serogroup Viral Encephalitis Cases, by State, 1964-2008.

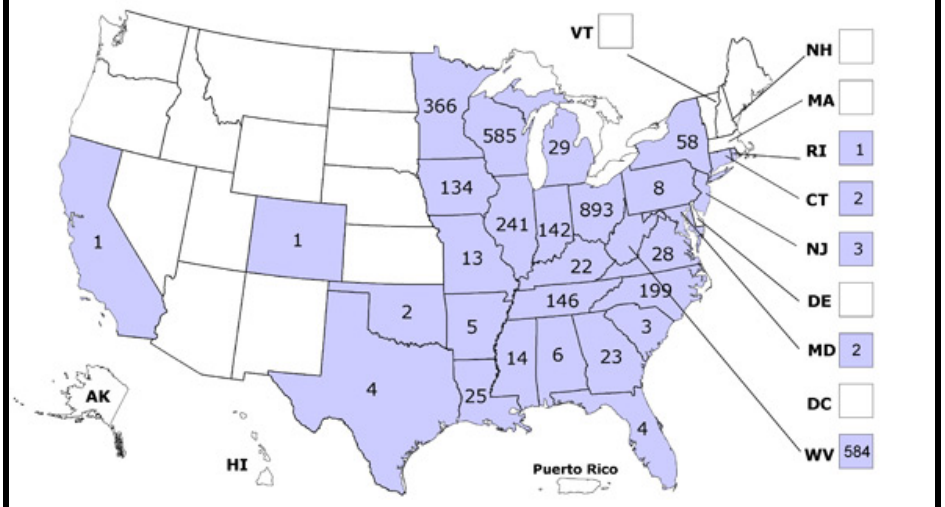


Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of La Crosse Encephalitis, by Year, Tennessee and the United States, 1999-2008.

	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	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	6	0.10
US	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	53	0.02

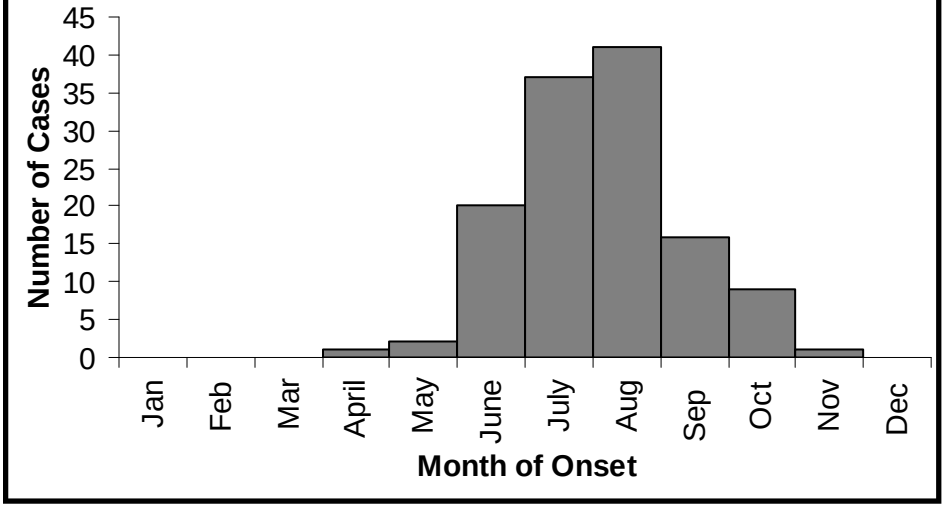
IR=Incidence Rate

NA= Notifiable Diseases is not compiled

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of La Crosse Encephalitis, by Age Group, Tennessee, 2003-2008.

	<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
TN (2008)	1	1.25	0	0.00	4	0.49	0	0.00	0	0.00	1	0.05	0	0.00

Figure 2. Distribution of La Crosse Encephalitis Cases, by Month of Onset, Tennessee, 1998-2008.



cephalitis cases in eastern Tennessee. The dramatic increase in LAC cases in Tennessee since 1996 has coincided with the arrival of *Aedes albopictus* in the eastern Tennessee region suggesting that this mosquito may be an important vector potentially increasing the number of human cases in endemic foci or expanding the range of the disease.

La Crosse virus can result in mild to severe infections with rare fatalities (CFR <1%). The ratio of unapparent 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 (**Table 2**). Although deaths are rarely associated with this disease, Tennessee reported a death of a child aged <5 years in 2003.

Those at increased risk for the disease include children <16 years old that are active outdoors and persons who reside in woodland habitats with numerous natural (tree holes) and artificial (tires, gutters etc.) containers present capable of supporting *Oc. triseriatus* or *Ae. albopictus* populations. 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 reduction in breeding sites.

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

Malaria

Malaria is a mosquito-borne disease caused by a parasite. Persons 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 2008, there have been 178 cases of malaria reported in Tennessee. None of these infections are thought to have been acquired locally but rather have been imported (i.e., U.S. born persons traveling to malaria endemic regions or foreign born persons coming from these regions to the U.S). Although 27 counties have reported cases, most of these have been from Davidson (31%) and Shelby (16%) counties, which have large populations that are more likely to travel abroad. Tennessee averages about 12 cases of malaria per year (**Table 1**), which is comparable to other vector-borne diseases in the state such as La Crosse and West Nile encephalitis. In 2008, sixteen cases of Malaria were reported in Tennessee. Malaria is reported in all age groups in Tennessee (**Table 2**) and most are susceptible when traveling. In the United States there have been 13,594 cases of malaria from 1995-2004, almost 1% of these from Tennessee. Of the approximately 1300 cases of malaria per year diagnosed in the United States, about 73% are from U.S. nationals and 27% are foreign-born. Almost 70% of all U.S. reported malaria cases have a travel history to continental Africa. Occasionally small outbreaks of malaria continue to occur in the United States due to the presence of *Anopheles* mosquitoes here, which may come in contact with travelers from a malaria endemic region. This has been referred to as "airport" malaria. Even though malaria has been eliminated from the United States, it continues to be a public health concern due the potential of re-introduction. Even without established transmission zones of malaria, we still see large numbers of cases annually. Travelers should take the appropriate precautions when traveling to areas with malaria.

The CDC recommends the following:

Visit your health care provider 4-6 weeks before foreign travel for any necessary vaccinations, as well as a prescription for an antimalarial drug, if needed. (There are no vaccines against malaria).

- Take your antimalarial drug exactly on schedule without missing doses.
- Wear insect repellent to prevent

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of Malaria, by Year, Tennessee and the United States, 1999-2008.

Year		TN	US	Year		TN	US
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	1528
	IR	0.33	0.50		IR	0.23	0.52
2001	No.	14	1383	2006	No.	9	1564
	IR	0.30	0.49		IR	0.15	0.52
2002	No.	15	1337	2007	No.	19	1505
	IR	0.26	0.46		IR	0.31	0.50
2003	No.	4	1278	2008	No.	16	NA
	IR	0.24	0.44		IR	0.26	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, 2008.

<1 year		1-4 years		5-14 years		15-24 years		25-39 years		40-64 years		>65 years	
#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
0	0.00	0	0.00	2	0.24	1	0.12	6	0.48	7	0.34	0	0.00

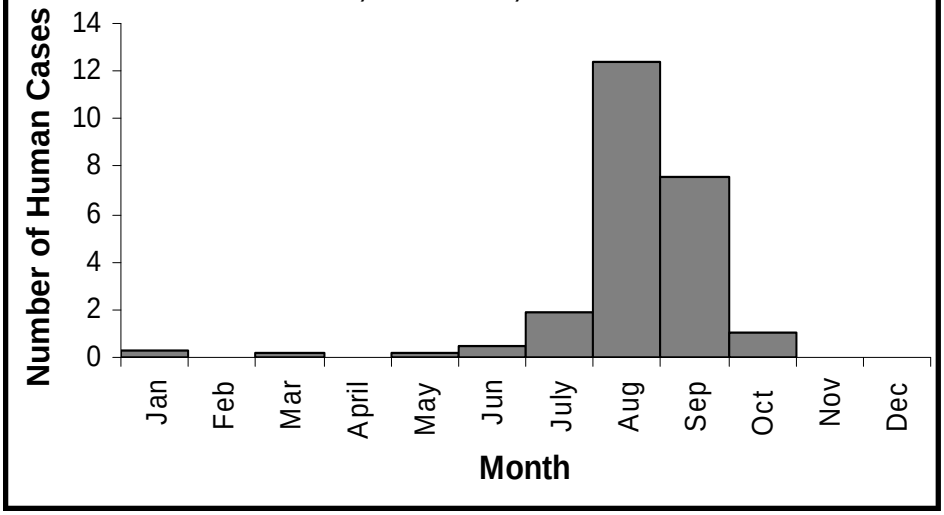
mosquito and other insect bites. Your insect repellent should contain DEET as its active ingredient. To prevent malaria, wear insect repellent if out of doors between dusk and dawn when the mosquito that transmits malaria is biting.

