COMMUNICABLE AND
ENVIRONMENTAL DISEASE SERVICES

2009 ANNUAL REPORT

Tennessee Department of Health

Communicable and Environmental Disease Services

2009 Annual Report

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

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

Tennessee Department of Health
Communicable and Environmental Disease Services

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

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

Timothy F. Jones, MD, State Epidemiologist,
Director, Communicable and Environmental Disease Services

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

http://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

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 2000 through 2009 and builds upon the 2000, 2001, 2002, 2003, 2004-2005, 2006, 2007 and 2008 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, and 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 D. Section E 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 F.

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

According to Statutory Authority T.C.A. 68-29-107, and General Rules Governing Medical Laboratories, 1200-6-3-.12 Directors of Laboratories are to submit cultures of the following organisms to the Department of Health, Laboratory Services, for confirmation, typing and/or antibiotic sensitivity including, but not limited to:

Salmonella species, including *S. Typhi*

Shigella species

Corynebacterium diphtheria

Brucella species

Mycobacterium species

Legionella species

Clostridium tetani

Listeria species

Plasmodium species

Vibrio species

Francisella species

Yersinia pestis

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

Clostridium botulinum

*Haemophlius influenzae**

*Neisseria meningitidis**

*Streptococcus pneumoniae**

*Group A Streptococcus**

Bacillus anthracis

Burkholderia mallei

Burkholderia psuedomallei

Vancomycin-resistant *Staphlyococcus aureus* (VRSA)

Vancomycin-intermediate *Staphlyococcus aureus* (VISA)

For pathogens marked with an asterisk (*), only isolates from sterile sites are required to be submitted. Sterile sites include blood, cerebral spinal fluid (CSF), pleural fluid, peritoneal fluid, joint fluid, sinus surgical aspirates or bone. Group A Streptococcus will also be considered in isolates from necrotizing fasciitis wound cultures.

Information for Sending Cultures

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

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

Tennessee Department of Health

Laboratory Services

630 Hart Lane

Nashville Tennessee 37216-2006

Phone 615-262-6300

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

Tennessee Department of Health

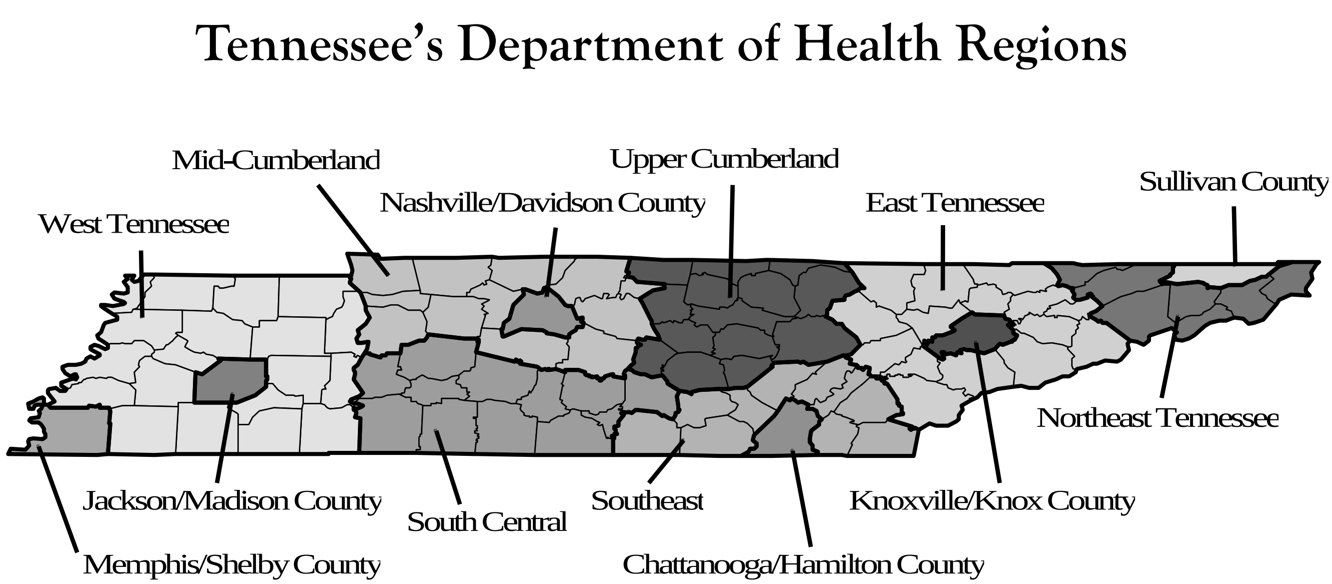
Laboratory Services

PO Box 305130

Nashville Tennessee 37230-5130

G. Tennessee Department of Health Regions

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



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.

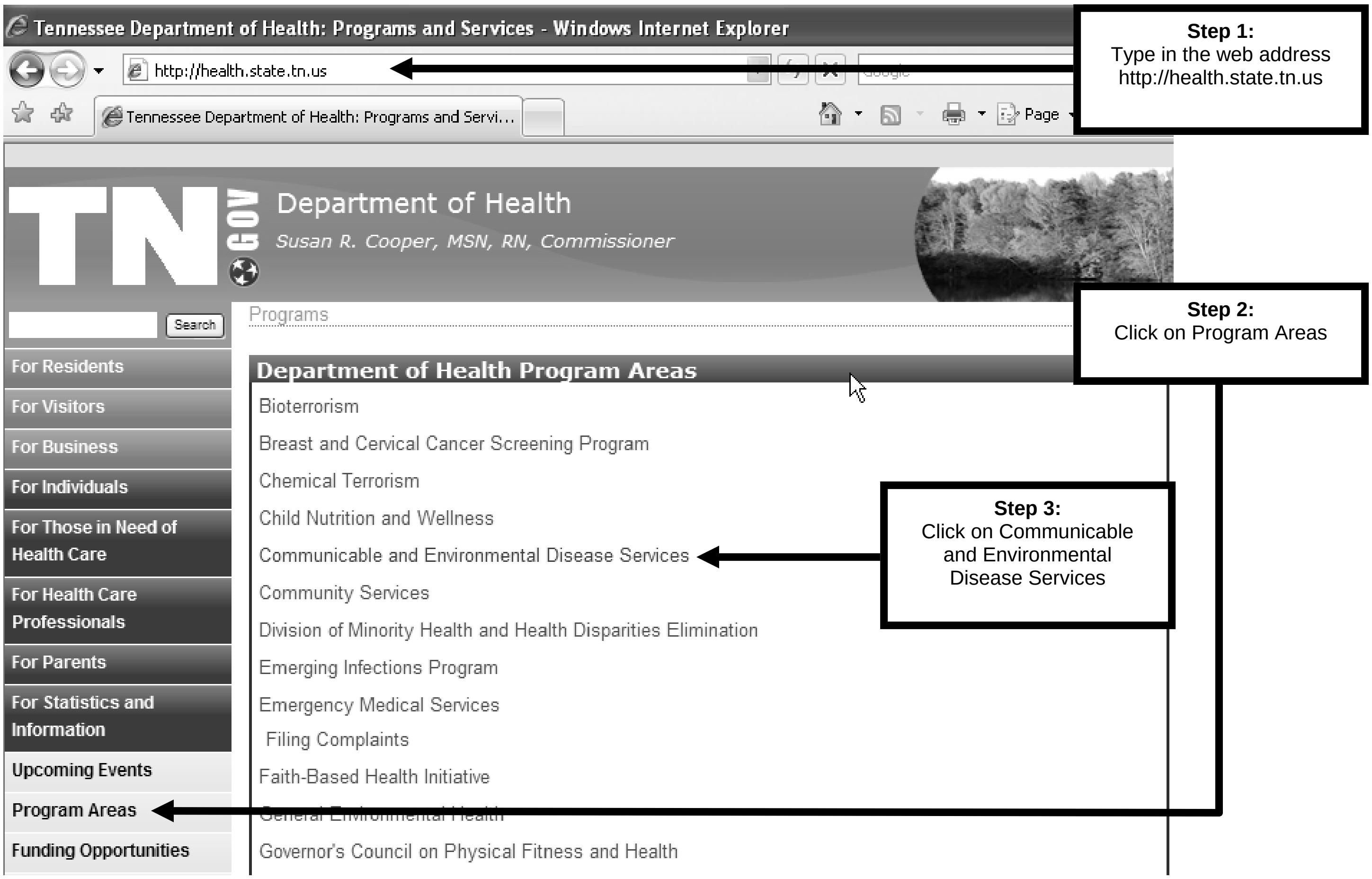
Currently, the EIP Network consists of ten sites: California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon and Tennessee.

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, 2009

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	3,012,973	<1	80,236	45-49	457,235
Female	3,151,794	1-4	324,377	50-54	442,122
RACE /SEX	**POPULATION**	5-9	411,024	55-59	391,894
White Male	2,456,860	10-14	414,451	60-64	333,037
White Female	2,533,941	15-19	426,668	65-69	252,774
Black Male	496,049	20-24	414,344	70-74	190,583
Black Female	555,817	25-29	409,566	75-79	145,152
Other Male	60,064	30-34	409,441	80-84	106,465
Other Female	62,036	35-39	421,797	85+	103,542
TOTAL	**6,164,767**	40-44	430,059		

L. Tennessee's Department of Health Regions: Counties and Population, 2009

East (Population 723,395)

County	Population	County	Population
Anderson	72,398	Loudon	43,437
Blount	117,181	Monroe	43,831
Campbell	41,568	Morgan	21,028
Claiborne	31,785	Roane	54,284
Cocke	36,144	Scott	23,241
Grainger	22,695	Sevier	82,506
Hamblen	62,054	Union	20,665
Jefferson	50,578		

Mid-Cumberland (Population 985,519)

County	Population	County	Population
Cheatham	40,831	Rutherford	221,138
Dickson	47,901	Stewart	14,050
Houston	8,312	Sumner	148,926
Humphreys	18,892	Trousdale	7,955
Montgomery	152,293	Williamson	158,054
Robertson	63,589	Wilson	103,578

Northeast (Population 341,126)

County	Population	County	Population
Carter	58,021	Johnson	18,708
Greene	66,292	Unicoi	18,042
Hancock	6,906	Washington	115,524
Hawkins	57,633		

South Central (Population 380,157)

County	Population	County	Population
Bedford	43,913	Lincoln	33,439
Coffee	52,409	Marshall	29,764
Giles	30,673	Maury	77,669
Hickman	25,701	Moore	6,173
Lawrence	42,478	Perry	7,817
Lewis	12,302	Wayne	17,819

Southeast (Population 320,601)

County	Population	County	Population
Bledsoe	13,224	McMinn	53,021
Bradley	96,353	Meigs	12,200
Franklin	41,894	Polk	16,716
Grundy	15,048	Rhea	30,553
Marion	28,718	Sequatchie	12,874

Upper Cumberland (Population 332,787)

County	Population	County	Population
Cannon	13,950	Overton	21,107
Clay	8,210	Pickett	5,279
Cumberland	52,562	Putnam	68,972
DeKalb	19,032	Smith	19,726
Fentress	17,768	Van Buren	5,738
Jackson	11,803	Warren	41,418
Macon	22,562	White	24,660

West (Population 543,199)

County	Population	County	Population
Benton	17,052	Haywood	20,061
Carroll	30,559	Henderson	27,386
Chester	17,024	Henry	32,289
Crockett	15,603	Lake	7,926
Decatur	11,918	Lauderdale	29,599
Dyer	38,871	McNairy	25,579
Fayette	33,290	Obion	33,332
Gibson	49,079	Tipton	59,529
Hardeman	30,920	Weakley	36,059
Hardin	27,123		

Metropolitan Regions (Population 2,506,674)

County	Population	County	Population
Davidson	607,835	Madison	98,674
Hamilton	315,940	Shelby	952,969
Knox	407,643	Sullivan	154,922

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, 2009, MMWR 2011; 58, No.53.

SECTION II.

Tennessee Reported Cases, 2000-2009

Reported Cases, by Year of Diagnosis, Tennessee, 2000-2009

DISEASE	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
AIDS	674	606	663	600	694	809	284	582	*	*
Botulism, Foodborne	0	0	0	0	0	0	0	1	0	0
Botulism, Infant	1	4	3	1	1	0	1	1	1	1
Brucellosis	0	1	0	0	1	0	1	2	1	0
California/LaCrosse Encephalitis	19	17	15	14	13	2	7	14	6	9
Campylobacteriosis	272	364	298	448	438	403	443	448	481	512
Chlamydia	15,073	15,556	16,042	21,034	22,513	23,041	25,303	26,969	28,001	29,710
Cryptosporidiosis	12	25	60	41	55	44	47	137	47	78
E. coli 0157:H7	59	50	51	35	48	45	88	54	54	38
Ehrlichiosis	46	20	26	31	20	24	35	39	91	32
Giardiasis	184	190	188	187	251	225	246	297	215	233
Gonorrhea	11,877	10,144	9,348	8,717	8,475	8,619	9,687	9,584	8,767	7,925
Group A *Streptococcus*	83	87	89	167	144	152	160	149	154	162
Group B *Streptococcus*	87	157	164	264	245	368	379	302	319	362
Haemophilus influenzae	26	48	37	58	53	93	72	92	101	114
Hepatitis B Surface Antigen Positive, Pregnant	36	104	103	109	115	191	146	191	184	154
Hepatitis A	154	187	122	202	96	149	69	59	35	13
Hepatitis B, Acute	213	272	128	212	221	153	173	149	155	140
Hepatitis C, Acute	97	64	26	23	35	28	28	38	33	30
Hemolytic Uremic Syndrome	12	10	7	14	16	10	24	21	19	9
HIV	1,127	805	833	549	586	665	697	792	*	*
HIV Disease	*	*	*	*	*	*	*	*	1,071	993
Legionellosis	14	30	20	37	44	40	50	40	45	66
Listeriosis	13	9	12	9	16	12	14	16	14	15
Lyme Disease	28	30	27	19	25	18	30	42	29	9
Malaria	13	14	4	7	13	14	9	19	17	8
Measles (indigenous)	0	0	0	0	0	1	0	1	0	1
Meningicoccal Disease	56	63	38	30	23	27	25	21	21	15
Meningitis, Other Bacterial	52	54	39	28	28	16	4	3	5	12
Methicillin-Resistant *Staphylococcus aureus*	*	*	*	*	946	1,972	2,005	1,973	1,990	1998
Mumps	2	1	2	5	4	3	11	4	4	3
Penicillin-Resistant *Streptococcus pneumoniae*	266	226	125	133	153	163	154	199	234	129
Penicillin-Sensitive *Streptococcus pneumoniae*	353	500	471	493	534	807	837	722	874	953
Pertussis	41	72	119	82	179	213	179	75	120	130
Rocky Mountain Spotted Fever	57	87	81	74	99	139	260	186	233	189
Rubella	1	0	1	0	0	0	0	0	0	0
Salmonellosis, Non-Typhoidal	693	724	853	736	776	820	841	849	905	793
Shigellosis	344	124	175	396	570	507	198	363	968	375
Syphilis, Congenital	18	24	11	2	9	19	8	4	10	14
Syphilis, Early Latent	627	553	390	227	206	205	233	294	310	333
Syphilis, Late Latent	511	570	424	461	400	359	434	442	475	498
Syphilis, Neurological	14	10	17	6	7	8	0	0	0	0
Syphilis, Primary	162	89	40	43	24	62	80	109	123	121
Syphilis, Secondary	370	242	128	93	106	155	169	259	288	282
Tetanus	0	1	1	0	2	0	1	1	0	0
Toxic Shock *Staphylococcus*	3	1	2	1	2	1	4	0	6	4
Toxic Shock *Streptococcus*	1	0	0	1	0	0	0	0	0	0
Trichinosis	0	0	1	2	0	1	0	0	0	0
Tuberculosis	383	313	308	285	277	299	277	234	282	219
Tularemia	1	6	4	3	2	7	0	2	2	2
Typhoid Fever	2	1	1	3	4	3	1	1	4	4
Vancomycin Resistant *Enterococci*	524	711	649	802	406	278	388	287	310	321
Yersiniosis	7	14	19	24	26	18	29	13	21	23

Number of Reported Cases of Selected Notifiable Diseases with Rates per 100,000 Persons, by Age Group, Tennessee, 2009

DISEASE		<1Y	1-4	5-14	15-24	25-44	45-64	≥65
	Total population	80,236	324,377	825,475	841,012	1,670,863	1,624,288	798,516
Campylobacteriosis	Number	39	58	76	52	115	103	66
	Rate	48.6	17.9	9.2	6.2	6.9	6.3	8.3
Chlamydia	Number	22	*	342	21906	7039	376	17
	Rate	27.4	~	41.4	2604.7	421.3	23.1	2.1
Gonorrhea	Number	*	*	82	5179	2384	260	11
	Rate	~	~	9.9	615.8	142.7	16.0	1.4
Group A Streptococcus	Number	4	13	11	12	23	52	48
	Rate	5.0	4.0	1.3	1.4	1.4	3.2	6.0
Hepatitis A	Number	0	0	1	2	4	3	3
	Rate	0.0	0.0	0.1	0.2	0.2	0.2	0.4
HIV Disease	Number	*	*	*	211	510	256	16
	Rate	~	~	~	25.1	30.5	15.8	2.0
Meningococcal Disease	Number	3	0	1	3	1	5	2
	Rate	3.7	0.0	0.1	0.4	0.1	0.3	0.3
Pertussis	Number	72	17	51	19	26	17	4
	Rate	89.7	5.2	6.2	2.3	1.6	1.0	0.5
Rocky Mountain Spotted Fever	Number	0	3	16	24	35	62	49
	Rate	0.0	0.9	1.9	2.9	2.1	3.8	6.1
Salmonellosis, Non-Typhoid	Number	90	131	108	65	133	162	118
	Rate	112.2	40.4	13.1	7.7	8.0	10.0	14.8
Shigellosis	Number	7	118	140	34	37	31	13
	Rate	8.7	36.4	17.0	4.0	2.2	1.9	1.6
Syphilis, Early Latent	Number	0	0	0	106	169	50	8
	Rate	0.0	0.0	0.0	12.6	10.1	3.1	1.0
Syphilis, Late Latent	Number	0	0	0	63	253	151	31
	Rate	0.0	0.0	0.0	74.9	151.4	93.0	38.8
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	22	66	32	1
	Rate	0.0	0.0	0.0	2.6	4.0	2.0	0.1
Syphilis, Secondary	Number	0	0	1	103	137	39	2
	Rate	0.0	0.0	0.1	12.2	8.2	2.4	0.3

SECTION III.

Disease Summaries

A. Foodborne Disease

Dr. Tim F. Jones' children help purchase product at a local grocery store during an outbreak investigation related to pepperoni-containing pizzas.

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 outbreaks through work in areas where active foodborne and waterborne disease surveillance systems are in place.

Ongoing projects include a survey of restaurant procedures for cooling cooked products, surveys of restaurant procedures for safely handling fresh produce and poultry products, and a large survey to learn more about consumers' perception of the usefulness of food product recalls. A study characterizing restaurants that have been associated with foodborne outbreaks is being completed. Data continues to be collected for the retail meat study; the goal is to determine the prevalence of contamination and antimicrobial resistance among *Salmonella*, *Campylobacter*, *E. coli* and *Enterococci* isolated from a convenience sample of chicken breast, ground turkey, ground beef and pork chops purchased from grocery stores in the United States. Water projects include a study of the health effects of failures of water systems to decontaminate water lines properly following maintenance and a pilot study of a small water system investigation tool.

Campylobacteriosis

Campylobacteriosis is one of the most commonly reported gastrointestinal illnesses in the United States as well as in Tennessee. 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 2 to 5 days after exposure. Illness typically lasts one week.

Rates of disease from 2000-2002 averaged about 5.5 cases per 100,000 persons. Since 2003, however, rates of campylobacteriosis have been fairly steady at approximately 7.6 cases per 100,000 persons (**Figure 1**).

Figure 1. Incidence of Campylobacteriosis, by Year, Tennessee, 2000-2009.