- Wear long pants and long-sleeved clothing.
- Sleep under a mosquito bed net (preferably one that has been treated with insecticide) if you are not living in screened or air-conditioned housing.

West Nile Fever/Encephalitis

The natural transmission cycle of West Nile virus (WNV) involves birds and mosquitoes that feed on birds. When the virus increases in the bird population as the summer progresses, there is an increased risk that mosquitoes that feed on mammals and birds will be infected with WNV. These opportunistic mosquitoes are more likely to transmit the virus to the human and equine population. Humans and horses are referred to as dead-end hosts because they do not re-infect subsequent feeding mosquitoes.

Figure 1. Distribution of West Nile Human Cases, by Month, Tennessee, 2002-2008.



Tennessee reported 19 cases in 2008. Although cases have gone down since 2002 (56 cases) and 2003 (26 cases), they continue to occur every year. Cases are found throughout the state but are mainly focused in Shelby County with 12/14 cases in 2004, 13/18 cases in 2005, 15/22 cases in 2006, 5/11 cases in 2007 and 10/19 cases in 2008. The epidemic curve for human cases occurs from late July through early October with peaks in August and September, which coincides with the primary mosquito vector activity **(Figure 1)**.

The first reported case of WNV infection in a horse occurred in 2001 (1 case) and then in 2002 and 2003 there were 141 and 103 horse cases reported, respectively. In 2004 there were 17 horse cases that were scattered throughout the state. From 2005-2008 there were 4-8 horse cases annually. This difference is most likely due to increase in awareness of the need for vaccinating horses in 2004-2008.

The incidence rate of WNV infection in Tennessee (0.97/100,000 population) and the US (1.06/100,000 population) were comparable **(Table 1)** during 2002, the largest outbreak year in Tennessee. Since 2002, infection rates in Tennessee have been going down and have always been lower than the national average infection rate. The infection rate in 2007 went down to 0.18/100,000, most likely due to extreme drought conditions experienced that year **(Table 2)**. In 2008, 19 human WNV cases were reported.. From 2003 to 2008, the rate of disease in various age groups has followed a consistent pattern of progressively increasing such that the highest rates are always seen in people 65 years of age and older. About 50% percent of the cases in 2004-8 were in people over the age of 65. Over 80 % of cases were in people over 40. In 2005, 15/18 cases had meningoencephalitis and 3/18 had WNV fever. In cases from 2004-8, over 30% of cases oc-

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		2008	
	#	Rate	#	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	19	0.31
US Total	310	1.06	969	3.30	241	0.82	290	0.98	426	1.43	3630	1.21	1356	0.45

*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, 2003-2008.

	<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
2003	0	0.00	0	0.00	0	0.00	1	0.12	3	0.24	8	0.43	14	1.93
2004	0	0.00	0	0.00	0	0.00	0	0.00	2	0.16	5	0.26	7	0.95
2005	0	0.00	0	0.00	0	0.00	1	0.12	2	0.16	6	0.31	8	1.08
2006	0	0.00	0	0.00	0	0.00	1	0.12	2	0.16	8	0.40	11	1.46
2007	0	0.00	0	0.00	0	0.00	1	0.12	3	0.24	3	0.15	4	0.52
2008	0	0.00	0	0.00	2	0.24	0	0.00	1	0.08	9	0.44	7	0.89

*One Fatality in 2003, 2005 and 2008.

curred in Africa Americans.

In 2002, the blood industry discovered that the virus could be spread by blood donations. Blood banks developed diagnostic tools to test every blood donation to ensure the nations' blood supply remained safe. Through this screening process, WNV infected blood donors were identified and reported to state health departments. Three Tennesseans were identified as West Nile virus positive blood donors, through this system. One blood donor did develop disease symptoms and was subsequently identified as a case and the other two blood donors did not develop West Nile virus symptoms.

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

Tickborne Diseases

Ehrlichiosis

Human ehrlichiosis is an emerging tickborne disease that became nationally notifiable in 1999, although Tennessee has been tracking cases since 1996. As with many other arboviral diseases, human ehrlichiosis is probably underreported. Since the discovery of ehrlichiosis in the United States, two strains of human ehrlichiosis have been identified (**Table 1**). These include human monocytic ehrlichiosis (HME) and human granulocytic 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 on-

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

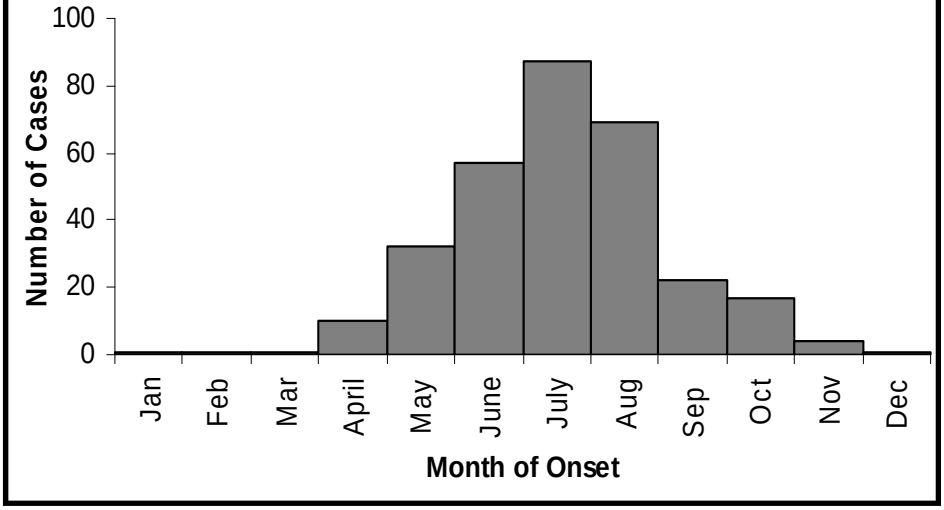
Disease	Human Monocytic Ehrlichiosis	Human Granulocytic Anaplasmosis
Fatality Rate	2-5%	7-10%
Year Discovered	1987	1994
Etiologic Agent	*Ehrlichia chaffeensis*	*Anaplasma phagocytophilum*
Tick Vector	*Amblyomma americanum* (Lone Star Tick), *Dermacentor variabalis* (American Dog Tick)	*Ixodes scapularis* (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, 2003-2008.

	<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
2003	0	0.00	1	0.32	2	0.25	1	0.12	6	0.48	12	0.64	9	1.41
2004	0	0.00	0	0.00	0	0.00	1	0.12	5	0.40	9	0.47	5	0.69
2005	0	0.00	1	0.33	2	0.25	1	0.12	2	0.16	9	0.46	9	1.21
2006	0	0.00	0	0.00	2	0.25	1	0.12	5	0.41	6	0.30	14	1.85
2007	0	0.00	1	0.31	1	0.12	1	0.12	5	0.40	11	0.55	7	0.91
2008	0	0.00	2	0.62	0	0.00	5	0.60	10	0.81	47	2.32	28	3.57

set of high fever, severe headache, myalgia, rigors, and 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 40 years and 87% over the age of 25 years (**Table 2**). The case distribution is 55% for male and 45% for female. Most cases are reported from middle and west Tennessee. In 2008 there was a 243% increase in the number of cases of ehrlichiosis reported in the state, illustrating the importance of this tick-borne disease in Tennessee. Increases in human incidence are caused by multiple factors including climate and tick survival. .

Figure 1. Distribution of HME Cases, by Month of Onset, Tennessee, 1998-2008.



Increased incidence in Tennessee occurs 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 and in 2008 it was 1.56/100,000.

Table 3. Reported Cases and Incidence Rates (per 100,000 persons) of Human Monocytic Ehrlichiosis, by Year, Tennessee and the United States, 2001-2008.

	2001		2002		2003		2004		2005		2006		2007		2008	
	No.	IR	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	95	1.56
US	142	0.05	216	0.08	321	0.11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA= Notifiable Diseases is not compiled IR= Incidence Rate

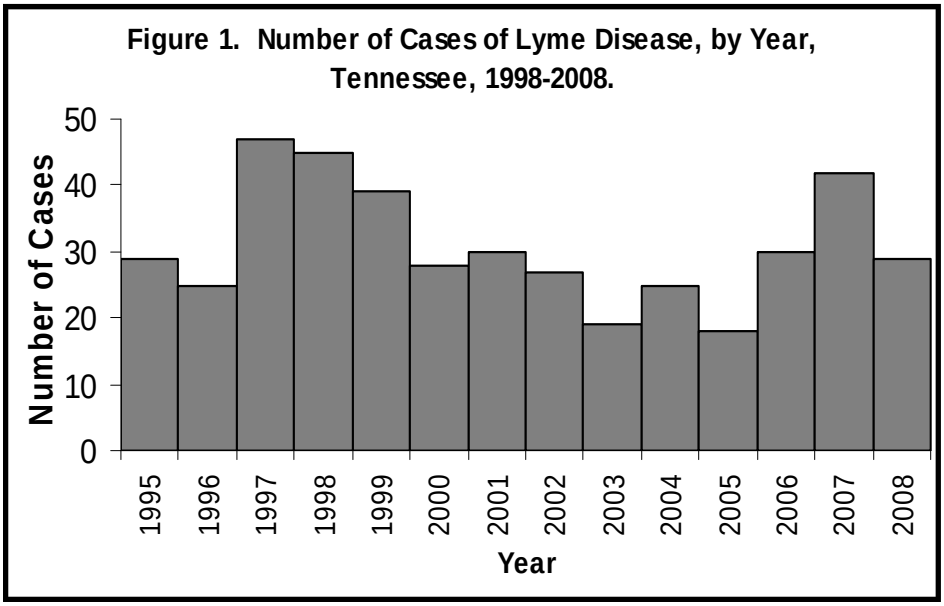
Lyme Disease and "Southern Tick Associated Rash Illness"

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 mouth into the skin of a host and slowly ingesting 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 (range, 3-30 days). Neurologic symptoms and long-term sequelae such as arthritis have also been associated with Lyme disease.

Figure 1. Number of Cases of Lyme Disease, by Year, Tennessee, 1998-2008.



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. In 2008, 29 cases of Lyme disease were reported in Tennessee. A new case definition for Lyme disease was implemented in 2008 emphasizing the importance of travel history documentation and two-tiered laboratory testing for confirming cases.

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 rash of Lyme disease, at the site of a tick bite. Symptoms can include generalized fatigue, headache, stiff neck, fever and other non-specific symptoms. STARI should be considered in patients with localized rash, history of tick exposure, and absence of antibodies to *B. burgdorferi* using standard serologic Lyme disease methods. Symptoms resolve quickly with antibiotic therapy. STARI patients do not normally experience disseminated disease

or long-term sequelae.

The lone star tick (*Amblyomma americanum),* the most abundant tick species in Tennessee, is the suspected vector of STARI. A new 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 prevalence 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 the Vector-Borne Disease Section at CEDS.

Rocky Mountain Spotted Fever

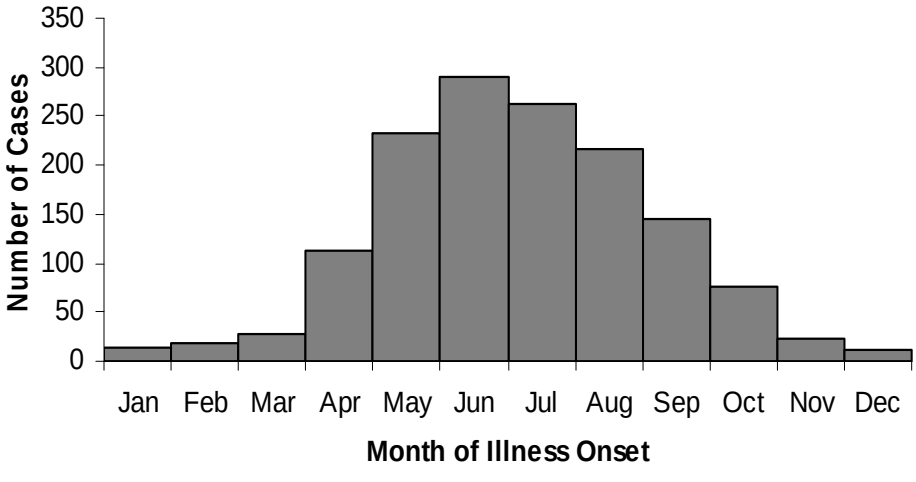
Rocky Mountain Spotted Fever (RMSF) is a tick-borne human disease caused by *Rickettsia rickettsii*. It is the most frequently reported tick-borne rickettsial disease in the United States and is likely underreported. There are approximately 22 rickettsial species found world wide, although only 7 are 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 of 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 habitat with ticks; only 1-3% of the ticks carry the pathogen. In addition, prolonged tick attachment is required for transmission. Ticks are considered the vector and the reservoir of the pathogen. Maintenance of the pathogen in nature is remarkably efficient and maintained by 3 independent transmission methods: horizontal transmission from an infected rodent to a feeding tick, which will remain infected for life; transovarial transmission from a female tick to the offspring; and venereal transmission of the pathogen from male to female during the mating process.

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

Year		TN	US	Year		TN	US
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
2003	No.	74	1091	2008	No.	232	3.80
	IR	1.27	0.38		IR	NA	NA

NA= Notifiable Diseases is not compiled IR= Incidence Rate

Figure 1. Distribution of Rocky Mountain Spotted Fever Cases by Month of Illness Onset, Tennessee, 1996-2008.



From 1997 to 2002, Tennessee reported 8% of the RMSF cases in the nation; 56% of the cases in the United States were reported from Tennessee, North Carolina, South Carolina,

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of Rocky Mountain Spotted Fever, by Age Group, Tennessee, 2003-2008.

	<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
2003	0	0.00	3	0.97	6	0.75	3	0.37	15	1.21	37	1.97	9	1.41
2004	0	0.00	3	0.96	10	1.24	6	0.74	24	1.93	40	2.08	15	2.07
2005	0	0.00	1	0.33	21	2.59	17	2.08	24	1.95	56	2.85	19	2.56
2006	1	1.25	7	8.73	30	3.69	20	2.43	54	4.38	97	4.89	49	6.49
2007	0	0.00	7	2.19	18	2.20	21	2.54	38	3.08	80	3.99	22	2.86
2008	0	0.00	12	0.62	20	0.00	31	0.60	42	0.81	97	2.32	33	3.57

Oklahoma, and Arkansas. From 1995 to the present, the overall incidence rate in Tennessee has been consistently higher than the national incidence rate (**Table 1**). Within the past decade, there has been a dramatic rise in RMSF incidence in Tennessee and surrounding states, which could be attributed to many factors such as increased patient testing and reporting. The incidence in Tennessee increased by 42% from 2004 to 2005 and by 63% from 2005 to 2006. In 2007, there was a 28% decrease in RMSF in TN. In 2007, Tennessee experienced extreme drought and heat conditions which may have reduced the contact between humans and ticks. However in 2008 there was a 126% increase in the number of RMSF cases compared to 2007. In 2008 the state experienced normal rainfall, which enhances tick survival in general. Incidence rates increase in age groups over 25 years and peak in the 40-64 year old age groups (**Table 2**). Transmission can occur all year long in Tennessee, although the majority of cases are generally reported between April and September (**Figure 1**).

The incubation period 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 ankles and 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 regarding 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 exposure to tick-infested habitats can prevent illness.