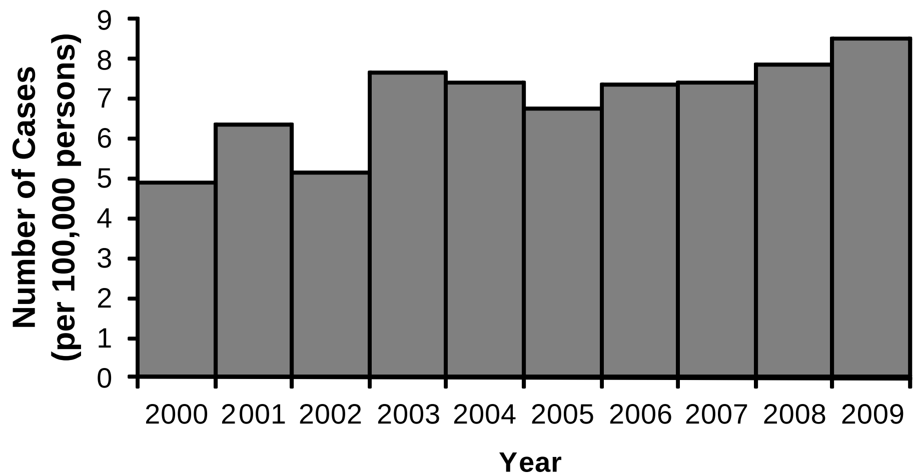
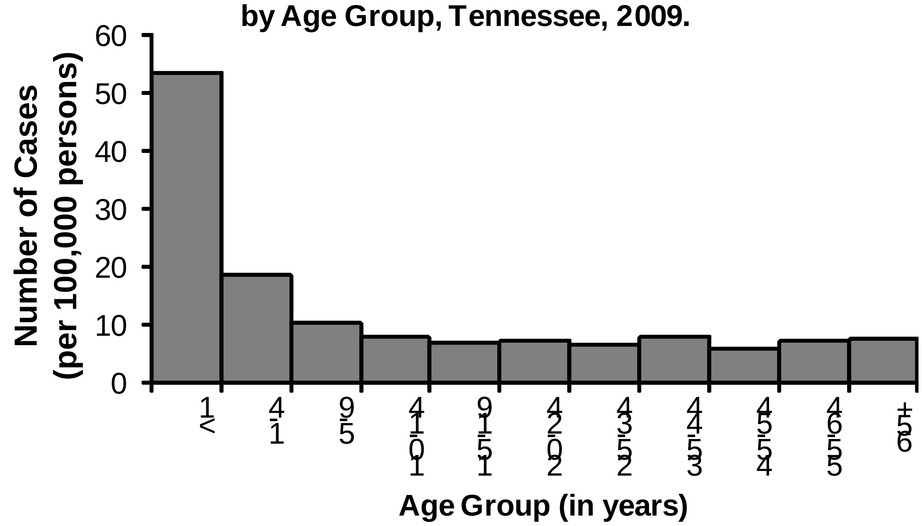


Figure 2. Incidence of Campylobacteriosis, by Age Group, Tennessee, 2009.

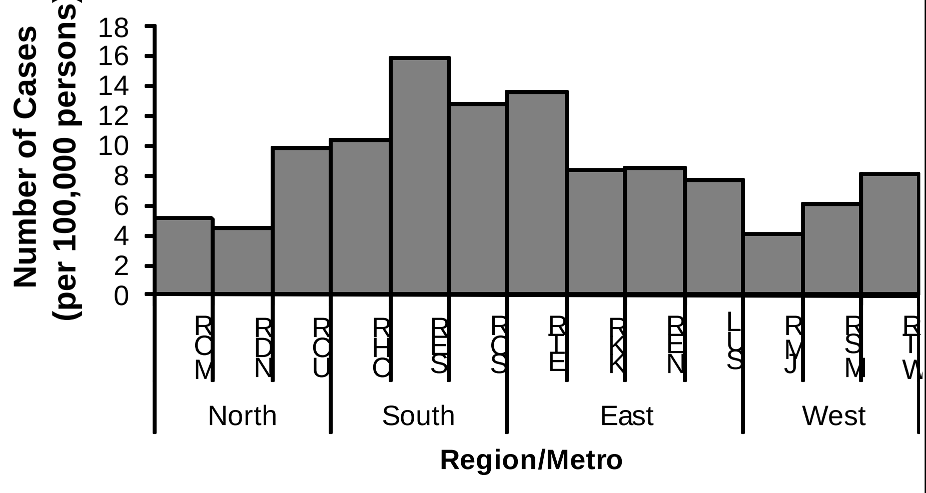


Active laboratory surveillance for *Campylobacter* is carried out statewide by the FoodNet program. Unlike other foodborne pathogens, isolates for *Campylobacter* are requested but not required by state law to be sent in to the state laboratory. In 2009, Tennessee began receiving *Campylobacter* reports that were tested using non-culture based methods (e.g. EIA and PCR). Some of the cases were clinically compatible with disease, whereas others were not. There were 7 cases reported, all from the Chattanooga/Hamilton County metropolitan area, tested only by these non-culture based methods. Further research is needed to determine how sensitive and specific the non-culture based methods are compared to culture, the gold standard.

Figure 2 illustrates that those at greatest risk of developing infection are under the age of 5 years. In 2009, the rate of disease in this population was 25.5 cases per 100,000 persons. The risk for those under the age of one year is even greater (53.6 cases per 100,000 persons).

In 2009, the rate of disease varied region to region across the state (**Figure 3**), with the highest rates (per 100,000 persons) in Southeast Region (15.9 cases), East Tennessee Region (13.7 cases), South Central Region (12.9 cases) and Chattanooga/Hamilton County metropolitan area (10.4 cases). The lowest rate was found in Jackson/ Madison County metropolitan area with 4.1 cases per 100,000 persons.

Figure 3. Incidence of Campylobacteriosis, by Region/Metro, Tennessee, 2009.



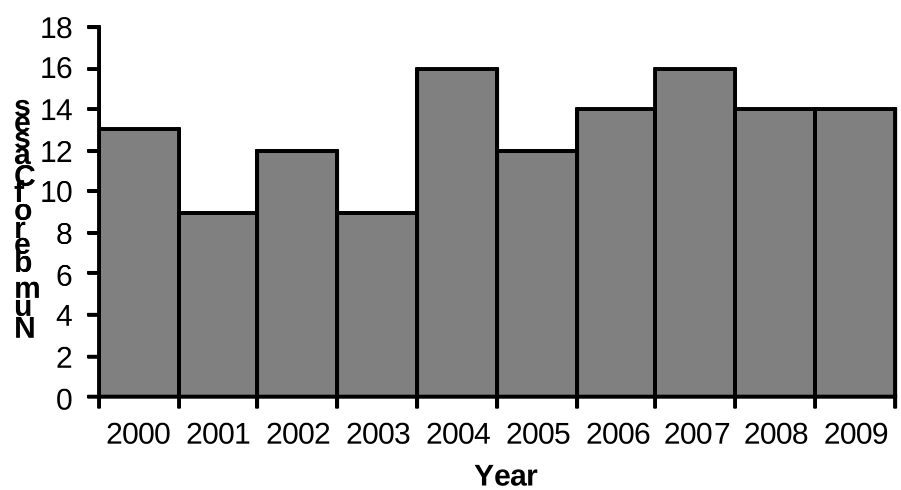
This regional variation is not just a Tennessee phenomenon, but a national one as well. Among FoodNet sites, there is remarkable variation in rates of campylobacteriosis. According to 2009 preliminary FoodNet data, Georgia reported the lowest rate of disease, with 7.6 cases per 100,000 persons, while California reported a rate almost quadruple that (29.4 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 listeriosis, a rare but serious bacterial foodborne disease. It results in only about 2,500 of the estimated 76 million foodborne illnesses per year in the United States. However, listeriosis accounts for 500 deaths and 2,300 hospitalizations, the highest rate of hospitalization of any foodborne illness. *L. monocytogenes* can cause meningitis, other severe neurological sequelae, spontaneous abortion, and infection in newborn infants. The primary vehicle is food.

Figure. Number of Cases of Listeriosis, by Year, Tennessee, 2000-2009.



The major risk factors for infection

with *L. monocytogenes* include consumption of high-risk foods such as non-pasteurized dairy products, frankfurters and ready-to-eat deli meats. Immunosuppressed persons and pregnant females are most susceptible to infection.

In Tennessee, listeriosis became a reportable disease in 1996. That year 6 cases were reported; the next year the number of cases jumped to 14. In 1998, a multistate outbreak of listeriosis resulted from post-processing contamination in a hot dog manufacturing plant in another state. Tennessee Department of Health staff assisted in the early identification of that outbreak. The number of cases in Tennessee has remained fairly constant since 1997.

Among FoodNet sites in 2009, the overall rate was 0.34 cases per 100,000 persons. Tennessee reported 14 cases in 2009 (0.22 cases per 100,000 persons) (**Figure**).

Salmonellosis

Salmonellosis is a gastrointestinal infection caused predominately by non-typhoidal serotypes of *Salmonella enterica*, a gram negative enteric bacterium. Common symptoms include nausea, diarrhea, abdominal cramps, and sometimes vomiting. Although the illness is generally relatively mild, death can occur in some cases. Infants, elderly persons and those with weakened immune systems are more likely to develop severe illness. Salmonellosis usually appears 6 to 74 hours after eating contaminated food and lasts for 4 to 7 days. Every year, approximately 40,000 cases of salmonellosis are reported in the United States. Because many milder cases are not diagnosed or reported, the actual number of infections may be 30 or more times greater.

Figure 1. Salmonellosis Rates, by Year, Tennessee, 2000-2009.

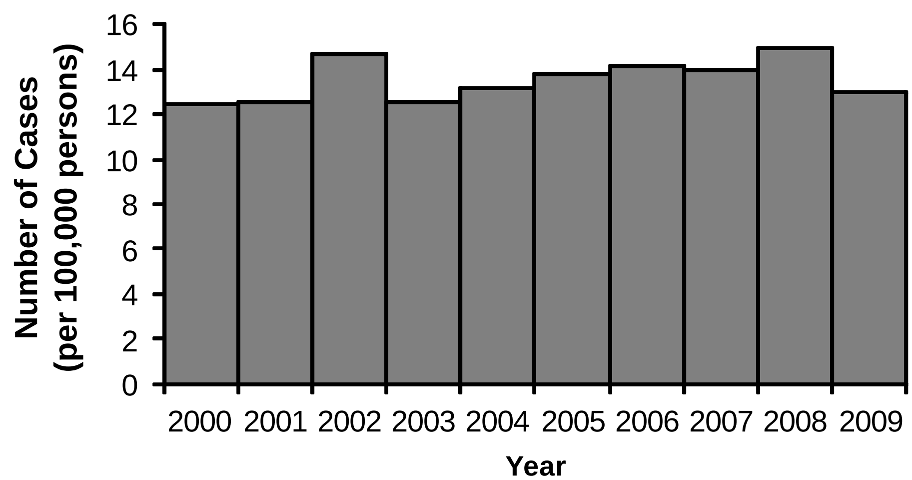
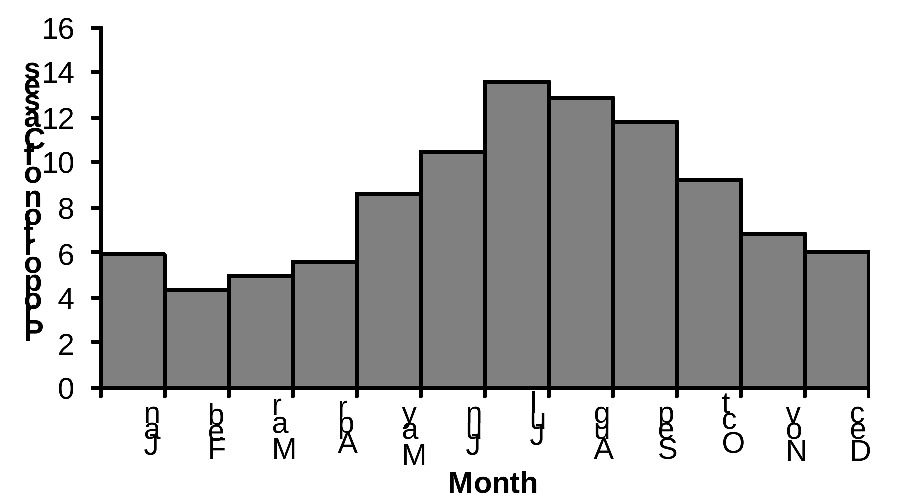


Figure 2. Proportion of Salmonellosis Cases, by Month, Tennessee, 1995-2009.



Since 1999, the incidence of salmonellosis has increased in Tennessee (**Figure 1**). The average incidence rate from 2000 through 2009 was 43% higher than that from 1995 through 1999. A total of 782 cases were reported to the Tennessee Department of Health (TDH) in 2009, representing a 2% decrease from the 2000-2008 average. The overall rate in 2009 was 13 cases per 100,000 persons, which was lower than the national rate (17 cases per 100,000 persons in 2008), but higher than the National Health Objective 2010 for incidence of salmonellosis (6.8 per 100,000 persons).

In 2009, the rates of infection in Tennessee varied by region. The West Tennessee and Upper Cumberland regions reported the highest rates of *Salmonella* infections (22 and 17 cases per 100,000 persons respectively) compared with 10 cases or less per 100,000 reported by the East, Southeast, and South Central regions. All 6 metropolitan regions reported 11-15 cases per 100,000 persons. Memphis/Shelby County reported an outbreak of *Salmonella* Heidelberg associated with a local barbeque restaurant, with 53 ill persons who had attended a family reunion event. TDH staff investigated another cluster of *Salmonella* Liverpool in Shelby County with 9 cases, mostly in older females with no specific exposure. Two major multi-state outbreaks of *Salmonella* were reported by CDC in 2009: *S.* Oranienburg among attendees of the Annual New Orleans Jazz Festival with unknown vehicle, and *S.* Montevideo associated with salami products containing contaminated black and red pepper. Tennessee had 3 and 5 confirmed cases matching these outbreak strains, respectively.

From 1995 to 2009, salmonellosis reports followed a typical seasonal trend, with two-thirds of cases occurring during the summer and fall (**Figure 2**). During this time period, 68% of cases were reported during the months of May through October. In 2009, salmonellosis cases peaked in July with 123 (16%) of 782.

As shown in **Figure 3**, from 1995 to 2009 *Salmonella* was isolated most frequently from children under 5 years of age, who accounted for 32% of all cases. In 2009, the incidence rates of salmonellosis were 90 cases per 100,000 infants under the age of 1 year and 131 cases per 100,000 children 1 to 4 years of age.

Figure 3. Salmonellosis Rates, by Age Group, Tennessee, 1995-2009.

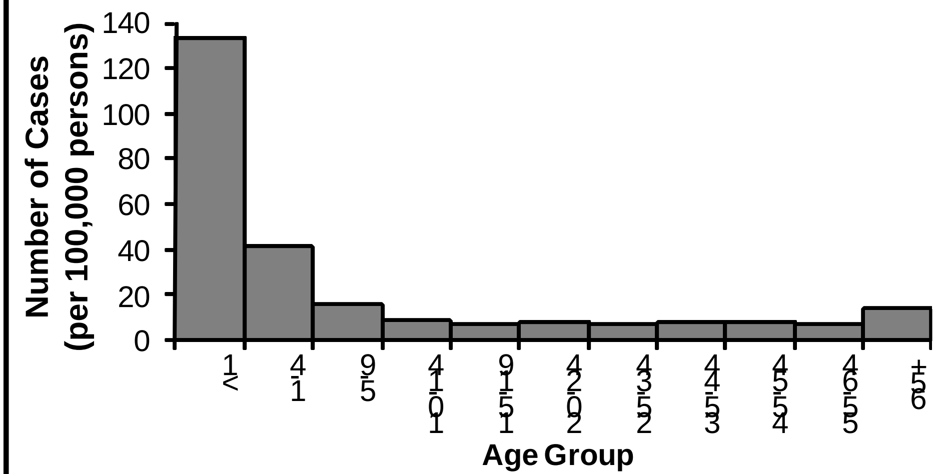
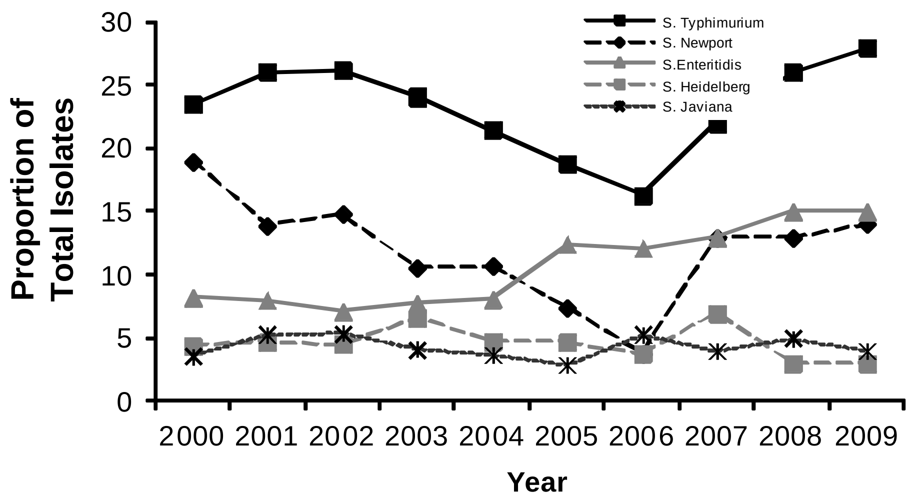


Figure 4. The Top 5 Serotypes of Salmonella, by Year, Tennessee, 2000-2009.



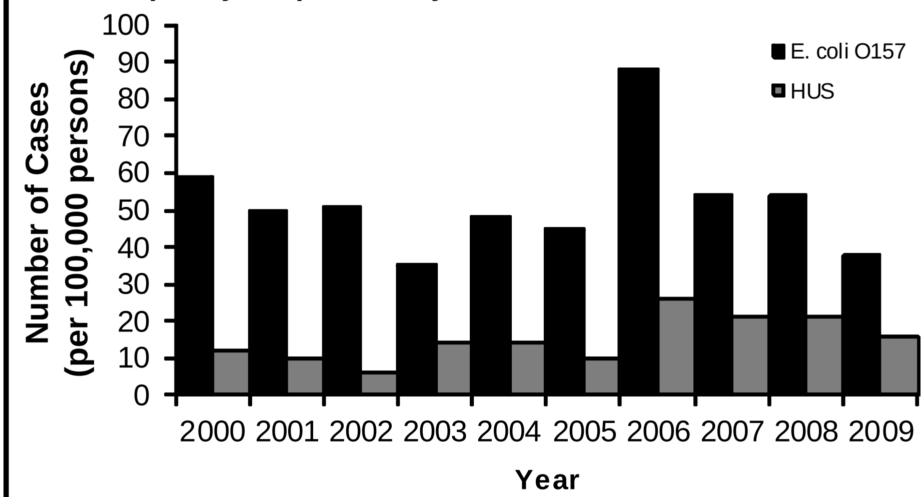
The 5 most common serotypes of *Salmonella* [*S.* Typhimurium including S. I 4,[5],12:i:- (a monophasic variant of S. Typhimurium), *S.* Enteritidis, S. Newport, *S.* Heidelberg, and *S.* Javiana] accounted for 64% of all *Salmonella* isolates sent to the TDH State Laboratory in 2009 (**Figure 4**). Four cases of *S.* Typhi were reported in 2009: an adult female from Shelby County who reported travel to India prior to illness, and 3 children of an expanded immigrant family living in Hamilton County.

CDC is monitoring the trends of antimicrobial resistance among non-typhoidal *Salmonella*. Nationwide, from 2003-2007, 3.5% of non-typhoidal *Salmonella* isolates were resistant to ceftiofur (third generation cephalosporin); 2.6% to nalidixic acid (quinolone); 7.0% to at least ampicillin, chloramphenicol, streptomycin, sulfonamide, and tetracycline (ACSSuT); and 2.3% to at least ACSSuT, amoxicillin-clavulanic acid, and ceftiofur (MDRAmpC). The prevalence of ACSSuT and MDRAmpC has declined since 2003. High rates of these resistance patterns were found in Western and Central states. In comparison, Tennessee had lower resistance proportions to each of these antimicrobial classes during the same time period (2-2.9 to ceftiofur, ≤1.0 to nalidixic acid, 5-9.9 to AcssuT, and 1-1.9 to MDRAmpC).

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

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

Figure. Culture-confirmed *E. coli* O157 and HUS (< 18 years) cases, by Year, Tennessee, 2000-2009.



Shiga toxin-producing *E. coli* (STEC) are a group of *E coli* that cause dysentery (bloody 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 contaminated ground meat, produce, and water, as well as direct contact with STEC-colonized animals and their environment. Enterohemorrhagic *E. coli* (EHEC) are diarrheagenic *E. coli* which are a subset of 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 which are distinctive (e.g. the organism does not ferment the sugar sorbitol).

EHEC, including *E. coli* O157, can cause watery or bloody diarrhea and hemorrhagic colitis. Severe abdominal cramping or pain is 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.

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 United States 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 United States include O26, O111, O103, O121, and O145.

Most clinical laboratories have the capacity to identify *E. coli* O157 by culturing sorbitol-negative *E.coli*. All positive STEC infections including *E. coli* O157 are reportable to the Tennessee Department of Health (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 2009, 62 cases of STEC were reported to TDH. Of these, 38 (**Figure**) were culture-confirmed *E. coli* 0157, 23 were culture-confirmed non-O157 STEC, and 1 was culture-confirmed STEC with O antigen undetermined. Sixteen cases of HUS were reported, all in persons less than 18 years of age (**Figure**). Of these, laboratory evidence of a preceding STEC infection was obtained in 13 (81%).

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

Figure 1. Incidence of Shigellosis, by Year, Tennessee, 1993-2009.

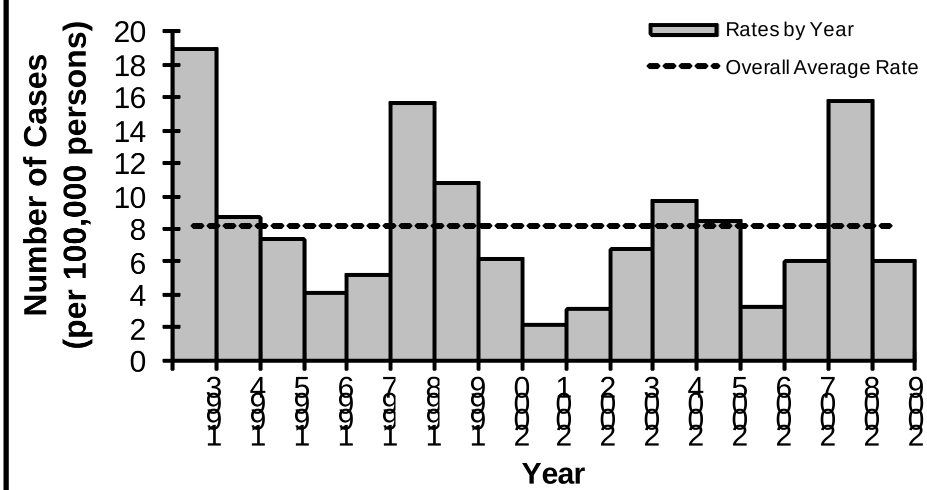
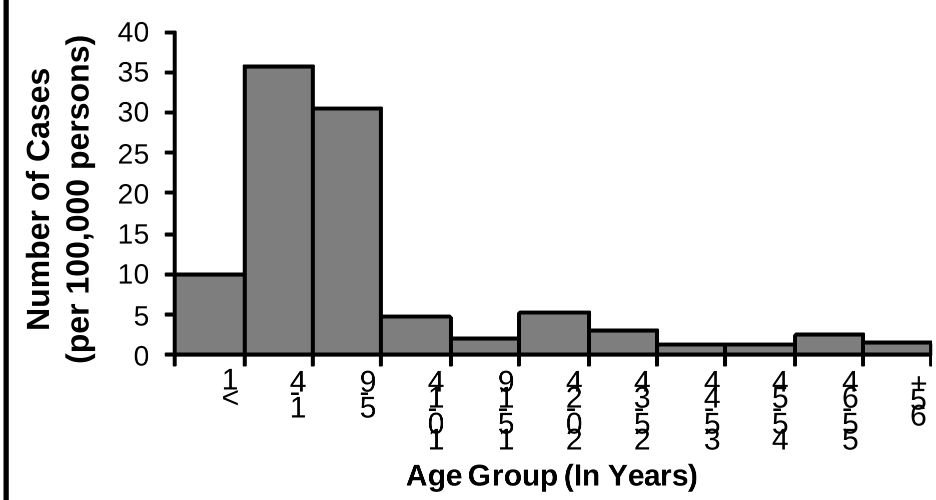


Figure 2. Incidence of Shigellosis, by Age Group, Tennessee, 2009.



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 2009 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 contact with uninfected children. In daycare 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.

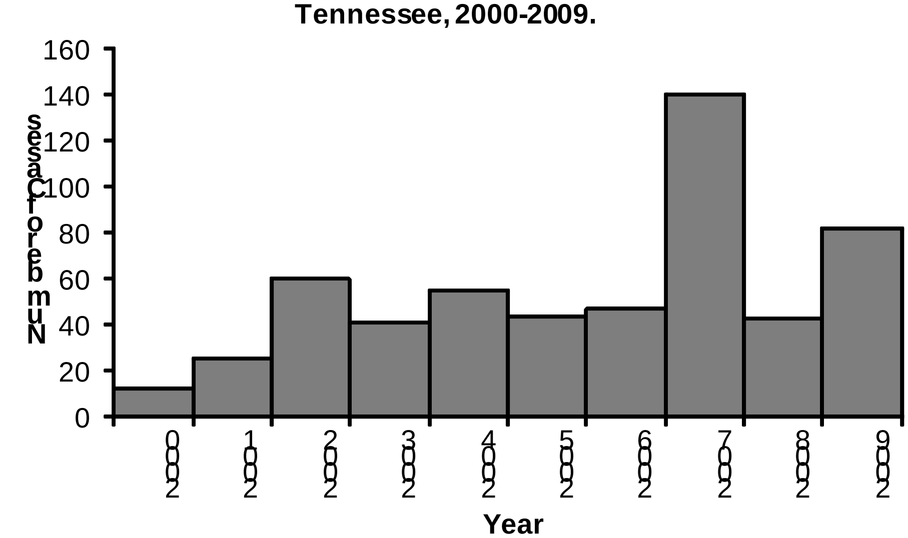
Foodborne and Waterborne Parasitic Diseases

Parasites can cause a range of diseases, many with mild symptoms and some that lead to severe outcomes and even death. Many parasitic diseases have traditionally been considered exotic or foreign to the United States, and have not been routinely included in the differential diagnoses of patients with acute diarrheal illness in Tennessee. Nevertheless, these organisms are a possible cause of illness in Tennessee residents. Immigrants from or tourists who have traveled to areas where these parasites occur continually, in addition to immune-compromised persons, are at risk for parasitic diseases in Tennessee and the rest of the United States. Two parasitic diseases are required to be reported in Tennessee: cryptosporidiosis and cyclosporiasis.

Cryptosporidiosis

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

Figure. *Cryptosporidium* cases, by Year, Tennessee, 2000-2009.



C. parvum has long been recognized in persons, pets, and ruminant animals in agricultural settings. Urban settings and demographics are contributing to the spread of *Cryptosporidium*, and a dramatic rise in cases has occurred both nationally and in Tennessee. Settings that facilitate close personal contact and environmental fecal contamination, such as expanded use of day care centers by infants and young children and an increase in the numbers of elderly people who live in institutions, might contribute to this rise. A growing number of immune-compromised persons are also at risk. Water distribution issues possibly contribute, as water is increasingly piped long distances from source to point of use. Finally, the availability of a 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.

In 1995 a single case of cryptosporidiosis was reported in Tennessee. During 2002–2009, a mean of 64 cases was reported each year (**Figure**). The 137 cases reported in 2007 included cases from at least 2 recreational water outbreaks, one of which was attributed specifically to *C. hominis*. During 2009, 82 cases were reported statewide with no known outbreaks.

Cryptosporidiosis case reporting has facilitated observation of spatial and temporal patterns of infection. The eastern third of Tennessee has reported higher incidence of cryptosporidiosis than the remainder of the state. Analyzing these trends over time may help identify previously unreported outbreaks or regional risk factors for infection.

The Tennessee Department of Health (TDH) distributes educational material on recreational water safety each year in an effort to reduce risk of *Cryptosporidium* infection and other waterborne illnesses. In 2007, TDH Laboratory Services acquired the equipment and training necessary to speciate *Cryptosporidium* specimens as well as to test drinking or recreational water for presence of *Cryptosporidium* and began using those capabilities in 2008. During 2008-2009, selected stool samples were subjected to species testing, and all were identified as *C. parvum*. More detailed identification such as the species of *Cryptosporidium* causing disease in an individual or in a region increases our ability to understand and evaluate common environmental exposures.

Cyclosporiasis

Cyclosporiasis is an intestinal infection caused by the parasite *Cyclospora cayetanensis*, first described in humans in New Guinea in 1977. The causative organism was taxonomically classified in 1993. *Cyclospora* oocysts are stable in the environment and readily survive freezing, exposure to formalin, and chlorination. Oocysts can contaminate food and water, and direct person-to-person transmission is considered common. The recommended treatment is trimethoprim-sulfamethoxazole. Alternative antibiotic regimens have not been identified for patients who do not respond or are unable to tolerate the standard treatment. Many persons with healthy immune systems will recover without treatment, though symptoms can last for several weeks to a month or more.

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.

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 5 years of age accounted for 26% of giardiasis cases from 1995 through 2009.

Acquisition of the parasite requires ingestion of Giardia cysts. This can occur in one of 3 ways: via contaminated water (most frequently), person-to-person transmission, and contaminated food. Many waterborne outbreaks have involved the use of untreated surface water or water that had been inadequately treated. Person-to-person transmission is due to fecal exposure and most frequently occurs among small children in daycare centers, persons in custodial living centers, and men who have sex with men.

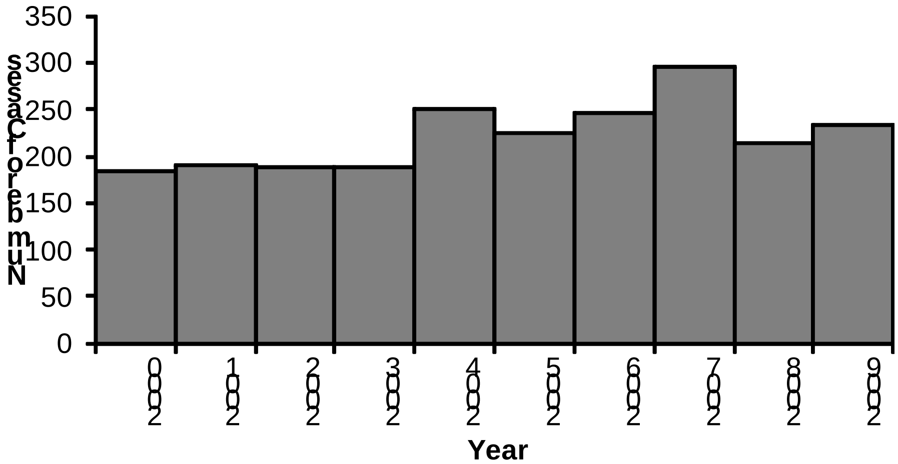


Figure. Number of Giardiasis Cases, by Year, Tennessee, 2000-2009.

The **figure** depicts the number of cases of giardiasis reported in Tennessee from 2000 through 2009; the numbers have remained fairly constant, ranging from a low of 184 in 2000 to a high of 295 in 2007. A total of 233 cases of giardiasis were reported in Tennessee in 2009. For the period of 1995-2009, giardiasis reports followed a typical seasonal trend with 60% of cases occurring during the summer and fall.

Foodborne Outbreaks

A foodborne disease outbreak is defined as the occurrence of 2 or more cases of a similar illness resulting from the ingestion of a common food. All suspected outbreaks and unusual patterns of gastrointestinal illness should be reported promptly to the local health department.

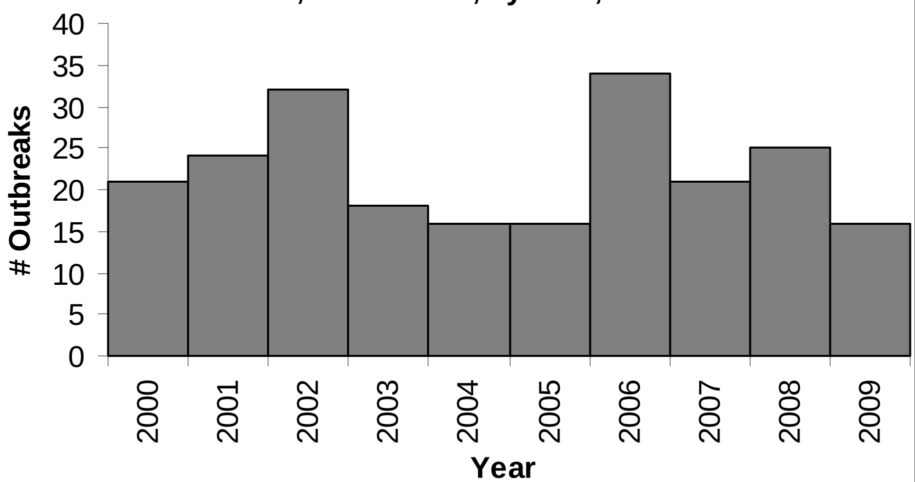


Figure 1. Reported Foodborne Disease Outbreaks, Tennessee, by Year, 2000-2009.

In 2009, 16 foodborne disease outbreaks were reported in Tennessee (**Table**). The increasing use of pulsed-field gel electrophoresis (PFGE) to determine relatedness of bacterial isolates has improved the recognition and investigation of suspected outbreaks. In 2009, a cluster of *Salmonella* Heidelburg with an indistinguishable PFGE pattern was identified. When cases in this cluster were interviewed, epidemiologists discovered that they had all consumed food prepared by the same local restaurant. Interestingly, the same pattern of *Salmonella* had also been isolated from ill patrons of this restaurant in 2007. 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. Over one-third of reported foodborne outbreaks in 2009 were caused by norovirus. Overall, 94% of reported foodborne disease outbreaks had a laboratory-confirmed etiology (**Figure**).

Table. Reported Foodborne Disease Outbreaks, Tennessee, 2009.					
ONSET	COUNTY	# ILL	ETIOLOGY	SITE	SUSPECTED VEHICLE
01/10/2009	Davidson	8	Norovirus GII	Private event, Restaurant	Cake
01/14/2009	Hamilton	22	Norovirus GII	Restaurant	Oysters
01/24/2009	Davidson	6	Norovirus GI	Restaurant	Unknown
02/15/2009	Dickson	1	*Salmonella* Saintpaul	Restaurant	Sprouts
03/06/2009	Hamilton	13	Norovirus GI	Restaurant	Oysters
03/06/2009	Bradley	1	*Salmonella* Carrau	Private home	Melons
03/21/2009	Shelby	1	*Listeria monocytogenes*	Private home	Mexican cheese
06/18/2009	Hamilton	11	Norovirus GII	Restaurant	Cheese dip
06/24/2009	Hawkins	6	Unknown	Office	Roast beef
07/10/2009	Shelby	53	*Salmonella* Heidelberg	Restaurant	BBQ pork
07/18/2009	Davidson	10	*Salmonella* Enteritidis	Restaurant	Unknown
10/01/2009	Davidson	13	*Salmonella* Newport	Restaurant	Lettuce, Roast beef
10/14/2009	Knox, Montgomery, Shelby, Sullivan, Williamson	5	*Salmonella* Montevideo	Private home, Workplace	Peppered salami
10/18/2009	Overton	1	*E. coli* O157:H7	Restaurant	Needle tenderized steak
10/20/2009	McNairy	1	*Salmonella* Newport	Private home	Ground beef
11/10/2009	Williamson	36	Norovirus GII	Restaurant	Salad

B. Hepatitis

Hepatitis A

Hepatitis A is caused by infection with the hepatitis A virus (HAV). The virus 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 initial 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 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.

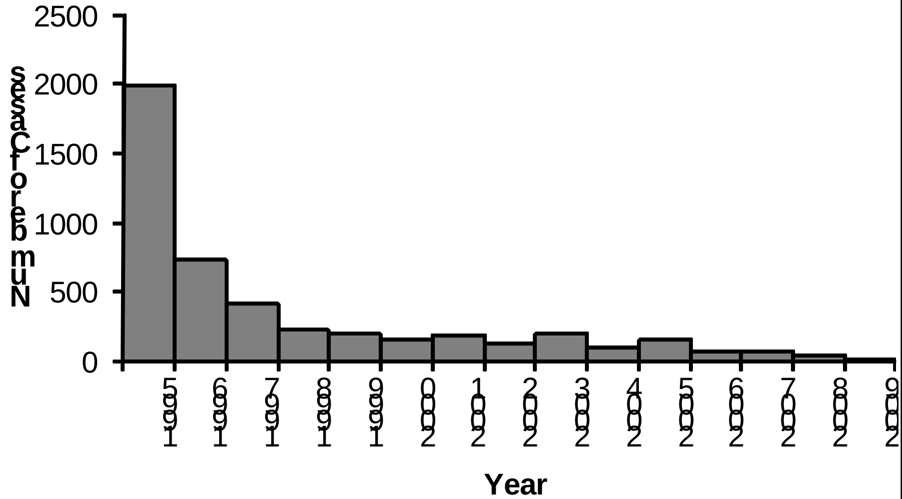


Figure. Acute Hepatitis A Cases, by Year, Tennessee, 1995-2009.

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 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 sexually transmitted diseases (e.g., use of condoms) do not prevent HAV transmission. In addition, efforts to promote good personal hygiene have not been successful in interrupting outbreaks of hepatitis A. 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, persons who are at increased risk for infection, persons who are at increased risk for complications from hepatitis A, and 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 12 cases (0.2 per 100,000 persons) were reported in 2009 in Tennessee, the lowest number to date.

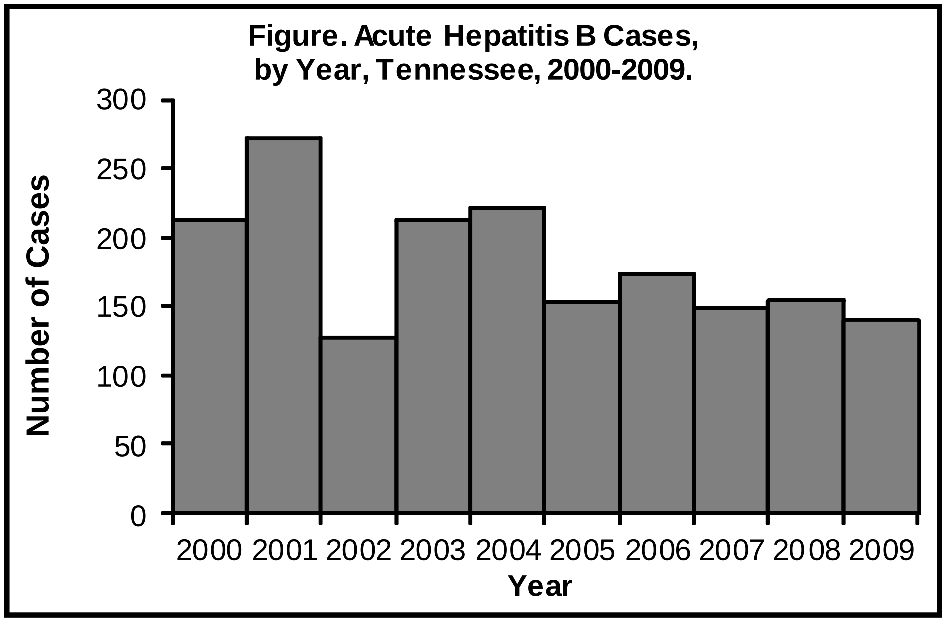
Hepatitis B

Hepatitis B is caused by infection with the hepatitis B virus (HBV). The incubation period from 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 approximately 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, birth to an infected mother, unprotected sex with more than one partner, men who have sex with men (MSM), history of sexually transmitted diseases (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
- 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. All unvaccinated adults seeking services in these settings should be assumed to be at risk for hepatitis B and should receive hepatitis B vaccination.