G. Tuberculosis

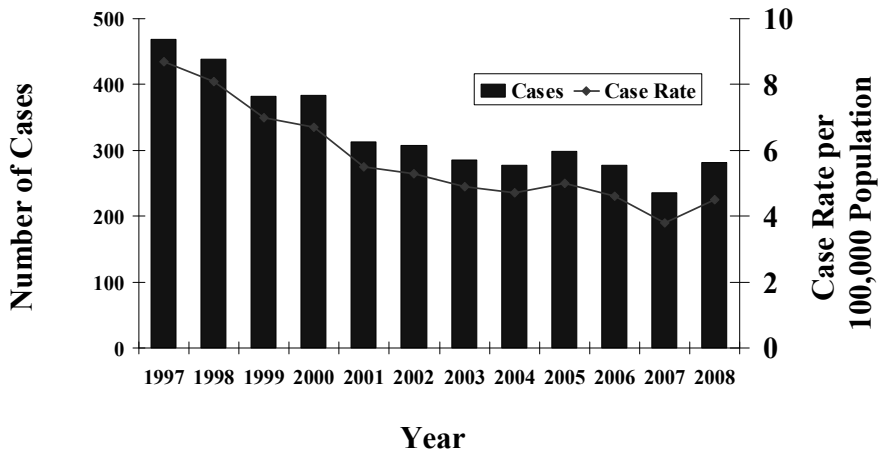
Central Office staff get together to take a photo to include in a holiday package of goodies for Captain Dan Schoelles, serving active duty military in Jalrez Valley near Wardak, Afghanistan. Jalrez Valley has long been one of the top safe havens in Afghanistan.

Source: Tennessee Department of Health.

Tuberculosis Elimination Program

Tennessee reported 282 cases of tuberculosis (TB) in 2008, which represented an increase of 20% compared with the 235 TB cases reported in 2007. The tuberculosis case rate for Tennessee for 2008 was 4.5 cases per 100,000 population, which is an increase from 3.8 cases per 100,000 population in 2007. In 2008, Tennessee's two largest metropolitan areas had the highest incidence of TB disease in the state: Memphis/Shelby County reported 88 cases (case rate 9.7 per 100,000 population) and Nashville/Davidson County reported 77 cases (case rate 12.3 per 100,000 population). The number of TB cases has been generally declining over time, as illustrated in **Figure 1**, and the significance of the increase in 2008 is not known yet. The increase in TB cases in 2008 may be attributed to increased efforts to identify cases of tuberculosis in the community, increased incidence of active TB disease, or both.

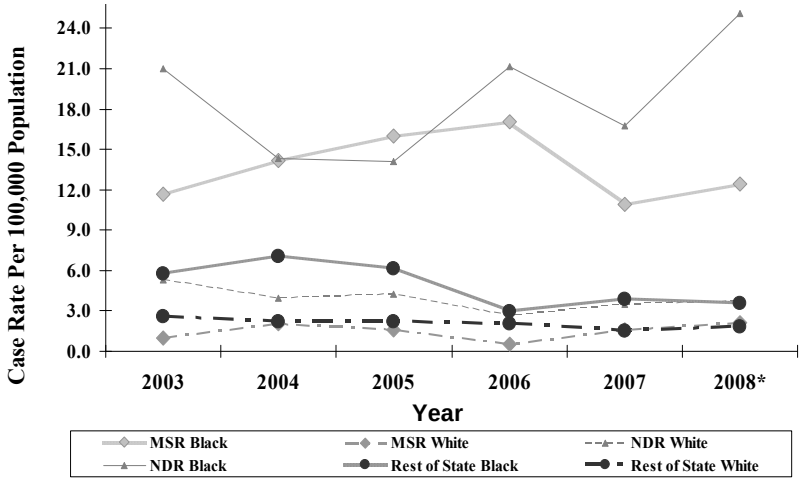
Figure 1. Number of Tuberculosis Cases, Tennessee, 1997-2008.



Racial and Ethnic Distribution

In 2008, using self-reported information from the patients, Tennessee reported 41% of TB cases as black non-Hispanic, 34% as white non-Hispanic, 9% as Asian/Pacific Islander, and 15% as Hispanic of any race; in 2007, the racial and ethnic distribution was nearly identical. A slight increase in TB cases among Asian/Pacific Islanders (from 8% in 2007) in Tennessee may correspond with a national increase of TB in this population. Among the 115 black non-Hispanic cases reported in 2008, 58 (50%) were from Memphis/Shelby County and 42 (37%) were from Nashville/Davidson County. Among the U.S.-born cases in 2008, the case rate of black, non-Hispanics in Memphis/Shelby County was 12.4 cases per 100,000 population compared with 2.1 for white non-Hispanics; Nashville/Davidson County had a black, non-Hispanic case rate of 25.1 cases per 100,000 population compared with 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 metropoli-

Figure 2. Estimates of U.S. Born Non-Hispanic White and Non-Hispanic Black Tuberculosis Case Rates, Memphis/ Shelby County (MSR), Nashville/Davidson County (NDR) and the Rest of the State of Tennessee, 2003-2008.



Population estimates are from the US Census Data
*Case rate calculated using 2007 population estimate

tan areas than the case rates for white non-Hispanic residents during the past five years. Elimination of the unacceptable racial disparity in TB incidence between whites and blacks, especially in Tennessee's largest metropolitan areas, remains a top priority of the TB Elimination Program.

TB Genotyping Program

Since 2005, the TB Elimination Program has used a laboratory technique called genotyping, or "DNA fingerprinting," to identify potential clusters of TB cases caused by a recent TB transmission. By identifying TB clusters, investigations and interventions can be conducted to interrupt further transmission of TB.

Tennessee is using genotyping for TB control by monitoring the percentage of clustered cases in the state. CDC defines a genotype cluster as "two or more *M. tuberculosis* isolates that share the same genotype." The most basic indicator of recent transmission is the percentage of cases that are clustered compared to the percentage that are not clustered. 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. The percentage of cases that are clustered gives the TB program an estimate of the amount of recent 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 is now monitoring the total clustering percentage in the state; more specifically, comparing that of the U.S.-born vs. foreign-born cases in order to determine any changes in transmission patterns. Clustering percentages for TN TB cases reported between 2004 and 2008 can be found in the **Table**.

Table. TB Clustering Percentages Tennessee & the United States, 2004-2008.

Categories	Case Counts	
	2004 - 2005	2004 - 2008
# of Reported Cases in TIMS	576	1,372
Total # of Submissions	401	952
# of Clustered Isolates	201	560
Tennessee Clustering Percentage	50%	59%
# of US-born Submissions	323	727
# of US-born Clustered isolates	189	500
US-Born Clustering Percentage	59%	69%
# of Foreign-Born Submissions	78	225
# of Foreign-Born Clustered Isolates	12	92
Foreign-born Clustering Percentage	15%	41%

† TIMS: Tuberculosis Information Management System

‡ Submission: Verified case of Tuberculosis submitted for genotyping

The Centers for Disease Control and Prevention (CDC) has developed a new TB Genotyping Information Management System (TB-GIMS) to store and manage genotyping data. TB-GIMS is expected to be very useful in improving access to and dissemination of genotyping information nationwide. Tennessee will be one of the states to pilot this new system with full implementation expected in 2010.

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 at least 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 2008, Tennessee reported one initial MDR-TB cases, with no reported case of acquired MDR-

TB. This compares to five initial MDR-TB cases reported in 2007. Although reports of MDR-TB are uncommon in Tennessee, nine cases of initial MDR-TB have been reported since 2003 (1 case in 2003, 2 cases in 2005, 5 cases in 2007, and 1 case in 2008). Tennessee also reported two cases of acquired MDR-TB, one case in 2001 and one in 2002. A significant function of the TB Elimination Program is to closely monitor the anti-TB therapy of all TB cases to prevent development of acquired MDR-TB.

Section IV.

Environmental Health

David Borowski and Joseph George celebrate Arbor Day by planting a tree behind the Cordell Hull Building in Nashville.

Source: Tennessee Department of Health.

Environmental Epidemiology Program

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). The Public Health Emergency Preparedness Cooperative Agreement funds two positions.

EEP had a busy 2008 responding to environmental public health questions and ending with a bang with the TVA Kingston Fossil Plant coal ash release just before Christmas.