Hepatitis B case reports in Tennessee have decreased over time (**Figure**). A total of 141 cases were reported in 2009 (2.3 cases per 100,000 persons). The prevalence of HBV infection among adolescents and adults is 3 to 4 times greater for black individuals than for white individuals.

Perinatal Hepatitis B

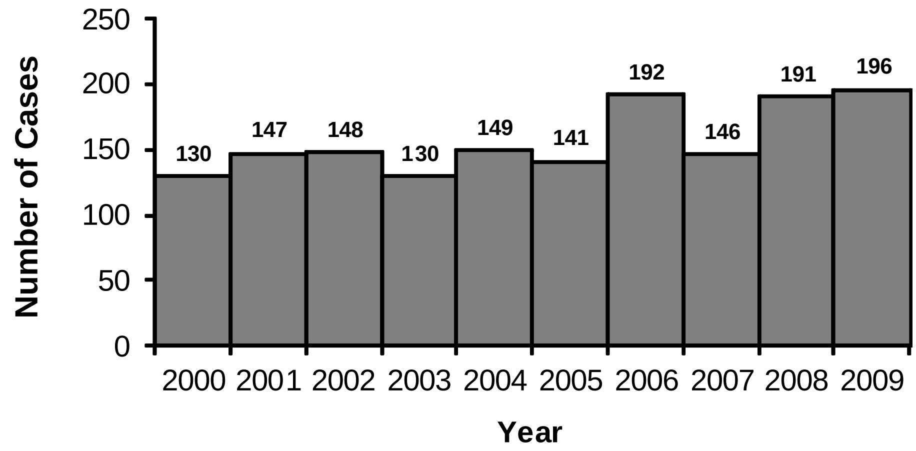
Children born to hepatitis B surface antigen (HBsAg)-positive women are at high risk of becoming chronic carriers of hepatitis B virus. If these children are administered hepatitis B immune globulin (HBIG) and hepatitis B vaccine at birth, their chances of being protected from the illness are greatly 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 Perinatal Hepatitis B Prevention (PHBP) Coordinators in local or regional health departments counsel all pregnant women who are reported as HBsAg-positive. PHBP regional coordinators are supported by the PHBP Program, located within the Immunization Program. As part of this program, other at-risk contacts are identified, counseled, tested and vaccinated. Program representatives ensure that the delivering hospitals have a record of the mothers' status and verify that the hospitals have HBIG and vaccine available.

Figure. Reported Number of Infants Born to Hepatitis B Surface Antigen Positive Women, by Year, Tennessee, 2000-2009.

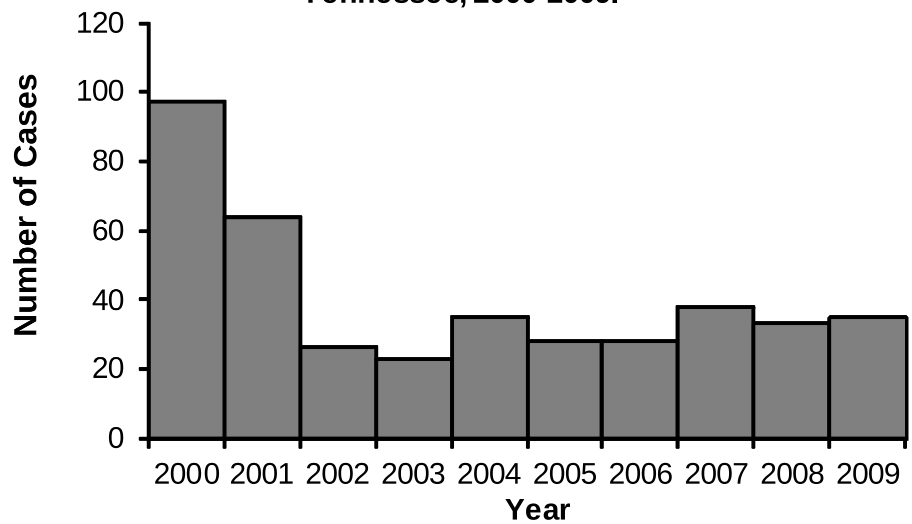


One measure of the quality of the program is the number of infected women identified and contacted annually; the CDC estimates that approximately 300 hepatitis B-infected women deliver babies in Tennessee each year. The **figure** shows the number of infants reported as being born to an HBsAg positive mother in recent years.

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. The number of reported cases of acute hepatitis C illness in Tennessee is low; 35 cases were reported in 2009 (0.6 per 100,000 persons) (**Figure**).

Figure. Acute Hepatitis C, by Year, Tennessee, 2000-2009.



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 (anti-HCV), or seroconversion, is 8–9 weeks, and anti-HCV can be detected in >97% of infected 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 for decades after infection.

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 injection drugs). Although much less frequent, occupational, perinatal, and sexual exposures also can result in transmission of HCV.

The role of sexual activity in the transmission of HCV has been controversial. 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 men who have sex with men (MSM) who deny injection 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 injection drug use is no higher than that of heterosexuals. Because sexual transmission of other bloodborne viruses, such as HIV, is more efficient among homosexual men than in heterosexual men and women, the reason that HCV infection rates are not substantially higher among MSM is unclear. Overall, these findings indicate that sexual transmission of HCV is possible but inefficient.

Although HCV is not efficiently transmitted sexually, persons at risk for infection through injection drug use might seek care in STD treatment facilities, HIV counseling and testing facilities, correctional facilities, drug treatment facilities, and other public health settings where STD and HIV prevention and control services are available.

C. Sexually Transmitted Diseases

Human Immunodeficiency Virus (HIV) Disease

Acquired Immunodeficiency Syndrome (AIDS) and Human Immunodeficiency Virus (HIV) infection have been reportable diseases in Tennessee since 1982 and 1992, respectively. Through the year ending December 31, 2009, 23,020 HIV or AIDS cases had been reported to the Tennessee Department of Health (TDH) Communicable and Environmental Disease Services (CEDS) section. This number includes those persons currently living with HIV disease, as well as those who are now deceased.

For the purposes 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 the following categories: (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 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 or living with AIDS will be discussed further in a subsequent portion of this report.

In 2009, there were 945 reported new diagnoses of HIV disease among Tennessee residents. Of these cases, 73% were male. African-Americans represented the largest proportion of new diagnoses (64%), followed by whites (30%), and persons of Hispanic origin (5%). The largest proportion of new cases of HIV disease were reported among persons aged 25-44 years at time of diagnosis (51%). Most of the remaining new HIV disease cases were among ages 15-24 years (21%) and 45-54 years (17%).

Figure 1. Persons Living with HIV Disease, by Gender, Tennessee, 2005-2009.

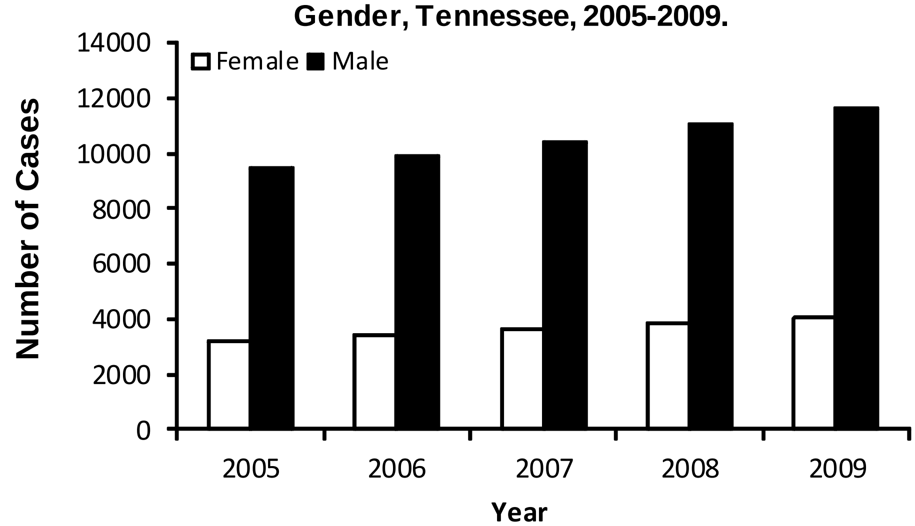
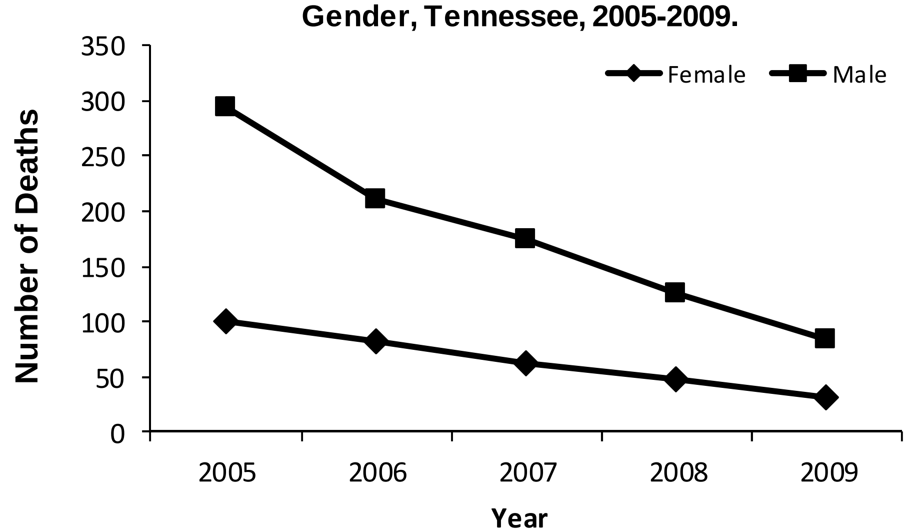


Figure 2. Deaths among HIV-Infected Persons, by Gender, Tennessee, 2005-2009.



Among males, men who have sex with men (MSM) was the most frequently reported exposure category for HIV disease (54%). Heterosexual contact with partners infected with HIV was the second leading exposure category (10%) followed by injection drug use (3%). At the end of 2009, 32% of all newly reported HIV disease cases among men had no identified exposure category; this statistic indicates the historical difficulty in identifying source/spread relationships among HIV-infected persons. Females acquired HIV disease primarily through heterosexual contact with an infected partner (52%), injection drug use (3%), and perinatal exposure (2%). At the end of 2009, 43% of all newly reported HIV disease cases among women had no identified exposure category.

As of December 31, 2009, there were 15,715 persons living in Tennessee with HIV disease (11,636 males and 4,079 females). Of this total, African-Americans represented 58%, whites 38%, and persons of Hispanic origin, 3%. The largest proportion of persons living with HIV disease in Tennessee are 45-54 years of age (33%), followed by those 35-44 years of age (30%), and 25-34 years of age (17%). The numbers of males living with HIV disease increased 23% from 2005-2009; the number of females living with HIV disease increased 24% during the same period (**Figure 1**).

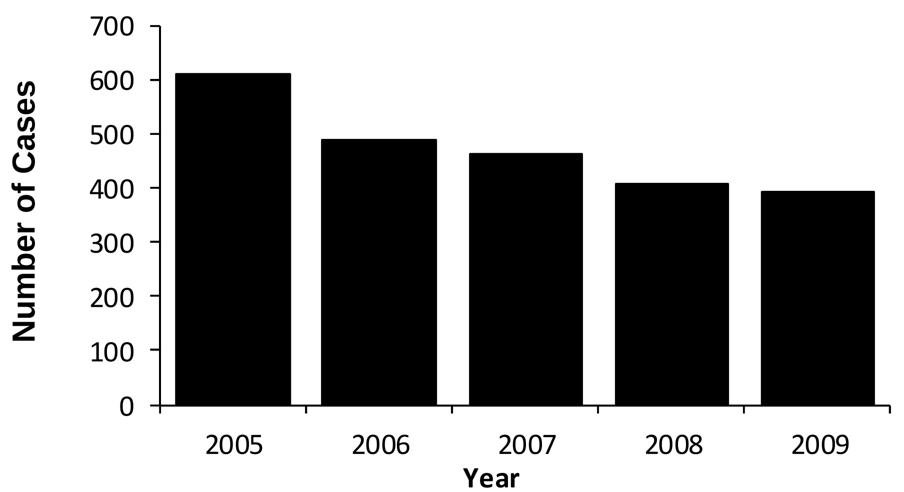
While HIV disease has affected every county in Tennessee, metropolitan areas within our state have traditionally reported the greatest burden of disease. Of the 835 new diagnoses of HIV disease among Tennessee residents, 41% were from Memphis/Shelby County and 21% were from Nashville/Davidson County.

In 2009, there were 116 reported deaths among persons with HIV disease. Over the past 5 years, reported deaths among persons diagnosed with HIV disease have decreased 70% (**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, 2009, 7,928 AIDS diagnoses had been reported since AIDS reporting began in Tennessee in 1982. Over the past 5 years (2005-2009), reported AIDS diagnoses among Tennessee residents have decreased 24% (**Figure 3**). In 2009, 392 cases of AIDS among Tennesseans were reported to the Tennessee Department of Health.

Figure 3. Reported AIDS Cases, by Year, Tennessee, 2005-2009.



Of the total reported AIDS cases, 71% were male. 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 cases of AIDS was among persons aged 35-54 years at time of diagnosis (59%). The remaining AIDS diagnoses were reported among ages 25-34 years (23%), 55-64 years (9%), and 15-24 years (9%).

Of all reported AIDS diagnoses in 2009, men who have sex with men (MSM) was the most frequently reported exposure category (28%). Heterosexual contact with partners infected with HIV was the second leading exposure category (11%), followed by injection drug use (8%). At the end of 2009, 25% of all newly reported AIDS diagnoses were among men who had no identified 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 392 new diagnoses of AIDS among Tennessee residents, 31% were from Memphis/Shelby County and 28% were from Nashville/Davidson County.

D. Vaccine-Preventable Diseases

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 (TIP)'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 school are adequately protected. With the exception of pertussis, a disease to which neither vaccine nor natural disease results in lifelong immunity, and hepatitis B, a disease against which most adults are not vaccinated, the occurrence of these diseases is very low. **Table 1** below depicts the number of cases reported from 2002 to 2009.

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, TIP 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

Table 1. Vaccine-Preventable Disease Morbidity, Tennessee, 2002-2009.

Disease	Pertussis	Diphtheria	Tetanus	Polio	Measles	Mumps	Rubella	Hepatitis B	*H. influenzae* 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
2008	120	0	0	0	0	4	0	155	1
2009	217	0	0	0	1	3	0	144	1

Table 2. Immunization Survey Results, Tennessee, 2009.

Survey	Immunization Level
24-Month-Old Children*	80.76%
Day Care Center Enrollees**	94.41%
Public Kindergarten Survey**	96.62%
Private Kindergarten Survey**	97.45%

* "4:3:1:2:3:1" series complete

** Compliance with State Immunization Requirements

4 doses of diphtheria-tetanus-pertussis (DTaP) vaccine, 3 doses of polio vaccine, 1 dose of measles-mumps-rubella (MMR) vaccine, 3 doses of Haemophilus *influenza* type b (Hib) vaccine, 3 doses of hepatitis B vaccine (HBV) and 1 dose of varicella vaccine (VZV). Together, these are known as the "4:3:1:3:3:1" immunization series. For the 2009 survey, the target goal for *Haemophilus influenzae* type B was changed from 3 doses to 2 doses because a vaccine shortage from December 2007 to late summer 2009 led the Centers for Disease Control and Prevention (CDC) to suspend the booster dose from the recommended schedule for healthy children during that period, including the birth cohort in this assessment. Thus, all assessments shown in this survey are 4:3:1:2:3:1 for 2009. The on-time completion of 4 doses of pneumococcal conjugate vaccine (PCV7) and at least 2 doses of influenza vaccine (Flu) is also reported. Prior surveys have defined complete immunization as the receipt of a minimum of 4 doses of DTaP, 3 doses of polio and 1 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 2009 surveys are presented below (**Figures 1-3**).

The 2009 survey identifies certain characteristics of children at increased risk of not completing immunizations. Principally, those are the following:

1. Beginning immunizations at older than 120 days of life;

Figure 1. 2009 Tennessee Immunization Status Survey of 24-Month-Old Children: Percent with Age-Appropriate Immunization Levels by Vaccine.

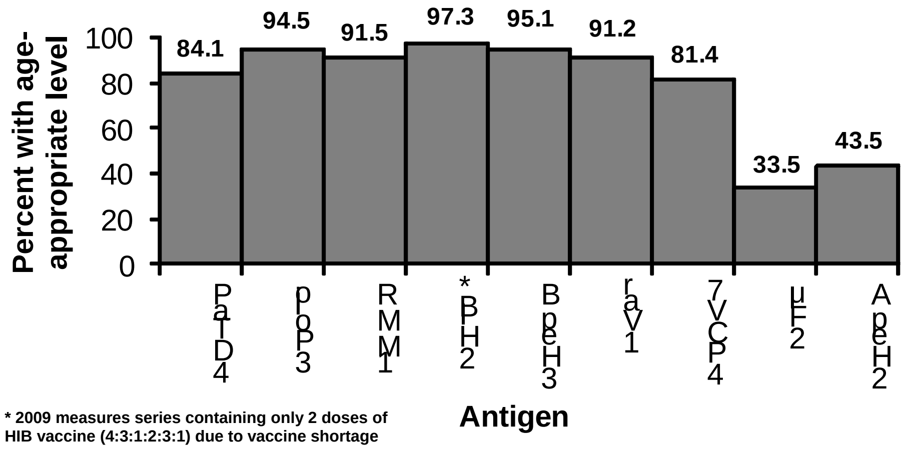


Figure 2. 2009 Immunization Status Survey of 24-Month-Old Children in Tennessee: "4:3:1" and "4:3:1:2:3:1*" Immunization Level Trends: 2000 to 2009

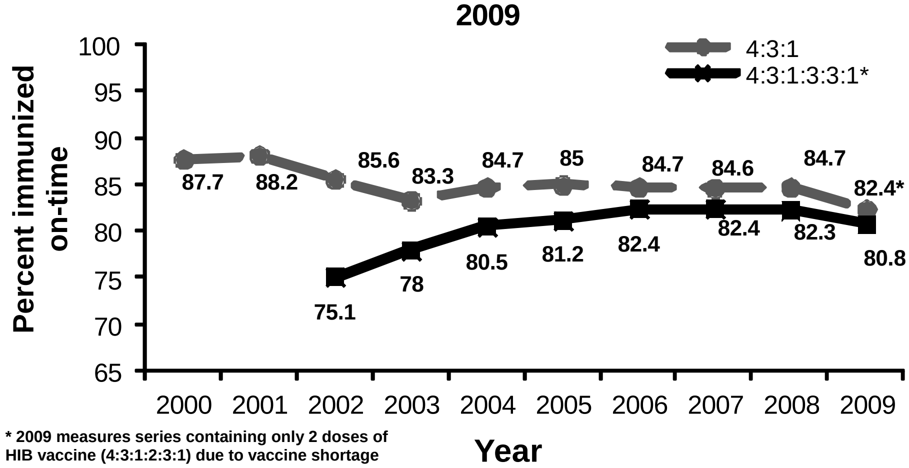
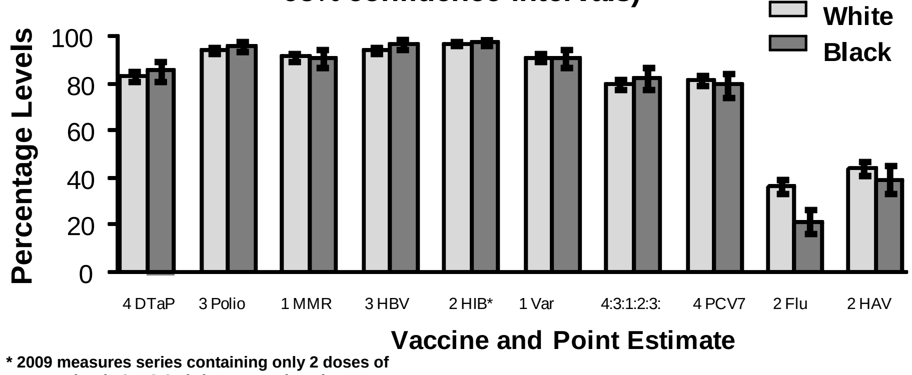


Figure 3. 2009 Immunization Status of 24-Month-Old Children in Tennessee: Statewide percentage of children with age-appropriate immunization levels by vaccine and race (point estimates and 95% confidence intervals)



2. Having 2 or more living siblings at birth; and
3. Being identified as black race, specifically for influenza vaccine.

Key findings of the 2009 survey

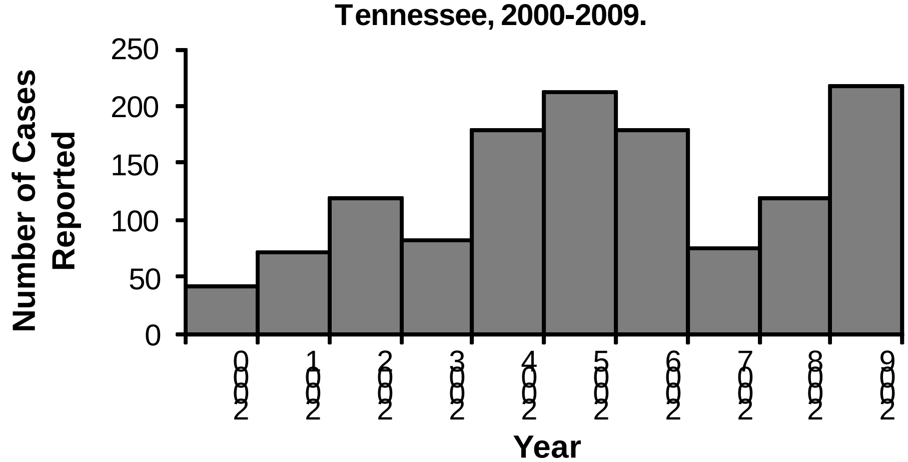
1. The statewide point estimate of on-time administration of all vaccines in the 4:3:1:3:3:1 series was level from 2006-2008 (82.3-82.4%). The 2009 aggregate analyses were conducted with a modified vaccine series (4:3:1:2:3:1 series) because of the Hib shortage, for a statewide coverage measure of 80.8%.
2. TIP's goal of reaching at least 90% on-time coverage with each vaccine included in the 4:3:1:2:3:1 series was achieved for all vaccines except DTaP (84.1%). DTaP vaccination remains the critical barrier to improving overall immunization coverage. DTaP is traditionally the most difficult because it requires 4 doses to be complete. Immunization improvement efforts should focus on this target.
3. The percentage of children with 4 doses of PCV7 was estimated at 81.4%; however, 95.1% of children in the survey had received at least 3 doses by 24 months of age.
4. The percentage of children who had received at least 2 doses of influenza vaccine by 24 months increased slightly. One third of children surveyed in 2009 (33.5%) received 2 or more doses. Annual increases have been measured since this survey began tracking influenza vaccination (18.4% in 2007 and 28.6% in 2008). Despite gains in most areas, extreme regional disparities in coverage with this vaccine exist, ranging from 54.8% coverage in Sullivan County to just 15.3% coverage in West Tennessee Region. A pronounced racial disparity persists in influenza vaccine coverage.
5. No statistically significant difference was detected between black and white children in on-time immunization for the 4:3:1:2:3:1 series in 2009.
6. For the second year, significantly lower rates of influenza immunization were detected in children in both TennCare and WIC programs.

The 2009 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 CDC'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, 2000-2009.



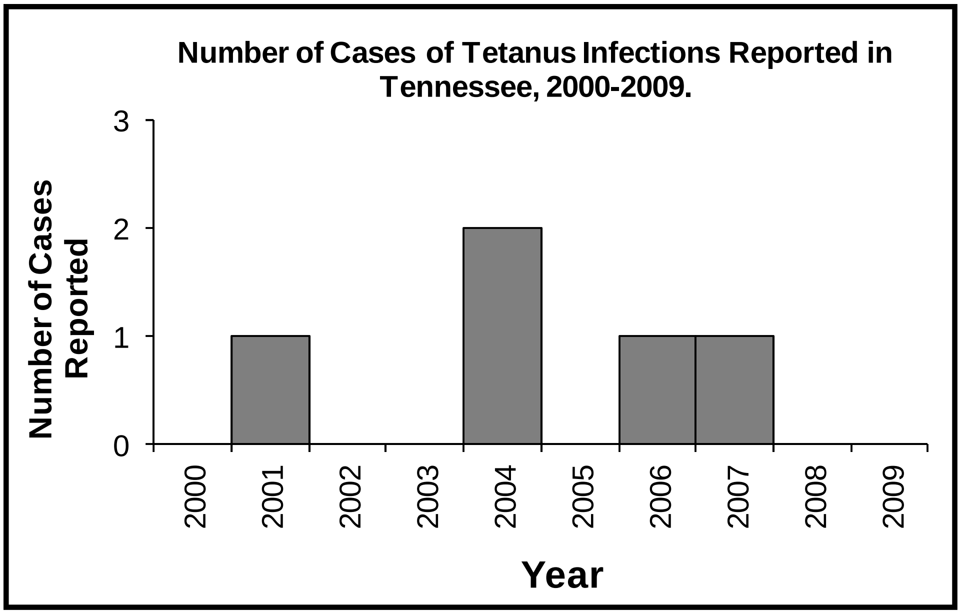
Infants are at greatest risk for complications or death from pertussis, but the disease causes significant illness in adolescents and adults, who account for more than half of all reported cases and are often the source of illness in infants. The most common complication among those with pertussis, and the leading cause of mortality, is secondary bacterial pneumonia. Seizures and encephalopathy are also complications, most frequently occurring 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 2009 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 (many asymptomatic) 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; regulations adopted in December 2009 will require Tdap boosters for all children entering 7th grade in Tennessee in the fall of 2010.

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. 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 and in-dwelling catheters, for example) 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 (**Figure**). 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.

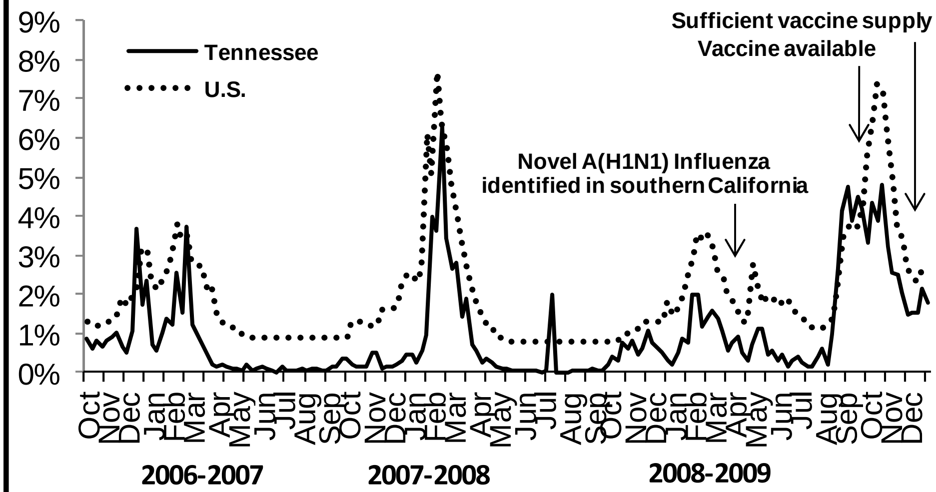
Influenza

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 thousands of Americans each year, 90% of whom are aged 65 years and older.

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 may 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.

In April 2009, a virus with a unique combination of influenza viral genes was identified in southern California. More cases with similar infections were detected elsewhere in California and Texas and, within months, across the United States and in numerous other countries. Tennessee received confirmation its first case of the 2009 influenza A (H1N1) virus on May 5, 2009. The World Health Organization designated this virus a pandemic strain in June 2009, and it was the dominant circulating strain from May through the end of 2009. Because routine seasonal influenza vaccine production was already underway when the new strain was identified, the federal government contracted with vaccine manufacturers to produce a special monovalent influenza vaccine to protect against this 2009 H1N1 pandemic virus. Both seasonal and pandemic influenza vaccines were recommended

Figure. Percentage of Influenza-like Illness Reported in Outpatients U.S. and Tennessee, 2006-07 through 2009.



in the fall 2009 season; distribution of the pandemic vaccine began in October.

Because of the early pandemic influenza peak in Tennessee, vaccine demand was highest just as vaccine began to be distributed. Only small quantities of vaccine were available through October, and eligibility for vaccine was limited to persons in CDC-designated target populations. The pace of administration of available doses in Tennessee significantly exceeded the national average. According to the CDC's Countermeasure Response Administration, Tennessee reported vaccinating 7.13% of its population by November 21, 2009, compared to the national coverage rate of 4.87% of the United States population by that date. Disease activity and demand for vaccine dropped off in Tennessee by late November 2009. As a result, all H1N1 vaccine providers with sufficient supplies were permitted to administer it to anyone requesting it by December 1. By the end of January 2010, CDC estimated 22.5% (+/- 3.3%) of persons aged 6 months and older in Tennessee had received at least one dose of pandemic influenza vaccine (median rate among states was 23.9%).[1]

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 predictably when influenza virus is circulating in the community. The **figure** shows the percentage of outpatients with ILI reported weekly from October 2006 through December 2009. The timing and height of the peak week of influenza activity varies; influenza typically peaks in late January or early February in Tennessee. Pandemic influenza viruses may not follow typical seasonal patterns, and may produce more than one wave of illness; the 2009 H1N1 virus was no exception. In May-June

2009, 2009 H1N1 triggered an ILI peak (pandemic wave 1), with higher than normal levels of ILI reported over the summer months as the virus continued to circulate at lower levels, followed by a wave of illness occurring shortly after schools and colleges were back in session in August and September 2009 (pandemic wave 2).

Nationally, the largest number of 2009 influenza A (H1N1) cases (57%) occurred in persons 5-24 years of age who also accounted for 41% of the hospitalizations. The highest rates of hospitalization were among children younger than 5 years. Persons over age 65 were largely spared, apparently as a result of immunity derived from exposure to related H1N1 strains in the 1940s and 1950s, although those who did become ill were at increased risk of complications and death. Unlike seasonal influenza epidemics, where about 90% of fatalities occur among people 65 or older, about 90% of reported deaths in the United States from 2009 H1N1 were in persons younger than 65. Pregnant women and people with neuro-developmental disorders also were at high risk of complications. In Tennessee, only 13% of hospitalizations occurred in people 50 years and older, and there were few cases and no deaths in people older than 65 years. Tennessee Department of Health received reports of 73 laboratory-confirmed deaths due to 2009 A (H1N1) or a Type A influenza strain (not characterized further). Of these, 13 were in children aged 18 years or younger. In the United States, during the pandemic period from April 26, 2009 to May 22, 2010, 341 confirmed influenza pediatric deaths due to influenza were reported to the CDC.

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

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

Vaccine ▼ Age ▶	7–10 years	11–12 years	13–18 years
Tetanus, Diphtheria, Pertussis[1]	*see footnote 1*	Tdap	Tdap
Human Papillomavirus[2]	*see footnote 2*	HPV (3 doses)	HPV Series
Meningococcal[3]	MCV	MCV	MCV
Influenza[4]	Influenza (Yearly)		
Pneumococcal[5]	PPSV		
Hepatitis A[6]	HepA Series		
Hepatitis B[7]	HepB Series		
Inactivated Poliovirus[8]	IPV Series		
Measles, Mumps, Rubella[9]	MMR Series		
Varicella[10]	Varicella Series		

Range of recommended ages

Catch-up immunization

Certain high-risk groups

E. Vectorborne & Zoonotic Diseases

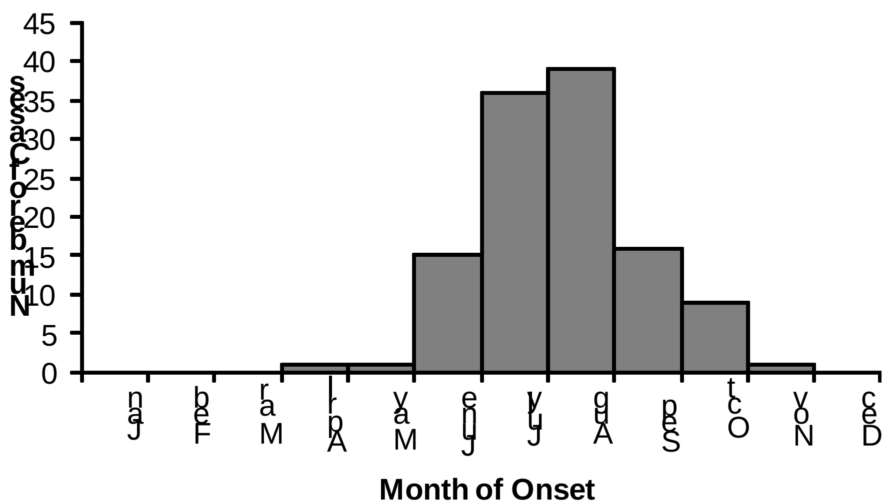
Arboviral Diseases

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 Lakes states, but an increase in incidence has been detected in the Mid-Atlantic states in recent years. Five of the 8 states bordering Tennessee (Kentucky, Virginia, North Carolina, Georgia, and Mississippi) typically report LAC cases. LAC is the leading cause of pediatric arboviral encephalitis and is considered an emerging disease in Tennessee.

In 2002, 164 cases of LAC 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 (WNV), this increase in cases is likely due to improved WNV human case surveillance in the United States (MMWR 2003, 51:53). In Tennessee, from 1998-2009, there have been 136 cases with a median of 13 cases (average: 12; range: 2-19) reported per year (**Table**). Incidence rates have ranged from 0.02-0.06 per 100,000 population in the United States and 0.03-0.33 per 100,000 population in Tennessee during 1998 to 2009. Since it has been reportable, the mildest years for the disease have been in 1999 and in 2005 nationwide as well as statewide. Since the disease is only endemic in the eastern half of the United States, the incidence rates for the Tennessee population will be higher than the incidence rates of the United States population overall (**Table**). The incidence rates in Tennessee have remained relatively consistent since 1998, indicating that the disease is endemic in the state. The incidence of only 2 cases in 2005 may have been due to lower abundance of vectors during that summer compared to other years. In Tennessee, the disease primarily occurs from late May through October with peak transmission in August (**Figure**).

Figure. Distribution of La Crosse Encephalitis Cases, by Month of Onset, Tennessee, 2000-2009.



Traditionally, *Ochlerotatus triseriatus* (Eastern treehole mosquito) is the primary vector of LAC, but in recent years *Aedes albopictus* (Asian tiger mos-

Table. Reported Cases and Incidence Rates (per 100,000 persons) of La Crosse Encephalitis, by Year, Tennessee and the United States, 2000-2009.

	2000		2001		2002		2003		2004		2005		2006		2007		2008		2009	
	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR	No.	IR
TN	17	0.3	15	0.26	14	0.24	13	0.22	2	0.03	7	0.11	14	0.23	6	0.10	6	0.10	9	0.15
US	128	0.05	164	0.06	NA	NA	112	0.04	73	0.02	67	0.02	53	0.02	53	0.02	53	0.02	50	0.02

IR=Incidence Rate

NA= Notifiable Diseases is not compiled

quito) has been associated with LAC cases in eastern Tennessee. The dramatic increase in LAC cases in Tennessee since 1996 has coincided with the arrival of *Ae. albopictus* in the eastern part of the state, suggesting that this mosquito may become an important accessory vector and potentially increase the number of human cases in endemic foci or expand the range of the disease. In 2003, cases of LAC were identified in Hickman (2 cases) and Robertson (1 case) counties, which adds to the increasing evidence that the virus is moving westward across the state due to the increasing presence of *Ae. albopictus*. In 2004, a case in Cocke County emerged, suggesting that transmission is possible in the Northeast Region as well. In 2006, the Northeast Region was directly affected with a case in Greene County. In 2007, Cocke County had 2 cases, and 4 cases occurred in the Upper Cumberland Region, west of the traditional East Region surrounding Cumberland County. In 2008 and 2009, most cases were confined to the East Region.

LAC virus can result in mild to severe infections, with fatalities rare (CFR <1%). The ratio of inapparent 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, a Tennessee patient >65 years of age was reported as a confirmed LAC case in 2003. Although deaths are rarely associated with this disease, Tennessee reported the death of a child in the 1-4 year age group in 2003.

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

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

LAC should be considered in patients (particularly children) presenting with fever and signs or symptoms of central nervous system infection (aseptic meningitis or encephalitis) during summer months. Treatment is supportive. The diagnosis can be confirmed by demonstrating a 4-fold or greater change in serum antibody titer between acute and convalescent specimens, or enzyme immunoassay antibody capture in CSF or serum. Antibody testing is available free of charge at the Tennessee Department of Health State Laboratory, and can be arranged by contacting the local health department.

West Nile Fever/Encephalitis

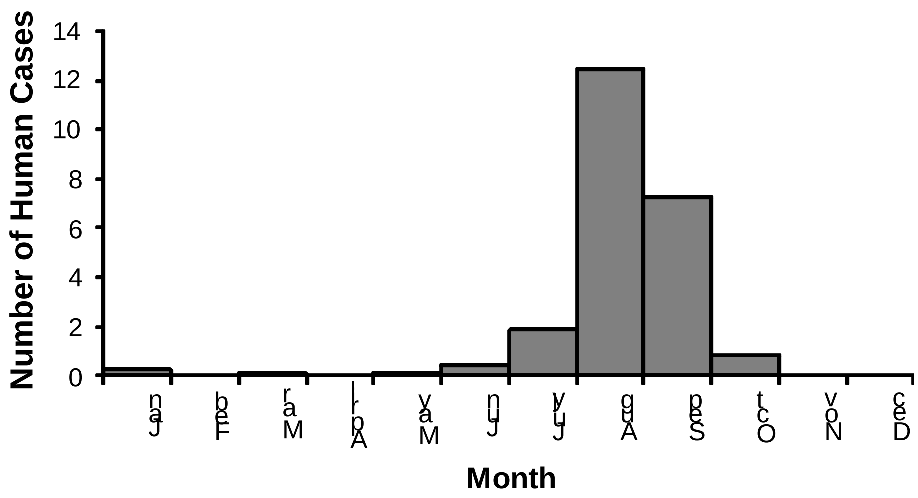
West Nile Virus disease is a febrile illness caused by West Nile virus (WNV). The disease emerged in the United States in 1999, and is now reported throughout the continental United States.

The natural transmission cycle of WNV involves birds and those mosquitoes that feed on birds. As summer progresses, viral load builds in the bird population. As a result, mosquitoes that feed on both birds and mammals (opportunistic mosquitoes) are more likely to come into contact with the virus and transmit it to human and equine populations. Humans and horses are referred to as dead-end hosts because they do not circulate enough infectious units in the blood to infect a subsequent feeding mosquito.

Tennessee reported 9 cases of WNV in 2009, representing the lowest number since 2002 (**Table 1**). Although cases have decreased since 2002, they continue to occur every year. Cases are found throughout the state but are mainly focused in Shelby County, which has reported 60 (65%) of the 93 cases in Tennessee since 2004. Human cases occur from late July through early October with a peak in August and September, which coincides with the primary mosquito vector activity (**Figure**).