EEP published eight 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 seven short reports called Technical Assists to document our smaller projects and responses.

In January 2008, EEP welcomed a new staff member. Joseph George is a professional geologist with an MS from Southern Illinois University. Joe came to EEP with experience in the private sector, working with environmental hazardous waste sites.

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 website.

Environmental Epidemiology Program

EEP began its long-term goal of environmental public health tracking with two projects. We began an air quality study in which we are correlating hospitalization rates for asthma with levels of PM2.5 and ozone in metropolitan areas. This has been done in New York City and a few other areas. We are using this study to refine our methodology to assist the Department with its asthma reduction efforts.

EEP was a working member of the State of Tennessee Asthma Task Force. We worked with Maternal and Child Health and the Office of Policy, Planning, and Assessment in developing the Surveillance and Epidemiology objectives and strategies for the State Asthma Plan.

EEP worked with the regional environmental epidemiologists to give out free radon kits at the local health departments. The Department of Environment and Conservation analyzed the kits and shared the results with EEP. EEP then mapped the results by county and zip code, creating maps that showed areas of the state with the highest likelihood of having homes with radon levels greater than the recommended maximum of 4 picocuries per liter of air.

EEP examined the relationship between indoor radon levels (in pCi/L) and lung cancer mortality rates per 100,000 for males and for females, averaged over the years 2001 through 2005. The main questions of interest were to determine how lung cancer mortality and indoor radon levels are related and to determine if there is a geographical factor in the relationship between east, middle, and west Tennessee.

Based on data from 2001 through 2005, there does not appear to be a significant relationship between lung cancer mortality in males or females and average indoor radon level. Furthermore, there does not appear to be a geographical factor when looking at lung cancer mortality rates by gender. However, there is a geographical factor

when looking at average indoor radon levels with eastern and middle Tennessee being much higher than west Tennessee. Benefits of this project include improved, targeted education regarding radon testing in eastern and middle Tennessee.

Health Consultations and Exposure Investigations

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

May Oil — Giles County

The Tennessee Department of Environment and Conservation (TDEC), Division of Underground Storage Tanks contacted EEP about vapors in the basement of a Giles County church. These vapors were believed to have originated from contaminated soil below the church. This soil was contaminated when diesel fuel leaked from an underground storage tank (UST) at the nearby May Oil Company.

EEP was supplied indoor air sampling data to review and was asked to provide recommendations as to whether or not the air inside the church is safe to breathe. EEP concluded that all contaminant concentrations detected in air at this Church were below levels of health concern.

Lebanon Road Landfill — Davidson County

The TDEC Division of Remediation (DoR), contacted EEP about landfill gas vapor intrusion concerns in buildings near the old Lebanon Road Landfill. In the past, indoor methane vapor levels were measured above the lower explosive limit. This explosion hazard led to the installation of a passive vapor extraction system. TDEC continued to provide oversight for the site, and they remained concerned about the danger of methane gas.

EEP, with assistance from the Nashville Public Health Department, concluded that a health hazard existed at the site because of the unpredictable nature of methane vapor intrusion which can lead to fire or explosion. EEP made recommendations to mitigate the possibility of fire or explosion including a site safety plan, employee training, and institutional controls.

Green Hills Cleaners — Davidson County

The Green Hills Cleaner was located ins a triangular lease space at the southwestern end of a strip shopping mall. The drycleaners moved in 2006 to a different lease space at the same address. The drycleaners continues to provide cleaning services although the new lease space is a pick-up location only.

EEP was contacted by the TDEC Drycleaner Environmental Response Program (DCERP) to evaluate the results of indoor air sampling conducted within the cleaner's former lease space.

Because the detection limits for vinyl chloride and 1,2-dichloroethylene were not low enough, EEP could not make any conclusions about the possibility of a health hazard at either the old leased space or in other areas of the building. EEP recommended further sampling, with lower detection limits for chemicals of concern.

Former Charles A. Bell School — Hamilton County

The site of the former Charles A. Bell School has been identified as a potential brownfield site. A brownfield site is a property in which the expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance. Cleaning up and reinvesting in these properties protects the environment, reduces blight, and takes development pressures off greenspaces and working lands. To be able to reuse such property, the U.S. Environmental Protection Agency (EPA) developed the Brownfield Program in 1995. It allows interested parties to apply for money to clean up the contaminated area so that it is safe for community members to use.

TDEC contacted EEP about the reuse of the site as a recreational area . EEP concluded that no health hazard existed in locations where sampling oc-

curred. However, the entire site was not sampled. EEP recommended that the entire site should be covered with clean soil. EEP also recommended that the city should follow a site maintenance plan in order to keep the site

Cookeville Cleaners — Putnam County

DCERP contacted EEP to evaluate the results of indoor air sampling conducted within the former cleaner's space as well as two ground-floor apartments which are located in the rear basement area of the cleaners building. No apparent public health hazard existed because of onsite drycleaner chemical vapors or breakdown products within the former Cookeville Cleaners site or through the inhalation of indoor air in the adjacent common-wall ground-floor apartments. Because no sampling was done in the small market nearby, EEP recommended that DCERP monitor the market.

Tedford Road Landfill — Knox County

On December 24, 2007, an unpermitted demolition and wood waste landfill caught fire. The Rural Metro Fire Department, Knox County Engineering, and contractors began excavating the landfill and spraying the fires with water. TDEC provided sampling of residential well water near the site. Access to the site is not restricted. There is nothing to prevent nearby residents from wandering onto the site. Holes from excavation and other physical hazards from heavy equipment are evident on the site.

EEP concluded that there was no public health hazard from off-site exposures to chemicals detected through air sampling. If non-workers trespassed on site, a public health hazard could exist because of physical hazards.

EEP recommended that the Knox County Health Department and the contractor should prevent trespassers from going onto the site. EEP also recommended and that the contractor should ensure that a site safety and health plan was in place and understood by the workers.

Downtown School, Update 3 — Shelby County

In 1998, DCERP entered into an agreement with Nations Bank to perform a voluntary cleanup of the 10 North Fourth Street property owned by the bank. The property was the former site of Henry Loeb and Company Laundry and Memphis Steam Laundry Stable. A map dated 1907 details these structures. By the 1990s, the laundry and cleaners had been removed and an asphalt parking lot was in place. The property was later sold to the city of Memphis to be used as the site for a new elementary school.

The property was investigated for contamination from its past use as a laundry. A series of investigations determined that site soils contained tetrachloroethylene (PCE) and total petroleum hydrocarbons (TPH). Analysis of shallow groundwater detected contamination from PCE, trichloroethylene (TCE), TPH, cis1,2-dichloroethene (1,2-DCE), and vinyl chloride (VC).

In 1999 and 2001, cleanup projects removed contamination from the site. A pump-and-treat system was installed to extract and reduce pollutants in the groundwater. Then the Downtown School was constructed on the site.

EEP prepared three previous health consultations for the Downtown School Site. The initial reports released by ATSDR on January 2 and March 13, 2003, concluded there was no apparent health hazard from vapor intrusion of PCE or any of its breakdown products. School classes began in the fall semester 2003. A one-year follow up health consultation was published by ATSDR on February 27, 2004. Again, no apparent health hazard was concluded. During the fall of 2007, additional sampling was done at the school. Once again, EEP determined that no health hazard exists at the Downtown School because of vapor intrusion of drycleaner solvents.

Cypress Creek Exposure Investigation — Shelby County

In the years before environmental regulation, several chemical companies disposed of wastes in Cypress Creek in north Memphis, Shelby County. Cyclodiene pesticides accumulated in the sediment of the creek. In order to prevent flooding, the City of Memphis dredged the creek and lined it with concrete in the 1960s. The dredged

sediment, containing cylcodiene pesticides, was placed beside the creek in the backyards of residents and area businesses.

In 2006 EEP published a health consultation for the Cypress Creek area in Memphis. The purposes of the health consultation were: 1) to examine the possible exposure and hazard to residents living adjacent to and near Cypress Creek whose yards have had soil sampled; and 2) to work with TDEC, the Environmental Protection Agency (EPA), the Memphis and Shelby County Health Department (MSCHD), and Velsicol to jointly identify remedial action levels that are protective of human health.

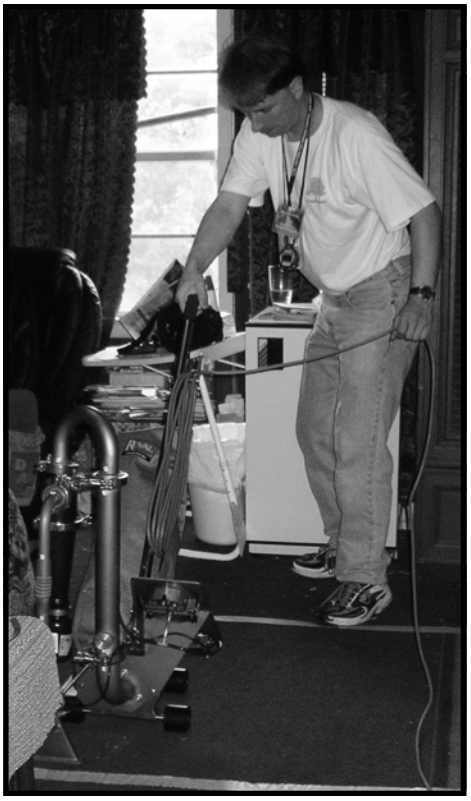
Conclusions of the Health Consultation were: 1) for the majority of residential properties, contaminants were not found at levels of concern and 2) past, current, and future public health hazards exist from exposure to soil contaminated with pesticides and associated chemicals on some residential properties in Sub-Area III adjacent to or near Cypress Creek in Memphis. At EEP's recommendation, the MSCHD worked with community leaders to establish the Mid-Town North Health Committee to work with the larger North Hollywood Community on all health issues.

Special vacuum for dust sampling, with 1 square meter marked off for sampling.
Source: David Borowski

EEP determined that additional data were needed to better evaluate potential human exposure to environmental contamination. In order to fill this data gap, EEP proposed an Exposure Investigation (EI) to determine if those community members who have the most potential for exposure have elevated blood levels of the cyclodiene pesticides, aldrin, dieldrin, and endrin. Nineteen homes in Cypress Creek Sub-Area III were targeted for blood serum and indoor dust sampling. Indoor dust concentrations of dieldrin and endrin were determined in the residences of community members chosen for blood sampling. A questionnaire was administered to find out how often these people worked in their yards and ate homegrown produce.

Outdoor soil concentrations of dieldrin and endrin did not correlate with indoor dust concentrations. Neither aldrin nor endrin was detected in any participants' blood. Soil and dust concentrations of dieldrin did not correlate with lipid-adjusted blood dieldrin levels.

The dieldrin concentration in the people over 20 years of age who participated in the EI were below the 95th percentile confidence interval for all persons 20 years and older in National Health and Nutrition Examination Survey (NHANES) 2001-2002. The youngest participants had lipid-adjusted serum dieldrin concentrations less than the analytical limit of detection. For past exposures to dieldrin in household dust, an indeterminate health hazard existed. Currently and in the future, no apparent health hazard exists from exposure to dieldrin in household dust.



David Borowski taking a dust sample.
Source: Bonnie Bashor

We cannot draw any conclusions from the survey responses on the consumption of eating homegrown vegetables because of small sample size. Recommendations include general food and safety guidelines such as washing hands before preparing and eating foods and thoroughly washing and peeling vegetables.

We will continue to work with TDEC to ensure continued cleanup of any remaining pesticide pollution related to Cypress Creek.

We will continue to work with MSCHD and the Mid-Town North Health Committee to educate the pub-

lic about environmental public health issues near Cypress Creek and in their endeavors to assist the entire community.

Technical Assists

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

EEP prepared several Technical Assists in order to provide immediate assistance to other agencies. In 2008, EEP prepared TAs for the following situations:

- A mercury spill in an apartment in Sullivan County that required cleanup by EPA's Emergency Response section.
- Assistance to TDEC with controlling future use of contaminated groundwater near the Nilok site in Dyer County.
- Assistance to the MSCHD with technical issues of measuring indoor air concentrations of contaminations due to vapor intrusion in a work place.
- Assistance to TDEC with the public health impact of acetone and toluene in ambient air near the Egyptian Lacquer facility in Williamson County.
- Assistance to TDEC with the public health implications of trichloroethylene in a groundwater plume under a new house with a residential well in Henry County.
- Investigation of mercury exposure in Maury County that resulted in a law enforcement investigation.
- Assistance to the Tennessee Department of Finance and Administration's State Architect in writing contracts for environmental remediation of the old Alvin York High School in Fentress County.

Other Activities

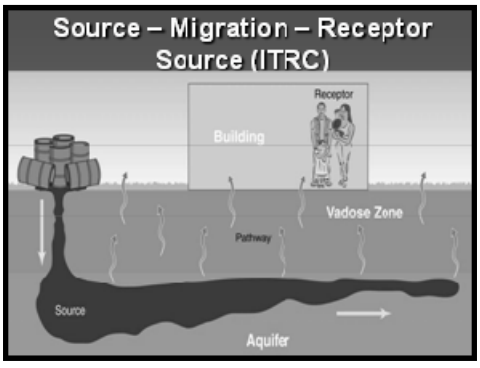
Throughout the year, EEP is involved with various activities promoting public health throughout Tennessee, involving education or community involvement.

Education — Tennessee Department of Environment and Conservation, Division of Remediation

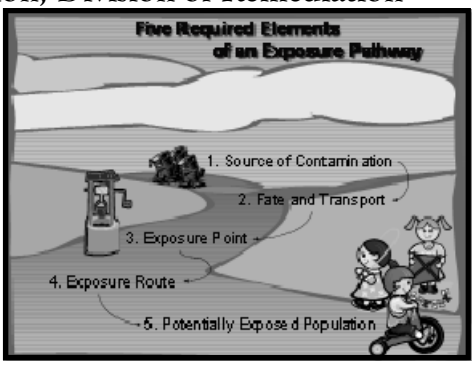
EEP provided education at the DoR fall 2008 retreat on vapor intrusion, environmental toxicology, and routes of exposure.

Vapor intrusion is the migration of volatile chemicals from the subsurface into overlying buildings. Volatile chemicals from spills or leaks, in buried wastes, and/or contaminated groundwater can emit vapors that may migrate through subsurface soil or sediment and into air spaces of overlying buildings. In extreme cases, the vapors may accumulate in dwellings or occupied buildings to levels that may pose near-term safety hazards, acute health effects, or aesthetic problems.

The education about vapor intrusion was technical, covering aspects of modeling, methods of vapor intrusion detection, and sampling and analysis for vapors.



The education about environmental toxicology was simple, beginning with poisonings in antiquity. Topics covered included toxic effects by organ system, how toxins move in the body, dose response, and regulatory health comparison values.



The education on routes of exposure covered how chemicals move in the environment, how people can come into contact with those chemicals, and how those chemicals can get into the body.

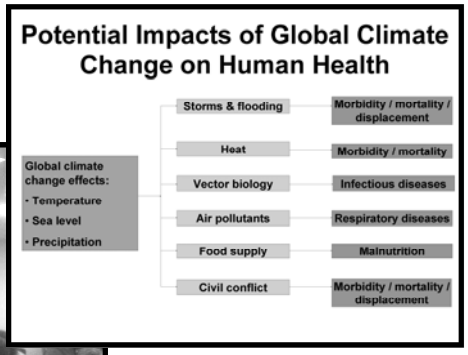
Climate Change

EEP was active during Public Health Week in 2008. EEP provided educational materials about climate change and health to each of the regional and local health departments, in addition to having a display and reusable water bottle give away.

In March 2008, EEP presented a talk and was an exhibitor at the East Tennessee Environmental Conference in Kingsport.

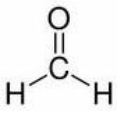
East Tennessee Regional Office, Green Luncheon in celebration of Public Health Week.

Source: David Borowski

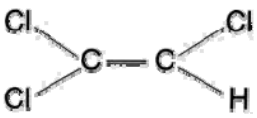


EEP made presentations at the East Tennessee Regional Health Office public health week luncheon, at the Tennessee Department of Health brown bag seminar, and at other venues.