The first equine West Nile case in Tennessee occurred in 2001, then in 2002 and 2003 there were 141 and 103 cases, respectively. In 2004 there were 17 equine cases that were scattered throughout the state. From 2005-2009 there were 4-8 cases annually. This difference is most likely due to increased vaccination of horses rather than a reduction of risk in 2004-2009.

Figure. Distribution of West Nile Human Cases, by Month, Tennessee, 2002-2009.



The incidence rate of WNV in Tennessee and the United States were comparable during 2002, the largest outbreak year in Tennessee. Since 2002, incidence in Tennessee has decreased and has always been lower than the national average (**Table 1**). From 2003 to 2009, the rate of disease in various age groups has consistently been correlated with age, such that the highest rates are seen in people 65 years of age and older (**Table 2**). About 50% of the cases in 2004-2009 were in people over the age of 65, and more than 80% of cases were in people over 40 years of age.

In 2002, it was discovered that WNV could be spread by blood transfusion. Blood banks developed diagnostic tools to test every blood donation to ensure the nation's blood supply remained safe. Through this screening

Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of West Nile Virus, Tennessee and the United States, 2002-2009.

	2002		2003		2004		2005		2006		2007		2008		2009	
	#	Rate	#	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	9	0.15
US	31	1.06	96	3.30	24	0.82	290	0.98	426	1.43	3630	1.21	1356	0.45	720	0.24

*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, 2003-2009.

	<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
2009	0	0.00	0	0.00	2	0.24	0	0.00	2	0.16	3	0.15	4	0.50

*One Fatality in 2003, 2005 and 2008.

process, viremic blood donors were identified and reported to state health departments. Three Tennesseans were identified as WNV-positive through this system. One of the 3 blood donors subsequently developed symptoms and was identified as a case.

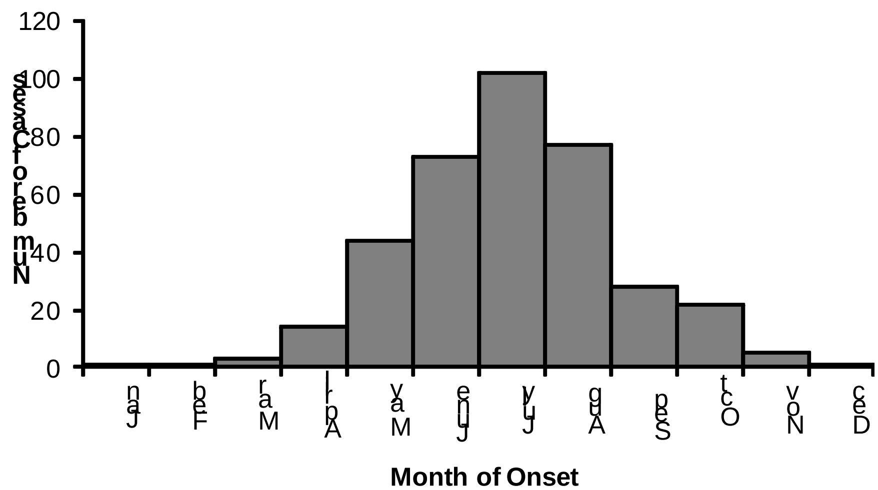
After a thorough review of the 2002 WNV human cases, it was found that these infections lead to high rates of mortality and substantial persistent morbidity. People of advanced age with preexisting health conditions are particularly susceptible to severe neurological disease, long-term morbidity, and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

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, 2 strains of human ehrlichiosis have been identified (**Table 1**). These are 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.

Figure 1. Distribution of HME Cases, by Month of Onset, Tennessee, 2000-2009.



HME is characterized by an acute onset of high fever, severe headache, myalgia, rigors, and malaise with leu-

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, 2003-2009.

	<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
2009	0	0.00	2	0.62	3	0.36	11	1.31	6	0.48	35	1.70	30	3.76

Table 3. Reported Cases and Incidence Rates (per 100,000 persons) of Human Monocytic Ehrlichiosis, by Year, Tennessee and the United States, 2001-2009.

	2001		2002		2003		2004		2005		2006		2007		2008		2009	
	No.	IR	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	92	1.51	88	1.43
US	142	0.05	216	0.08	321	0.11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA= Notifiable Diseases is not compiled IR= Incidence Rate

kopenia, 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 with Rocky Mountain Spotted Fever. More severe symptoms are expected in older and immunocompromised individuals. Approximately 68% of cases are reported to be over the age of 40 years and 87% over the age of 25 years (**Table 2**). Typically, the case distribution is 55% male. Most cases since 1996 have been reported from the Mid-Cumberland Region and Nashville/Davidson metropolitan area, and from the West Tennessee Region and Memphis/Shelby metropolitan area. In 2008 and 2009 there was a large increase over the previous years in the number of cases of ehrlichiosis reported in the state, illustrating the importance of this tick-borne disease in Tennessee.

Lyme Disease and "Southern Tick Associated Rash Illness"

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

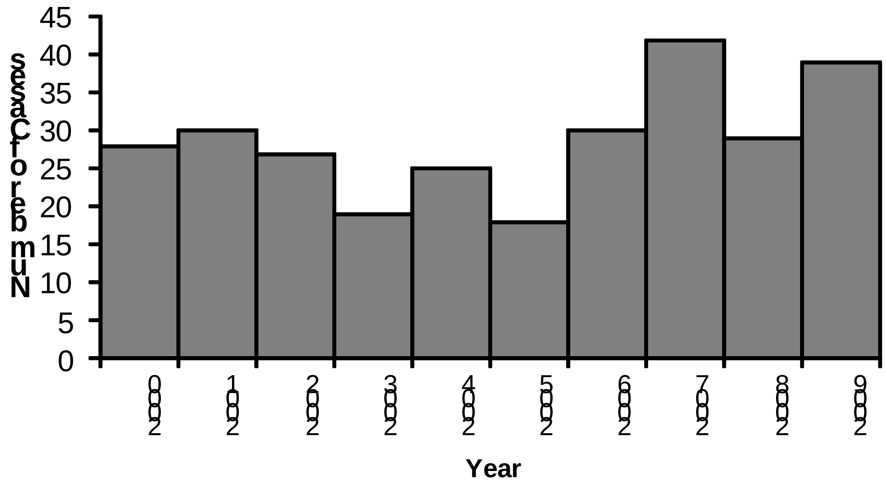
The primary vector of Lyme disease, *Ixodes scapularis*, is rare in Tennessee. *Ixodes* ticks are much smaller than common dog and cattle ticks. In their larval and nymphal stages, they are no bigger than a pinhead. Ticks feed by inserting their mouths into the skin of a host and slowly taking in blood. *Ixodes* ticks are most likely to transmit infection after feeding for 2 or more days.

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

2008, emphasizing the importance of travel history documentation and 2-tiered laboratory testing for confirming cases.

The **figure** depicts the number of reported cases of Lyme disease in Tennessee since 1995. The number of cases of Lyme disease reported in 2007 was higher than it has been since 1998, with 42 cases. In 2009, 39 cases were reported.

Figure. Number of Cases of Lyme Disease, by Year, Tennessee, 2000-2009.



In recent years, patients from southern and southwestern states have been reported with rash illnesses following tick bites, but without laboratory confirmation of Lyme disease. This newly recognized disease has been called **southern tick-associated rash illness (STARI)**. STARI infections are characterized by an expanding circular skin rash, similar to the erythema migrans of Lyme disease, at the site of a tick bite. Symptoms can include 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 true prevalence/incidence is not known. Currently, no commercial diagnostic test is available for STARI. It is possible that some of the Lyme disease cases reported in Tennessee are actually STARI. Patients suspected of having STARI can be enrolled in a CDC study by contacting the Vector-Borne Disease Section at CEDS.

Rocky Mountain Spotted Fever

Rocky Mountain Spotted Fever (RMSF) is a tick-borne 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 known rickettsial species worldwide although only 7 are human disease agents. The primary tick vector in Tennessee is *Dermacentor variabilis* (American dog tick). *R. rickettsii* have been isolated from *Amblyomma americanum* (lone star tick) but this tick remains a minor vector with little impact on the transmission cycle. Both species of ticks are ubiquitous throughout Tennessee. *R. rickettsii* normally circulates in nature between ticks and small rodents (ground squirrels, chipmunks, mice and voles). As with many zoonoses, humans and companion animals such as dogs are incidental hosts. The risk of humans becoming infected with RMSF is extremely low, even in habitats with ticks. Only 1-3% of the vector species ticks carry the pathogen. In addition, prolonged tick attachment is required for transmission. Ticks are considered the vector as well as the reservoir of the pathogen. Maintenance of the pathogen in nature is remarkably efficient and is maintained by 3 independent transmission cycles. The pathogen can be passed from a viremic rodent to a feeding tick, which will remain infected for life. The pathogen is then transmitted vertically from a female tick to the offspring as well as horizontally from male to female during the mating process.

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, Oklahoma, and Arkansas. From 1995 to 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, although this could be attributed to factors such as increased patient testing and reporting. Incidence in Tennessee increased by 42% from 2004 to 2005, and again by 63% from 2005 to 2006. In 2007, there was a 28% decrease in RMSF in Tennessee, likely due to extreme drought and heat conditions which may have reduced the contact between humans and ticks. However, 2008 saw normal rainfall and a 126% increase in RMSF cases. Incidence rates increase in ages over 25 years and peak in the 40-64 years age range (**Table 2**). Transmission can occur all year in Tennessee, although the majority of cases are generally reported between April and September (**Figure**).

Figure. Distribution of Rocky Mountain Spotted Fever Cases by Month of Illness Onset, Tennessee, 2000-2009.

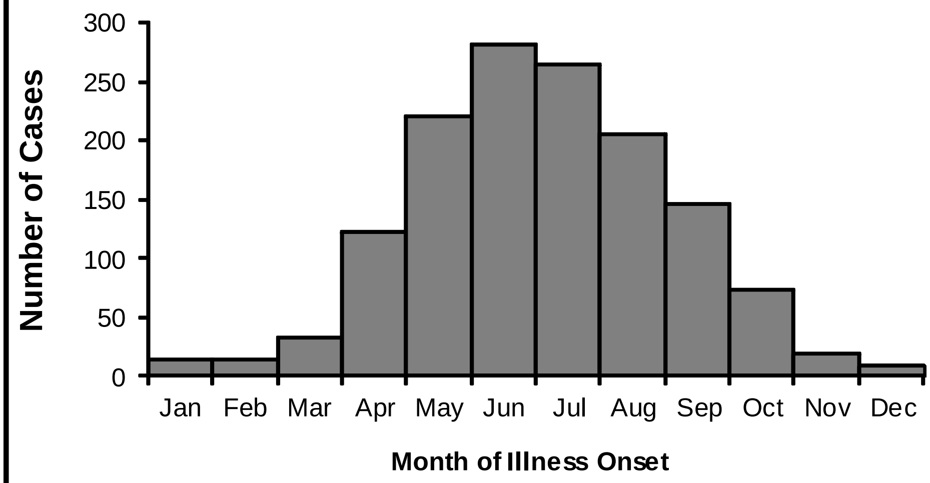


Table 1. Reported Cases and Incidence Rates (per 100,000 persons) of Rocky Mountain Spotted Fever, by Year, Tennessee and the United States, 2000-2009.

Year		TN	US	Year		TN	US
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	2563
	IR	1.27	0.38		IR	3.80	0.85
2004	No.	98	1514	2009	No.	189	1815
	IR	1.66	0.52		IR	3.07	0.59

NA= Notifiable Diseases is not compiled IR= Incidence Rate

The incubation period for RMSF ranges from 2-14 days, although most cases are symptomatic within 5-7 days. The initial symptoms are fever, headache, malaise, myalgia, nausea and gastrointestinal involvement. A rash

Table 2. Reported Cases and Incidence Rates (per 100,000 persons) of Rocky Mountain Spotted Fever, by Age Group, Tennessee, 2003-2009.

	<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
2009	0	0.00	3	0.92	16	1.94	24	2.85	25	2.01	72	3.50	59	7.39

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 can be misdiagnosed due to severe gastrointestinal symptoms that some patients experience. If the disease is not recognized and treated properly, symptoms can advance to confusion, coma and death. Approximately 20% of patients who do not receive anti-rickettsial therapy will die, and, even with proper treatment, 2% will die.

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

Zoonotic Diseases

Rabies

Human rabies cases occur very rarely in the United States and in Tennessee. However, rabies risk assessment remains an important responsibility of the Tennessee Department of Health (TDH). In 2009, no documented human rabies cases occurred in Tennessee. The last confirmed Tennessee rabies case occurred in 2002 following a bite from a rabid bat. The total number of rabies-positive animals submitted for testing remained relatively stable between 2006 and 2008 and decreased slightly in 2009. The proportion of raccoons among all rabid animals has fluctuated, increasing from zero in 2001 to 22% in 2008. In 2009, raccoons accounted for 14% of all positives.

TDH Communicable and Environmental Disease Services (CEDS) 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 spread of raccoon rabies. The USDA-WS program consists of enhanced surveillance and an oral rabies vaccination (ORV) campaign. ORV baiting was conducted in the fall of 2009.

In 2009 1,800 animals were tested for rabies in state laboratories. Animals tested included 588 dogs and 468 cats. The majority of domestic dog and cat submissions were from metropolitan areas. Among animals tested by TDH laboratories, no domestic cats, and only 0.8% of dogs, were positive. To minimize unnecessary rabies submissions of low-risk domestic species, TDH continues to emphasize non-laboratory methods to assess rabies risk, such as a 10-day observation pe-

Table. Animals Testing Positive for Rabies by Species, Tennessee, 2000-2009.

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Skunk	88	98	76	74	27	23	98	82	69	56
Bat	15	11	27	15	11	16	19	22	18	11
Dog	3	2	2	3	1	1	2	5	3	5
Raccoon	0	0	1	4	8	4	3	21	28	12
Fox	0	0	1	2	1	3	4	0	7	2
Horse	0	0	0	4	0	1	0	0	1	1
Cattle	0	0	1	0	0	0	2	1	0	0
Cat	1	0	0	1	0	0	3	1	2	0
Goat	0	0	0	0	0	0	0	0	0	1
Opossum	0	0	0	0	1	0	0	0	0	0
Total	**107**	**111**	**108**	**103**	**49**	**48**	**131**	**132**	**128**	**88**

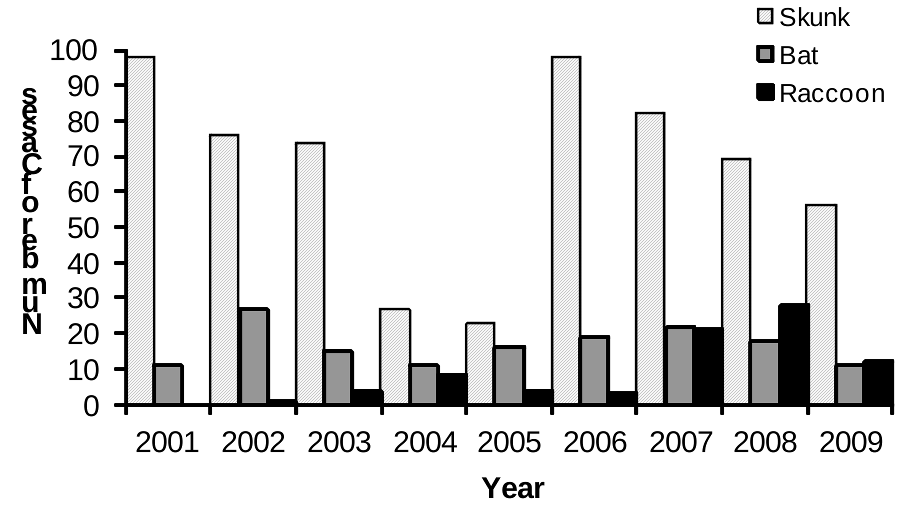
riod for dogs and cats that bite humans.

Statewide, 88 cases of animal rabies were confirmed in 2009 (**Table**). Tennessee has 3 wildlife rabies vector species that, when found rabid, are typically infected by a host-adapted rabies virus variant. These are bats, skunks, and raccoons. For 2009, there were 11 rabies-positive bats distributed across the state, 56 skunks in middle and eastern Tennessee, and 12 raccoons in the eastern part of the state. Six cases of rabies occurred in domestic animals in 2009: 5 dogs (from Marshall, Lincoln, Bedford, Wilson, and Greene counties), and 1 horse (infected with north central skunk variant in White county).

Raccoon-variant rabies cases continued to occur in 2009 and spill over into other species, though less extensively than 2008. Monoclonal subtyping of animal rabies cases indicated that 15 raccoon-variant rabies cases occurred in 4 east Tennessee counties: Carter (5), Greene (2), Johnson (2), and Sullivan (6), in 1 bobcat, 4 skunks, and 10 raccoons. Note that **Figure 1** depicts the number of rabid animals by species rather than the variant with which the animal was infected. Raccoon-variant rabies was first documented in Tennessee in 2003, and animal cases of raccoon-variant rabies have occurred in 10 counties since that time.

As part of the ongoing USDA-WS ORV program to prevent the spread of raccoon-variant rabies, areas of 8 counties were baited in northeast Tennessee, Carter, Cocke, Greene, Hamblen, Hawkins, Sullivan, Unicoi, and Washington. The ORV campaign in southeast Tennessee included Bradley, Hamilton, McMinn, Meigs, Monroe, and Polk counties (**Figure 2**). In 2009, 671,236 baits were distributed over a total of 4,076 square miles in these 14 counties. Raccoon rabies remains as an emerging threat to Tennesseans, and containing or slowing the spread of raccoon-variant rabies westward will require continued support from USDA-WS and other partners.

Figure 1. Rabies Cases Among Wildlife Vector Species in Tennessee, 2001-2009.



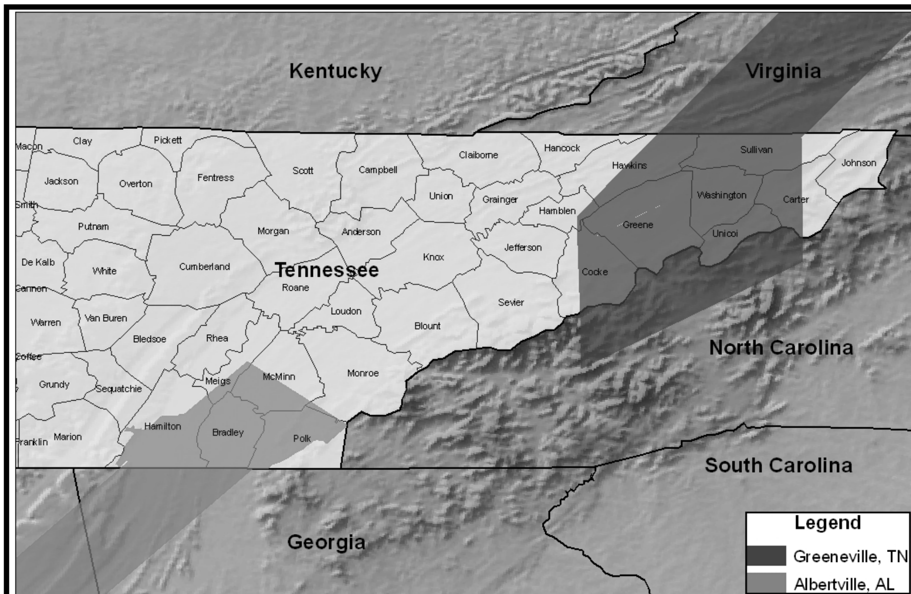


Figure 2. 2009 Bait Zones — Tennessee.