Chemical Toxicity Questions



After Hurricane Katrina, CDC and ATSDR discovered that many FEMA trailers had unacceptable levels of formaldehyde in them. Since FEMA trailers were being used after a series of tornadoes in Tennessee, EEP was tasked with determining what a "safe" indoor level of formaldehyde might be for Tennessee. The CDC and ATSDR would not offer suggestions. With assistance from EEP and CEDS leadership, Commissioner Cooper was able to announce that Tennessee would accept trailers with less than 40 parts per billion in indoor air. The State of Arkansas soon followed Tennessee's lead, with other states receiving FEMA trailers using Tennessee's level.



The Tennessee Department of Environment and Conservation , Division of Remediation (DoR) asked for assistance with health comparison values for trichloroethylene (TCE). The U.S. Environmental Protection Agency had retracted its risk assessment for TCE, leaving all the states with no regulatory health comparison values. ATSDR, also, pulled its health comparison values for TCE. These changes left environmental regulatory agencies with TCE contaminated sites that needed to be regulated or to be examined for adverse public health implications. EEP considered the academic literature and the National Academy of Sciences review of EPA's risk assessment for TCE, and the reasoning of the States of California and New York in setting health comparison values for TCE. EEP recommended that DoR use New York's TCE values until either EPA or ATSDR had published a health comparison value.

Earth Day

EEP staff members participated in the annual Nashville Earth Day Festival held at Centennial Park in April. Information was available about radon concentrations by zip code, about climate change, and about what we can do to help maintain our health.

Source of pictures: David Borowski

Regional Environmental Epidemiologists

As part of TDH's CDC Cooperative Agreement for Public Health Emergency Preparedness, a statewide network of Environmental Epidemiologists was created. These public health officials work to keep people in their regions safe from the adverse effects of environmental pollution.

In 2008, the Regional Environmental Epidemiologists did a wide-range of projects. Several regions assisted with needs of people displaced by springtime tornadoes and later by Hurricane Gustav. All Environmental Epidemiologists prepared for emergencies, by participating in drills, maintaining syndromic surveillance systems, and writing plans for chemical emergencies.

Other activities ranged from dealing with hazardous waste sites to assisting with infectious disease outbreaks to collecting hazardous household materials. Several regions partnered with the TDEC to host successful mercury thermometer exchanges. During the exchange, the old mercury was collected for proper disposal. At the same time, the old thermometer was exchanged for a new mercury-free thermometer.

Special events were planned, participated, and improved by the participation of the Regional Environmental Epidemiologists. Radon Action Month was a big success with the distribution of free radon test kits. Public Health Week educated about world issues linked to global climate change. Earth Day turned green with environmentally conscious activities.

The Regional Environmental Epidemiologists assisted with the investigation of hazardous waste sites. Investigations included: landfill methane vapors in Davidson County, pesticides in residential yards in Shelby County, heavy metals in residential soils in Loudon County, a landfill fire in Knox County.

Source: EEP files

SECTION V.

Investigations and Outbreaks

Dr. Allen S. Craig stops to take a photo with some local kids while conducting a cluster sample survey of over 4,400 homes during April and May of 2008 in Zambia.

Source: Tennessee Department of Health.

Highlighted Investigations and Outbreaks in Tennessee in 2008

The Communicable and Environmental Disease Services (CEDS) section and health department personnel from across the state investigate outbreaks each year. In 2008, several outbreak investigations highlighted the importance of these activities and the measures taken by public health professionals to prevent additional outbreaks.

E. coli O157 in a Correctional Center, Nashville, May 2008

On May 27, 2008, Metro Public Health Department (MPHD) was notified of 3 culture-confirmed cases of *E. coli* O157:H7 with indistinguishable pulsed-field gel electrophoresis (PFGE) patterns and a history of being incarcerated in a Davidson County jail. A PulseNet query identified additional cases from North Carolina, Ohio, and Virginia with similar dates of stool sample collection. Investigation at the correctional facility, which included a detailed environmental assessment, found that no ground beef was served in the facility during the likely exposure period. Following review of the menu, a case-control study was conducted. Six cases and 21 controls were enrolled from correctional center inmates. One common exposure was implicated among all 6 cases and by the analytic study. Brand A prepackaged tossed salad served on 5/01/2008 was identified as the likely food vehicle. Among 6 additional cases in the PFGE cluster from other states, Brand A bagged salad exposure was reported by 5 persons. A review of PulseNet data indicated that ongoing transmission was unlikely. Results of the Nashville investigation and multistate investigation were shared with the Food and Drug Administration (FDA), Centers for Disease Control and Prevention (CDC), and Brand A manufacturer.

Recurrent *Salmonella* Anatum Outbreaks Linked to Pulled Pork Barbecue-TN, 2006-2008

The West Tennessee Regional Health Office investigated an outbreak of salmonellosis associated with a barbeque restaurant. The investigation objectives were to describe the outbreak, implement control measures, and prevent additional illnesses. CDC's Outbreak Management System (OMS) Version 1.2 was used in the investigation. This was the first documented use of OMS in a foodborne disease outbreak. Ill persons were initially identified by area physicians and by routine laboratory reporting. Additional cases were identified via active surveillance. All patients were interviewed using standardized FoodNet and *Salmonella* questionnaires. Stool and food specimens were tested for enteric pathogens. OMS and NetDraw were used for data management and visualization.

In the 2006 outbreak (Outbreak 1), fifty-five ill persons were identified, including 11 laboratory-confirmed cases and 44 probable cases which were epidemiologically linked to confirmed cases. In 2008 (Outbreak 2), 50 (96%) of 52 persons interviewed were ill, including 13 laboratory-confirmed cases and 37 probable cases which were epidemiologically linked. All culture-confirmed cases were positive for *Salmonella* Anatum, *XbaI* pattern JAGX01.0001, as were pulled pork barbeque specimens collected from ill persons in 2008. In 2008, 50 (96%) out of 52 persons who consumed pulled pork barbecue became ill. In two separate outbreaks, a total of 105 confirmed and probable cases of salmonellosis were linked to contaminated pulled pork barbeque from a single restaurant/catering establishment. *Salmonella* is not considered an adulterant of meats. Risks with pulled pork barbeque were reviewed with the restaurant including appropriate cooking temperatures, handling, and ways to mitigate cross contamination during preparation. OMS was a valuable asset for tracking specimens, identifying relationships between cases, and identifying relationships between cases and exposure events. Social network analysis provided a visual depiction of epidemiological links between cases, potential exposure events, and laboratory specimens. Use of OMS and social network analysis should be considered in future investigations.

Acute Selenium Toxicity Associated with a Dietary Supplement, 2008

Selenium is an element necessary for normal cellular function, but it can have toxic effects at high doses. TDH and other state and federal agencies investigated an outbreak of acute selenium toxicity associated with consumption of a dietary supplement. A case was defined as onset of symptoms of selenium toxicity in a person within

2 weeks after ingesting a dietary supplement manufactured by Company A, purchased after January 1, 2008. We conducted case finding, administered initial and 90-day follow-up questionnaires to affected persons, and obtained laboratory data where available. The source of the outbreak was identified as a liquid dietary supplement that contained 200 times the labeled concentration of selenium. Of 201 cases identified in 10 states, 1 person was hospitalized. The median estimated dose of selenium consumed was 41,749 µg/day (recommended dietary allowance [RDA] is 55 µg/day). Frequently reported symptoms included diarrhea (78%), fatigue (75%), hair loss (72%), joint pain (70%), nail discoloration or brittleness (61%), and nausea (58%). Symptoms persisting ≥90 days included fingernail discoloration and loss (52%), fatigue (35%), and hair loss (29%). The mean initial serum selenium concentration of 8 patients was 751 µg/L (normal ≤ 125 µg/L). The mean initial urine selenium concentration of 7 patients was 166 µg/24hours (normal ≤ 55 µg/24hours). Toxic concentrations of selenium in a liquid dietary supplement resulted in a widespread outbreak. The dietary supplement manufacturer did not adhere to current good manufacturing practices (cGMP), which currently are required for manufacturers of pharmaceuticals but not dietary supplements. Better regulation of dietary supplement manufacturing is necessary to prevent recurrent outbreaks of toxicity.

Outbreak of *Salmonella* Serotype Saintpaul Infections Associated with Multiple Raw Produce Items -- - United States and Tennessee, 2008

On May 22, 2008, the New Mexico Department of Health (NMDOH) notified CDC of four persons infected with *Salmonella* Saintpaul strains that were indistinguishable from each other by pulsed-field gel electrophoresis (PFGE) and 15 other persons with *Salmonella* infections whose isolates had not yet been characterized. In the following weeks, cases continued to be reported, and the outbreak expanded to include 43 states, the District of Columbia, and Canada. As of August 25, 2008, a total of 1,442 persons had been reported infected with the outbreak strain. At least 286 persons had been hospitalized, and the infection may have contributed to two deaths. The outbreak began late in April 2008, and most persons became ill in May or June. Of the 1,442 person infected with the outbreak strain, 10 were residents of Tennessee. Two cases were reported from Williamson County, 2 from Davidson County, one case each from Rutherford, Shelby, Wilson, Carroll, Anderson and Knox Counties. Sixty percent of the Tennessee cases were female and ages ranged from 16-52 years with a median age of 25.5. Most Tennessee cases reported eating tomatoes, peppers, or salsa at a Mexican restaurant. Preliminary epidemiologic and microbiologic results to date support the conclusion that jalapeño peppers were a major vehicle by which the pathogen was transmitted and serrano peppers also were a vehicle; tomatoes possibly were a vehicle, particularly early in the outbreak. Contamination of produce items might have occurred on the farm or during processing or distribution; the mechanism of contamination has not been determined. These findings indicate that additional measures are needed to enhance food safety and reduce illnesses from produce that is consumed raw.

SECTION VI.

Public Health Emergency Preparedness Program

Greg Galfano, Senior Bioterrorism Planner for the Public Health Emergency Preparedness program, reminisces about the old days as Director of Williamson Medical Center's Emergency Medical Services team.

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. A primary objective for the use of these funds has been to supplement response capacity by continuing to augment public health infrastructure. In 2008, PHEP received $14,114,281 from the Centers for Disease Control and Prevention (CDC) cooperative agreement.

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. In 2008, the pandemic influenza plan was reviewed and revised to reflect the most recent guidance by CDC.

Strategic National Stockpile (SNS)

A high priority in the development of these plans is the inclusion of detailed processes concerning receiving, staging, storing and distributing assets from the SNS. In 2005, 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. 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 CDC to compare all 62 preparedness project areas and identify best practices across the country. The Tennessee Department of Health received a TAR score of 89 points from CDC in 2008.

Trust for America's Health Report

Tennessee achieved a score of 9 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 2008 from the Trust for America's Health. The 10 items addressed were SNS plans, antiviral stockpiles, laboratory capacity, laboratory staffing, communicable disease surveillance, volunteer liability protection, exercises, medical reserve corps coordination, 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 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 has worked to improve networks among the state's clinical and hospital laboratories. A database of contact information of hospital and clinical labs has been de-

veloped, and information is shared with them as necessary. Training continues to be provided to hospital and sentinel laboratories across the state. These trainings include the isolation and diagnosis of potential bioterrorist agents. The Chemical Terrorism Laboratory is operational and has successfully completed validations for urine/blood heavy metals and blood cyanide. Training has been conducted with hospitals on the proper collection and packaging of clinical samples. The TDH laboratory has 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 done 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. Public health staffs have redundant methods available to communicate statewide, including e-mail, pagers, cell phones, facsimile machines, HAM radios, and high frequency radios. 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. Two Volunteer Mobilizer applications are now being used for statewide volunteer contact and are used as the method for credentialing medical professionals during emergency deployment.

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

Training

TDH developed and participated 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 program conducted a series of trainings throughout the state related to Strategic National Stockpile, Points of Dispensing (POD), and warehouse operations. Training participants received instruction and practice using the State Pharmaceutical and Laboratory Information Tracking (SPLIT) system. The SPLIT system utilizes state-of-the-art wireless technology for patient registration, movement, medication dispensing, and inventory management. Staff have also been trained in Receipt, Stage, and Store (RSS) operations that are, similarly, managed through a computerized warehousing system. Allocations for specific PODs can be managed, orders can be dropped and picked, and shipping instructions produced through the SPLIT system. Training for state staff included the operation of handheld computer devices used in both POD and RSS activities. These handheld devices are capable of managing patient movement within PODs through the process of registration, triage, medical consultation and dispensing. In the RSS warehouse, staff used the handheld devices to "receive" medications and supplies in the warehouse, view and "pick" orders for the PODs, and wirelessly allow order shipment information to be printed.

PHEP staff continued educational development of Regional Hospital Coordinators (RHCs) and hospital personnel in the use of the State's Hospital Resource Tracking System (HRTS). The hands-on training sessions proved to be very successful in providing understanding of the capabilities of the HRTS system and the roles and responsibilities of its users.

Volunteer Coordinators and PHEP staff have worked together through a series of on-line and telephone sessions to hone procedures and protocols for the recruitment, training, retention, deployment, and management of medical and non-medical volunteers to support response efforts in the state.

Also, recognizing a need for public information training statewide, over 100 public health employees participated in a training developed by CDC (Mass Antibiotic Dispensing: Public Information and Communication). The one-day workshop was a collection of presentations, group exercises, discussions, and supporting materials used to provide technical assistance to health communicators who may be involved in a mass antibiotic dispensing operation. The course introduced state and local communicators to the Division of Strategic National Stockpile (DSNS) and helped them better understand their roles and responsibilities in the event of an SNS deployment.

Exercise Program

In 2008, PHEP staff in cooperation with the Office of Homeland Security (OHS) and Tennessee Emergency Management Agency (TEMA) developed a comprehensive exercise program. This was to fulfill Tennessee's identified need to coordinate planning, training, and exercising to strengthen overall defenses. Our approach to our training and exercise program highlights the cooperation between the Tennessee OHS, TEMA, and TDH.

The program was designed to be conducted over a two-year period in the 11 Tennessee Office of Homeland Security Jurisdictional Districts. There are four (4) basic exercise scenarios that will be used over the course of the eleven (11) exercise series:

1. Point-of-Distribution (POD) activation secondary to a widespread respiratory exposure to weapons grade anthrax spores
2. CBRNE event with a significant HAZMAT component
3. CBRNE event with a significant mass casualty component
4. Pandemic influenza wave

These exercises were held in each Grand Division of the State of Tennessee with the opportunity to participate extended to selected public safety, public health, and hospital agencies/ organizations in every Homeland Security District, health department, and TEMA region in the state.

The program encouraged the integration of exercise and evaluation opportunities to provide training and experiences covering functional, operational, and inter-jurisdictional relationships and communications.

Our goal is to foster multi-agency collaboration through combined, comprehensive, and scenario-driven, workshops, tabletops, and full-scale exercises and to simulate intensity similar to what would be expected during an

actual terrorist incident or natural disaster. Additionally, Tennessee Homeland Security Exercise Program (TN HSEP) strives to:

- Ensure all exercises are coordinated to meet the needs of all participants
- Ensure funds designated for exercises are wisely used to produce meaningful results
- Ensure results are documented and lessons learned are applied to future

Tennessee's districts have different levels of preparedness. Because of these differences, the TN HSEP is designed to permit varying levels of complexity and involvement for each region within the state. Our approach employs progressive steps in exercise design, complexity, and execution, and allows for the appropriate training and preparation to occur in a district prior to conducting an exercise. Our purpose is to build and maintain capabilities to prevent, protect against, respond to, and recover from major disasters, both natural and man-made.

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 2008, 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.

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 Epidemic Intelligence Service (EIS) Officer, takes some time out to visit Victoria Falls while in Zambia to provide consultation on implementing influenza sentinel site surveillance.

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 57 years, more than 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 traveling 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. Jennifer MacFarquhar, RN, MPH continued her assignment in Tennessee during 2008.

Examples of recent EIS investigations in Tennessee include:

- 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
- Acute selenium toxicity associated with a dietary supplement
- Shiga toxin-producing *Escherichia coli* outbreak associated with a youth hunting event
- Health effects from a coal ash spill near Kingston TVA fossil plant
- Possible mass psychogenic illness among middle school students

Epidemic Intelligence Service Officers, 1970-2008
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, 2008

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