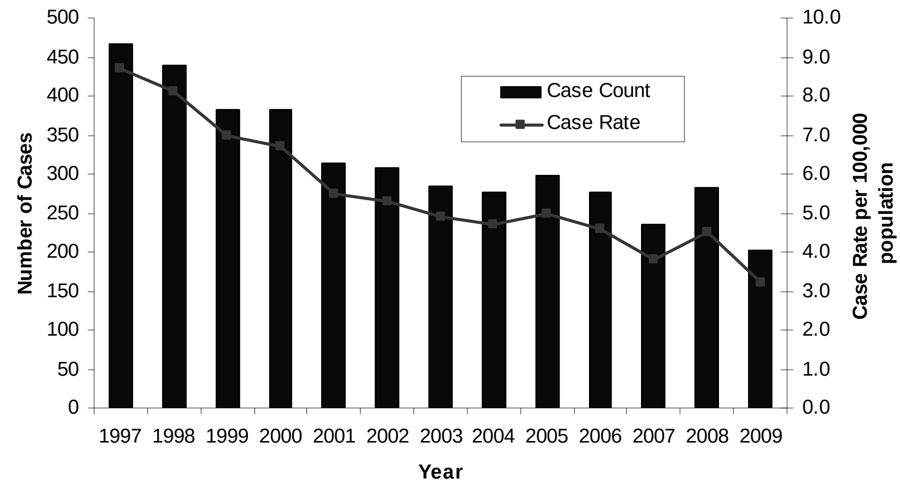
USDA United States Department of Agriculture Animal and Plant Health Inspection Service Wildlife Services

F. Tuberculosis

Tuberculosis Elimination Program

Tennessee reported 202 cases of tuberculosis (TB) in 2009, which represented a decrease of 28% compared with the 282 TB cases reported in 2008. The tuberculosis case rate for Tennessee for 2009 was 3.2 cases per 100,000 population, which is a significant decrease from the 4.5 cases per 100,000 population in 2008 (see **Figure**). In 2009, Tennessee's two largest metropolitan areas had the highest incidence of TB disease in the state: Memphis/Shelby County reported 64 cases (case rate 7.0 per 100,000 population) and Nashville/Davidson County reported 62 cases (case rate 9.8 per 100,000 population).

Figure. Number of Tuberculosis Cases, Tennessee, 1997-2009.



Racial and Ethnic Distribution

In 2009, using self-reported information from the patients, Tennessee reported 40% of TB cases as black non-Hispanic, 32% as white non-Hispanic, 12% as Asian/Pacific Islander, and 14% as Hispanic of any race; in 2008, the racial and ethnic distribution was 41%, 34%, 9% and 15% for the same categories, respectively.

TB Genotyping Program

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

CDC defines a genotype cluster as "two or more *M. tuberculosis* isolates that share the same matching genotypes." 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 provides the TB program with an estimate of the amount of recent TB transmission occurring in various jurisdictions. 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 over time. TTBEP has been monitoring the total clustering percentage in the state. More specifically, the program routinely compares clustering percentages for U.S.-born versus foreign-born culture-confirmed TB cases in order to determine any changes in transmission patterns. Clustering percentages for Tennessee's culture-confirmed TB cases reported between 2004 and 2008 can be found in the **Table** on right.

In 2010, Tennessee transitioned the state genotyping database to the CDC's TB Genotyping Information Management System (TB-GIMS). TB-GIMS national distribution reports have been very useful for prioritizing cluster investigations.

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 strains of *M. tuberculosis* that are resistant to at least isoniazid (INH)

Table. Tuberculosis Clustering Percentages, Tennessee 2004-2009.					
Category	Time Period				
	2004-2005	2004-2006	2004-2007	2004-2008	2004-2009
Reported cases (TIMS database)	576	855	1,090	1,372	1,574
Culture-positive reported cases (TIMS)	455	661	825	1,020	1,154
Total culture submissions for genotype	401	625	759	952	1,068
No. of clustered isolates	201	332	428	560	634
Clustering proportion of all TN submissions	**50.1%**	**53.1%**	**56.4%**	**58.8%**	**59.4%**
No. of U.S.-born case isolate submissions	323	504	591	727	803
No. of U.S.-born clustered isolates	189	308	380	500	540
Clustering proportion of U.S.-born case isolate submissions	**58.5%**	**61.1%**	**64.3%**	**68.8%**	**67.4%**
No. of foreign-born case isolate submissions	78	121	168	225	263
No. of foreign-born clustered isolates	12	24	48	92	94
Clustering proportion of foreign-born case isolate submissions	**15.4%**	**19.8%**	**28.6%**	**40.9%**	**35.7%**

† TIMS: Tuberculosis Information Management System

‡ Submission: Verified case of Tuberculosis submitted for genotyping

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). Reports of MDR-TB remain uncommon in Tennessee; in 2009, Tennessee reported one case of initial MDR-TB cases, with no reported cases of acquired MDR-TB. 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

In January 2009, staff from Central Office, East Tennessee Regional Office and the National Center for Environmental Health gather at Roane County Health Department to prepare to perform door-to-door surveys following the coal ash spill.

Source: Tennessee Department of Health.

Environmental Epidemiology Program

The Environmental Epidemiology Program (EEP) within Communicable and Environmental Disease Services (CEDS) of the Tennessee Department of Health (TDH) works to protect the public from exposure to hazardous substances. Environmental Epidemiology works in all 95 counties in Tennessee. 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 faced several public health challenges in 2009, including vapor intrusion of volatile organic compounds into homes and businesses, improper disposal of pesticides, and the Tennessee Valley Authority (TVA) Kingston Fossil Plant coal ash spill.

Tennessee is consistently listed as one of the top users and generators of hazardous materials in the United States.

The Environmental Epidemiology Program is responsible for environmental public health activities that relate to chemical exposures and pollution in Tennessee.

In 2009, Tennessee had 13 active Superfund National Priorities List (NPL) sites plus 2 proposed sites. There were 287 sites listed in the Environmental Protection Agency (EPA)'s Comprehensive Environmental Response, Compensation and Liability Information System database.

EEP conducts public health assessments (PHAs) and health consultations (HCs) under a Cooperative Agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). If a health hazard is identified, EEP makes specific recommendations to mitigate the hazard, including public health actions such as providing emergency water supply, restricting access, or taking necessary measures to stop the exposure.

ATSDR and EEP use the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposure and disease related to toxic substances. ATSDR provides funding and technical assistance to states and other partners through cooperative agreements and grants to identify and evaluate environmental health threats to communities. These resources enable state health departments and other grantees to further investigate environmental health concerns and to educate communities. From the fall of 2001 through 2009, EEP completed 66 HCs, 3 PHAs, more than 20 technical assists, and 2 environmental investigations.

Based on incident reports submitted to the National Response Center, the nation saw a decrease in the total number of oil and chemical spill incidents from 2006 to 2008; yet, the total number of oil and chemical spills in Tennessee had increased. This resulted in Tennessee having the second largest percent increase in oil and chemical spills among all states from 2006 to 2007 and the fifth largest percent increase from 2007 to 2008. A significant proportion of these incidents were reported as having an unknown cause and occurred in densely populated counties with the highest population of minorities and persons living below poverty level.

To address these incidents, in 2009, EEP began a second partnership with the ATSDR to participate in the National Toxic Substance Incidents Program (NTSIP). The purpose of the multi-component program is to collect, analyze, and use information on acute toxic substance incidents throughout Tennessee over the next 3 years. The goal of the NTSIP is to reduce injuries and deaths associated with toxic substance incidents.

In order to achieve this goal, EEP coordinates with federal, state, and local agencies involved with toxic substance activities. When a toxic substance is released, EEP collects information on where the release occurred, what factors contributed to the release, and what health consequences were associated with the release.

EEP will use this data to determine (1) the frequency and location of toxic substance releases, (2) the substances most frequently involved in a release, (3) the factors contributing to toxic substance releases, (4) the rate of toxic substance releases per census population, and (5) the evacuation capabilities of the area. This information can then be used to (1) help train emergency responders and improve emergency response planning, (2) promote methods that could prevent future

Regional Environmental Epidemiology Activities

Knoxville citizens brought their unwanted mercury thermometers, pharmaceuticals, and personal health care products to a collection event sponsored by the Knox County Health Department, Knox County Solid Waste Department, City of Knoxville, Knoxville Utility Board, Tennessee Department of Environment and Conservation, Knoxville Police Department, and students of the University of Tennessee School of Pharmacy.

Regional Environmental Epidemiologists provide local support to environmental public health projects as part of their responsibility to protect the health of Tennesseans. In 2009, Regional Environmental Epidemiologists performed a wide-range of projects.

East Regional Health Office, Roane County Health Department, Knox County Health Department, and Chattanooga/Hamilton County Health Department performed a door-to-door health needs assessment in response to the TVA coal ash release.

Regional staff participated in public meetings about hazardous waste sites, such as the Alton Park neighborhood brownfields in Chattanooga and the Pulvair Site in Millington.

Several Regions assisted local communities by providing education about and collection of pharmaceutical waste and mercury thermometers. Substantial quantities of these household hazards were properly disposed of.

Earth Day celebrations were held in Nashville, Knoxville, and Memphis.

North East Region participated in the planning of the East Tennessee Environmental Conference that was held March 10-11, 2009.

Nashville Metro Public Health Department spearheaded a Healthy People 2010 Environmental Health Indicators initiative to improve health status.

Shelby County Health Department was involved in a Community Health Survey, which included topics such as air toxins and childhood lead exposure.

Chattanooga/Hamilton County Health Department received an Energy Efficiency and Conservation Block Grant for green projects.

Southeast Region Health Office promoted the use of EPA's *Tools for Schools* resources for maintaining

Vegetables were being grown on the edge of the Lenoir Car Works Site. East Regional Health Office staff collected vegetables to determine if any had up taken contaminants.

indoor air quality in schools.

Knox County Health Department attended the National Environmental Health Tracking Conference in Washington, D.C.

Other Regional activities included assisting with disease outbreaks, preparing for emergencies, participating in drills, maintaining syndromic surveillance systems, and writing plans for chemical emergencies.

TVA Kingston Fossil Plant Coal Ash Release — Roane County

Tennessee witnessed one of our nation's largest environmental spills when a dike broke at TVA's Kingston Fossil Plant. Approximately, 1.1 billion gallons of coal ash sludge spilled over 300 acres of river and land. Amazingly, no one was injured.

On Monday, December 22, 2008 around 1:00 A.M., the retention wall of a coal ash-holding pond failed at the TVA Fossil Plant in Roane County, Tennessee. More than 5.4 million cubic yards of coal ash, mixed with 327 million gallons of water, spilled into a branch of the Emory River, 2 Emory River inlets, and the main channel of the Emory River. The release covered approximately 300 acres outside of the TVA coal ash dewatering and storage areas and is considered one of the largest environmental disasters in United States history.

The massive coal ash slide disrupted power and ruptured a gas line, prompting the evacuation of 22 residents. Although there were no deaths or injuries caused by this extraordinary ash slide, the spill has dramatically affected the environment and disrupted citizens' lives. Water quality in the Emory River at the site of the ash spill was impaired and aquatic habitat was destroyed.

The spill filled coves north of the ash containment pond with ash, soil, and debris from trees and boat docks. The ash and soil completely filled in these coves and spilled across the yards of a few homes. The ash spill damaged 3 homes to the point that they were condemned.

Many residents, whose yards backed

Residents awoke to find ash-filled waterways and their boats and docks damaged.

Deputy State Epidemiologist, Dr. David Kirschke, informed the public through the news media that the Health Department would be conducting door-to-door surveys during one of the many press conferences at the Joint Information Center.

up to the coves, were concerned about ash in their yards and in the river. They were also concerned about cenospheres floating in the river and about the ash becoming airborne.

Various governmental agencies, including the Roane County Emergency Services and Homeland Security Agency, the Tennessee Emergency Management Agency (TEMA), EPA, TDEC, ATSDR, TDH, and TVA, responded quickly. Initial activities focused on evacuating people, restoring power, repairing the ruptured gas line, collecting environmental samples, and clearing roads for access to the coal ash release area.

After coal is burned, the metals in the coal become concentrated in the coal ash. These have the potential to cause harm to the environment and to people. For this reason, TVA, EPA, and TDEC immediately began sampling and analysis of the ash itself, surface water, groundwater, drinking water, and air to determine if harmful levels were present. Much of 2009 was spent reviewing the analytical results make sure that public health was protected. EEP used data from TDEC, EPA, and TVA that were verified and validated. EEP also considered data from academia and non-governmental organizations.

The initial draft of the PHA was released on October 30, 2009. The public comment draft was released on December 9, 2009, with a 60-day comment period.

TDH continues to work with our state and local partners throughout the cleanup. The final report was released in 2010, following extensive review by the public, national environmental organizations, the ATSDR Office of Science, and 3 ATSDR-selected outside peer reviewers.

EEP and ATSDR are confident that no harm to health should have oc-

Rich Nichol from the federal Agency for Toxic Substances and Disease Registry and Bonnie Bashor from the Tennessee Department of Health talked with concerned citizens during a public open house in the gymnasium of Roane State Community College.

curred from any route of exposure to the ash or the metals in the ash. This lack of harm resulted from quickly removing people from the immediate spill area and very careful work around the ash so that it did not get into the air.

Health Consultations

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

Brownfields are defined as abandoned, idled, or under used industrial and commercial sites where expansion or redevelopment is complicated by real or perceived environmental contamination. They can be in urban, suburban, or rural areas. EPA's Brownfields initiative helps communities mitigate potential health risks and restore the economic viability of such areas or properties.

Alton Park Brownfields — Hamilton County

Three sites in Chattanooga were selected as possible brownfield redevelopment sites after the Chattanooga/Hamilton County Regional Planning Agency (CHCRPA) was awarded EPA grants to investigate the sites. Environmental sampling was conducted at all 3 sites. EEP reviewed reports generated by the agency's environmental consultant after the sampling results were obtained. EEP was asked by the CHCRPA to prepare HCs for each site, recommending the types of development, such as residential or commercial, that could be initiated on each site, depending on site conditions and sampling results. EEP did so and also participated in a meeting at which the results were shared with the community.

Egyptian Lacquer Company — Williamson County

This facility kept chemical solvents in underground storage tanks (USTs). There was a leak in underground piping that resulted in the release of acetone and toluene. The chemicals migrated underground to a creek where they came out of seeps in the creek bank. Homes and an elementary school were located near the facility. Some citizens complained about chemical odors in the air. Ambient air samples were collected and tested in an attempt to identify which chemicals might be causing the odor. After a laboratory determined which chemical vapors were present in the air samples, TDEC informed the local residents and school. EEP prepared a HC that concluded the intermittent presence of acetone and toluene in ambient air would not be a public health concern. Investigation of the ELMCO site continued into 2010.

Morrill Motors — Unicoi County

Groundwater data from a well near a former electric motor manufacturing plant showed contamination of 1,1-dichloroethylene (1,1-DCE) in the groundwater. The water well was used by an elderly homeowner as the sole source of water for drinking, bathing and cooking. Monitoring data indicated that 1,1-DCE concentrations were above EPA drinking water maximum contaminant levels (MCLs). EEP prepared a HC that evaluated the 1,1-DCE levels and concluded that those levels would not likely be a health concern. However, as a prudent public health measure, EEP recommended to TDEC that a filtration unit be placed on the water well to filter out the 1,1-DCE and provide the homeowner with a clean source of water. A filter was installed to purify

Wearing protective booties over their shoes, staff from the Shelby County Health Department and the TDEC Memphis Environmental Field Office toured the Pulvair Site.

the water.

Wolverine Tube — Giles County

A copper tubing manufacturer in Ardmore had a groundwater contaminant plume beneath its facility from its solvent cleaning tanks that leaked. TDEC's Division of Remediation was concerned about worker health and the health of anyone drinking well water near the site. EEP evaluated the human health risk assessment report done for the remedial investigation/ feasibility study. EEP agreed with the proposed actions and provided written comments.

Pulvair — Shelby County

The Pulvair Site was a potential brownfield redevelopment in Millington, north of Memphis. The site was an old pesticide blending facility, with herbicides, carrier solvents, and intermediate chemicals. Some of these chemicals were still present in soil. EEP, TDEC, the Shelby County Health Department, and the Mayor of Millington discussed property reuse options. EEP helped the city government understand various risk scenarios for potential future reuses of the site along with their potential future maintenance and operation costs.

Chemtura Site — Shelby County

An active chemical manufacturer in Memphis had a groundwater contaminant plume migrating beneath its facility from past manufacturing processes. TDEC's Division of Remediation was concerned for worker health and for the health of nearby residents and school children. EEP evaluated the situation and risk-based site-specific standards that their consultant developed.

Hardeman County Landfill — Hardeman County

One of Tennessee's legacy NPL Superfund Sites, the Hardeman County Landfill, contaminated its entire watershed. Elevated levels of carbon tetrachloride and chloroform were measured in groundwater, surface water, soil, gas, indoor air, and even ambient air. Data from a year-long air sampling survey performed by the EPA and TDEC throughout 2008 was under review and discussion in 2009. Homes have been remediated to lessen the indoor concentration of carbon tetrachloride and chloroform.

Restaurant Investigation — Shelby County

A restaurant in Memphis had a groundwater contaminant plume migrating beneath the building from an-

To gather community health concerns about potential exposure to hazardous substances, EEP and Shelby County Health Department staff joined community members for a Community Action Group meeting to discuss issues and problems related to the former pesticide blending facility at the Pulvair Site in other business' leaking UST. TDEC was concerned for worker health and asked a consultant to perform a vapor intrusion sampling inside the restaurant. EEP evaluated the results of the sampling and concluded no apparent health hazard existed from benzene in the restaurant's air.

ISS Oxford Building Services – Shelby County

A groundwater contaminant plume migrated beneath a manufacturing facility in Memphis from another source. TDEC was concerned for worker health and requested that their environmental consultant perform soil-gas sampling to check for vapor intrusion. EEP conferred with TDEC about the design of the work plan.

Chemtura Site – Shelby County

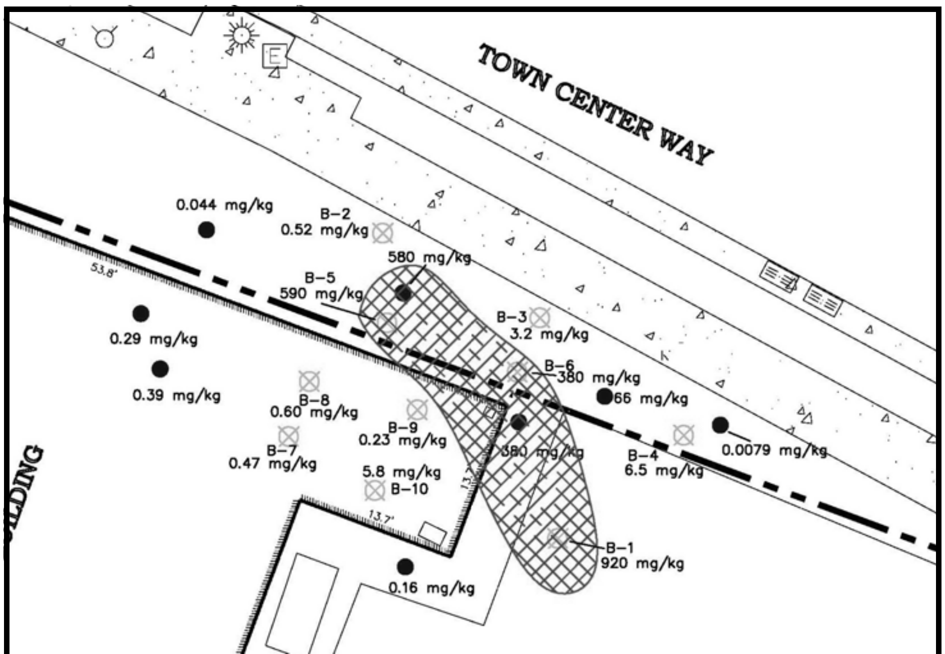
An active chemical manufacturer in Memphis had a groundwater contaminant plume migrating beneath its facility from past manufacturing processes. TDEC's Division of Remediation was concerned for worker health and for the health of nearby residents and school children. EEP evaluated the situation and risk-based site-specific standards that their consultant developed.

Drycleaner Site Investigations

In 2009, EEP reviewed air monitoring data from several drycleaner sites and provided evaluations varying from technical assistance to HCs. Some sites were AMark Cleaners in Oak Ridge, the Former Fashion Cleaners in Shelbyville, Carriage House Drycleaners in Brentwood, Valet Cleaners and Bunny Progressive Drycleaners in Memphis.

Fashion Cleaners – Bedford County

The building formerly known as Fashion Cleaners was being used as a church in Shelbyville. The church also operated a nursery in a small part of the building. The soil and groundwater under the building were known to be contaminated with drycleaner solvent. The TDEC Drycleaner Environmental Response Program (DCERP) had its contractor remove contaminated soil beneath a portion of the building slab and install a groundwater treatment system. A lactate solution was injected into the groundwater to speed decomposition of the contaminants. More groundwater sampling was conducted, and indoor air was sampled after the soil removal and groundwater injection. EEP wrote n HC about drycleaner solvent vapors inside the air of the church. No apparent health hazard was determined for the congregation.



Years ago the drycleaning solvent, tetrachloroethylene, was spilled at the Carriage House Cleaners Site. After extensive soil testing and removal of contaminated soil, the property was deemed ready for commercial reuse.

Carriage House Cleaners – Williamson County

EEP assisted with the site review of an urban drycleaner site known as Carriage House Drycleaners where an external above ground storage tank was believed to have leaked during the many years of drycleaner operations. An area of soil was contaminated with drycleaner solvent and subsequent breakdown products. The contaminated soil was excavated and removed. A sodium lactate aid was put on the bedrock before the area was filled to help bioremediate any residual contamination. EEP evaluated the site for indoor air vapor intrusion; a trace amount of tetrachloroethylene was measured in indoor air. EEP concluded that no apparent health hazard was likely. This investigation helped the plan to convert the drycleaner site into a commercial site move forward. A radon type vapor mitigation system was discussed to be included in the design of the new building to ensure that vapor intrusion would never be a concern.

Fairgrounds Cleaners — Greene County

A Greeneville drycleaner was reported to have stopped operating in November 2006. All drycleaning equipment and solvents were reported to have been removed. Staining on the floor and detection of tetrachloroethylene in nearby groundwater monitoring wells provided evidence of a past release. The new use of the building as a laundromat posed a potential vapor intrusion concern. A neighboring property and a tool and die company were also evaluated for vapor intrusion.

Other Environmental Public Health Activities & Updates

Throughout the year, EEP is involved with various activities promoting environmental public health across Tennessee through education or community involvement.

In January, EEP staff attended EPA's National Vapor Intrusion Forum in Philadelphia, Pennsylvania. Technical presentations included issues about sampling, risk assessment, and engineering considerations. Case studies illustrating vapor intrusion issues from the viewpoint of community stakeholders, brownfields, EPA, and states were also presented.

In March, EEP staff gave a presentation at the East Tennessee Environmental Conference in Kingsport about an investigation of lead in industrial and residential soils at Lenoir Car Works in Loudon County.

In September, EEP was called upon to assist school administrators in educating parents about the health implications of a roofing material containing diisocyanate being sprayed on the roof of a school.

In October, 4 EEP staff members attended the National Environmental Public Health Conference in Atlanta, Georgia. Joe George gave a presentation entitled "Is vapor intrusion lurking around your town's former friendly neighborhood drycleaner?" David Borowski gave a presentation on the TVA Kingston investigation entitled "Environmental disaster: Coal ash release: The Tennessee Department of Health story."

EEP coordinated with the Tennessee Department of Agriculture (TDA) to evaluate potential exposure to a pesticide, fipronil, in nursing homes across Tennessee. TDA asked for assistance with interpretation of laboratory results of wipe samples taken from nursing homes illegally sprayed with the pesticide. Sixty nursing homes were investigated from July 1 to September 30. While fipronil was identified in some locations, it was not present in quantities or found in living areas that would cause concern.

EEP welcomed 2 new staff members to the Central Office in 2009:

Rebecca Gorham is an Environmental Health Assessor with a BS in Natural Resource Management from the University of Tennessee in Knoxville. Mrs. Gorham came to EEP from TDEC where she spent 17 years working in programs that included Underground Storage Tanks, Air Pollution Control, Solid Waste Assistance, and Pollution Prevention. Prior to working with the state, Mrs. Gorham was an Environmental Protection Assistant at Fort Ord, California, and at Naval Air Station, Glenview, Illinois, where her primary duties involved hazardous waste management.

Judy Manners is an Environmental Health Specialist. Judy is part of the EHS-Net Water and Environmental Epidemiology programs. EHS-Net Water is a collaborative effort with the CDC, EPA, and 4 other states aimed at the prevention, surveillance, and

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control of waterborne disease outbreaks. Ms. Manners has 2 Bachelor of Science degrees from Western Kentucky University in Bowling Green, Kentucky, in Agriculture and in Biology. Ms. Manners also holds a Master of Science in Biology from Murray State University in Murray, Kentucky. Prior to coming to TDH, Judy was employed with TDEC for 10 years where she worked in the Divisions of Air Pollution Control and Water Pollution Control as an Environmental Specialist. Ms. Manners also worked for a brief time with the Tennessee Department of Transportation as a Biologist.

SECTION V.

Investigations and Outbreaks

Jennifer MacFarquhar collects environmental samples during an outbreak of a rare serotype of *Salmonella*, *Salmonella* Liverpool, in Memphis.

Source: Tennessee Department of Health.

Highlighted Investigations and Outbreaks in Tennessee in 2009

The Communicable and Environmental Disease Services (CEDS) section and health department personnel from across the state investigate outbreak each year. In 2009, several outbreak investigations highlighted the importance of these activities and the measures taken by public health professionals to prevent additional outbreaks.

Two Outbreaks of Norovirus Gastroenteritis Associated with Consumption of Raw Gulf Coast Oysters— Chattanooga, January & March, 2009

Outbreak – I

In January 2009, 33 persons from Tennessee and Mississippi reported gastrointestinal illness consistent with norovirus infection following the consumption of raw oysters. Twelve of these reported consuming oysters at a private party in Mississippi on January 10, 2009. Twenty-one reported eating at Restaurant B in Chattanooga, TN, between January 12 and 18, 2009. Diarrhea, vomiting, and nausea were the three most common symptoms.

A case-control study revealed a strong association between the consumption of oysters, raw or fire roasted, and illness (OR 24.3, $p<0.001$). One employee with illness inconsistent with viral gastroenteritis and with onset prior to oyster consumption by the case-patients was identified. Test results for this employee were negative for norovirus.

Five stool specimens from ill persons in Tennessee and Mississippi, and 19 oysters collected from Restaurant B, tested positive for norovirus GII. Fecal coliform and *E. coli* levels noted in oysters were <18 MPN/100g. Male-specific bacteriophage tested low (<6 pfu/100g oyster tissue). Stool specimens and oysters both contained norovirus GII with 100% sequence homology.

Oysters consumed at the private party in Mississippi and at Restaurant B had been harvested on January 5-6, 2009, from Mississippi's Conditionally Approved Area 2-C Shellfish Growing Waters in the western Mississippi Sound. During the environmental investigation of the harvesting area, the MDMR reported that 53 boats were present in the first harbor on January 27, 2009. One hundred-one of 108 fishermen present were interviewed. Thirty-six boats were present in the second harbor, and 35 fishermen were interviewed. Of 136 interview participants, one reported illness during the 2-3 weeks prior to January 5-9. Ninety-eight percent of interviewees had access to some type of restroom device on their boat with most reporting having access to Marine Sanitation Device (MSD) buckets. Ten percent said they had neither hand sanitizer nor soap on board. Most (67%) said they do not have holding tanks available on board. Eleven per cent admitted to not disposing of wastewater properly, but only 3% reported disposal of wastewater in reef areas.

Outbreak – II

In March 2009, 13 persons residing in Tennessee, Alabama, Georgia, and Missouri reported experiencing acute gastroenteritis after dining at Restaurant B. Diarrhea, nausea, headache, and stomach cramps were the most commonly reported symptoms. No ill employees were identified.

A case-control study was conducted with controls enrolled from well meal companions of ill persons or other well patrons identified from the reservation list. Raw oysters were strongly associated with illness (OR 91.0, $p<0.001$). No other foods were associated with illness.

Implicated oysters from Restaurant B were harvested from the same area as oysters associated with Oubreak I, Mississippi Conditionally Approved Area 2-C Shellfish Growing Waters, on February 2, 2009. Four stool samples submitted from ill persons in Outbreak III were confirmed positive for norovirus GI by the Tennessee Department of Health Laboratory Services. Twenty-four oysters collected from Restaurant B tested negative for norovirus.

Discussion

Investigation of Outbreaks I and II implicated oysters grown in the same area, Mississippi's Area 2-C Shellfish Growing Waters. In Outbreak I, norovirus GII was identified as the etiologic agent. However, two months later, in Outbreak II, norovirus GI was identified in patient stool specimens. This suggests that multiple contaminants may have been present in the harvest area, possibly from transient influxes of human sewage from on-

Outbreak of Salmonellosis Associated with Pulled Pork — Memphis, July, 2009

The Tennessee Department of Health (TDH) was notified of two family members hospitalized with salmonellosis, leading to rhabdomyolysis and renal failure after eating at Restaurant A on July 10 and gastroenteritis among attendees of a family reunion catered by Restaurant A the same day. Memphis/Shelby County and TDH staff initiated an investigation to identify risk factors for illness and strategies to interrupt transmission.

A cohort study was conducted among reunion attendees and an environmental health assessment of Restaurant A was performed. Reunion attendees were identified by the reunion coordinator, host hotel, and other attendees. A case was defined as diarrhea lasting ≥2 days or vomiting during July 10–July 15, or culture-confirmed salmonellosis in a person eating at the reunion.

Respondents (n = 87) lived in 12 states. Of these, 45 (52%) met the case definition; 96% reported diarrhea; 47% reported vomiting. Median incubation time was 27 hours (range: 0.5–118 hours); median duration of diarrhea was 4 days (range: 1–10 days). Twenty-six patients (58%) sought medical treatment; four (9%) were hospitalized. Pulled pork was consumed by 42 patients (93%) and was the only food item statistically associated with illness (risk ratio: 2.32; 95% confidence interval, 1.59–3.37). *Salmonella* Heidelberg was isolated from five patient specimens; the molecular subtype matched isolates from a 2007 outbreak associated with Restaurant A. Samples from food, surfaces, and restaurant employees tested negative for *Salmonella*; implicated pork was unavailable for testing.

Staff concluded that the outbreak of salmonellosis was associated with the consumption of pulled pork. Restaurant closure, employee education, and 6 months of increased monitoring were implemented to prevent additional illnesses.

Norovirus gastroenteritis among Restaurant O patrons — Brentwood, November, 2009

Mid-Cumberland Regional Health Department and Tennessee Department of Health officials conducted an investigation following multiple reports of gastrointestinal illness among patrons of Restaurant O. Initial investigation identified 4 persons who developed nausea, diarrhea, and vomiting after eating at the establishment on November 10, 2009 (**Figures 1&2**). A total of 26 ill were identified with one person requiring hospitalization. Clinical specimens from two of the ill persons tested positive for norovirus genogroup GII. An epidemiological study demonstrated an association between illness and salad consumption (**Table**). The establishment underwent extensive cleaning and received corporate consultation regarding employee health and food safety.

Figure 1. Illness onset among Restaurant O patrons who dined November 9-11, 2009.

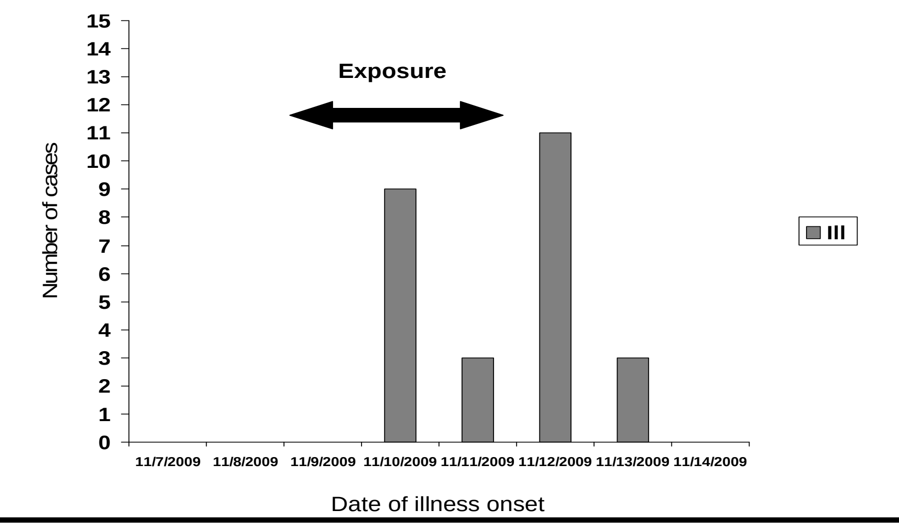
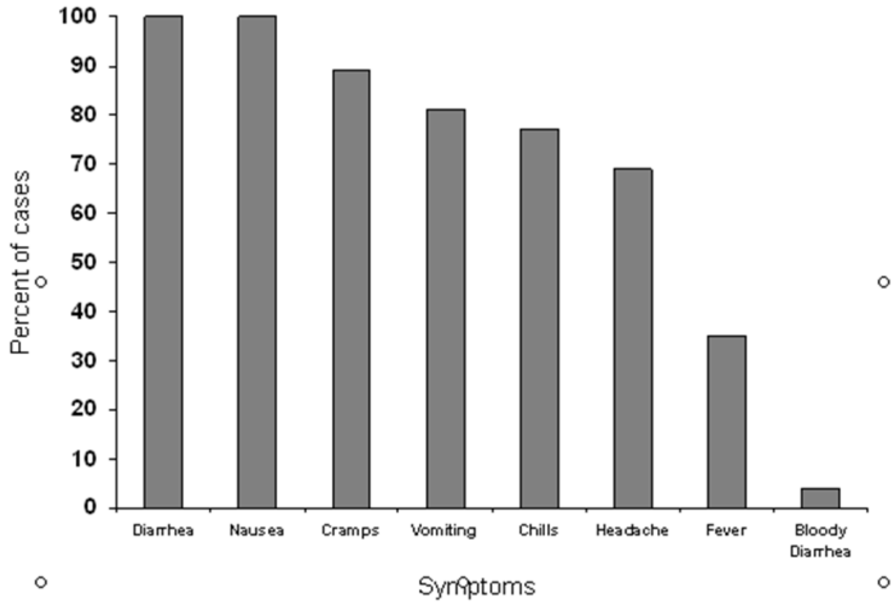


Table. Illness by Exposure to Salad among Restaurant O patrons, Brentwood, Tennessee, November 9-11, 2009.

Exposure	Ill	Well
Ate any type of salad	88	98
Did not eat any salad	15	11
Total	**107**	**111**

Figure 2. Reported symptoms among Restaurant O patrons who dined Nov 9-11, 2009.



SECTION VI.

Public Health Emergency Preparedness Program

Physician recruitment: Volunteers are recruited at the Tennessee Medical Association Annual Meeting.

Source: Tennessee Department of Health.

The Tennessee Emergency Preparedness (EP) Program

In August of 2002, the Communicable and Environmental Disease Services (CEDS) section was granted $19.9 million 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 Department of Homeland Security (DHS) to prepare for receipt and distribution of assets from the Strategic National Stockpile (SNS). From the beginning, it was recognized that preparedness for manmade disasters 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 2009, the Public Health Emergency Preparedness program (PHEP) received $12,369,036 from the CDC cooperative agreement.

In July, 2009, Tennessee received the first of 3 awards, totaling $26,557,651, that were intended to bolster preparedness and response capabilities in order to decrease morbidity and mortality associated with an influenza pandemic. Funding was provided through the Public Health Emergency Response (PHER) federal grant to local, regional, and metropolitan health departments to aid in planning, providing epidemiologic surveillance, providing laboratory services, and implementing vaccine strategies to prevent the spread of pandemic influenza.

The Tennessee Emergency Preparedness (EP) Program at a Glance

Located within:

- Tennessee Department of Health (TDH)
- Communicable and Environmental Disease Services (CEDS) section

Consists of:

- Public Health Emergency Preparedness (PHEP) program
- Tennessee Healthcare Preparedness Program (THPP)

Sources of funding:

- Department of Health and Human Services (DHHS)
- Centers for Disease Control and Prevention (CDC)
- Office of the Assistant Secretary for Preparedness & Response (ASPR)

Program charge:

- Strengthen public health infrastructure
- Enhance state's ability to plan, detect, respond to, and mitigate effects of manmade or naturally-occurring disasters

Program goal:

- Upgrade preparedness for, and response to, bioterrorism, infectious disease outbreaks, and other public health threats and emergencies

Tennessee Emergency Preparedness (EP) Program Activities—2009

H1N1 Response

During 2009, the EP program functioned as the lead program of the TDH response to the 2009 H1N1 influenza pandemic. Through coordination with other programs of the department and department leadership, TDH and the EP program demonstrated the ability to coordinate prevention and response efforts with local public health agencies, hospitals, state agencies, and other response partners.

Beginning on April 17, with CDC's notification of the Medical Director of the discovery of a novel influenza A strain, the program began ramping up its response. The TDH Incident Command System (ICS) was activated on April 26 and the State Health Emergency Operations Center (SHOC) at the Cordell Hull State Office Building was activated on April 27.

State and local coordination:

The EP program participated in weekly conference calls with partners to enhance state and local coordination by improving situational awareness, assessing and responding to resource needs, identifying and sharing useful practices, and clarifying planning/response assumptions.

Vaccine distribution and administration:

EP program staff assisted the Immunization Program in the development of multiple vaccine administration strategies and assisted with the development of a provider pre-registration process.

Public information and communication:

The program led in the development, production, and distribution of a bilingual influenza vaccination poster campaign effectively communicating steps that could be taken to maintain health and prevent infection. The poster utilized the internationally recognized ideogram (pictogram) symbology of the red circle and bar indicating "no" or "not allowed" along with appropriate actions to take as part of a personal responsibility message. In addition, a radio public service announcement campaign was produced targeting Hispanic and urban radio listeners, and an informational Pan Flu planning brochure was distributed to more than 3000 licensed child care programs throughout the state.

The EP program contracted with the Tennessee Poison Center (TPC) to staff and operate 24-hour information lines to answer H1N1-related questions for the public and for medical providers. Crisis and emergency risk-trained staff provided continuous guidance and situational updates to TPC professional staff.

The Departments of Health and Education reached out to school children and their parents across the state through a joint letter from Health Commissioner Susan R. Cooper and Education Commissioner Tim Webb. The message provided tips aimed at prevention and encouraged family preparation in the event of illness.

Medical provider communications:

EP staff collaborated with other TDH staff to make available important information for medical providers which included Web posting of the most current guidance, clinical and testing guidelines and resources, electronic (e-mail) updates for providers, and a letter printed and distributed to health care providers regarding 2009 H1N1 pandemic influenza updates and information.

Countermeasure distribution (non-vaccine):

The receiving, staging and storing (RSS) warehouse for SNS assets was activated throughout the response, utilizing professional warehousing staff (and their material handling equipment and expertise) for the distribution of medical countermeasures and personal protective equipment.

The EP program worked in conjunction with the Tennessee Pharmacy Association (TPA) to provide coverage for uninsured and under-insured Tennesseans. TDH and the EP program enacted retail pharmacy antiviral dispensing contracts with 284 pharmacies in 93 counties (98% coverage of the state).

The EP program also utilized TPA's network of pharmacists to clarify and distribute pediatric compounding guidance for anti-viral medications. Other pharmacy provider communications centered on billing of insurance procedures, potential for medication errors, and engagement with the larger medical community.

Information technology:

The Tennessee Countermeasure Distribution Response Network (TNCRN) was developed and implemented as an all-hazard web-based inventory management solution. With only 4 weeks of development time the network was launched, allowing for provider registration, verification, allocation, distribution, and reporting of medical countermeasure needs, usage, and availability. EP staff coordinated with the department's Office Information Technology to design and make available an application allowing for the visualization of disparate reporting systems, such as the Hospital Resource Tracking System (HRTS).

Laboratory services:

The TDH State Laboratories doubled PCR (Polymerase Chain Reaction) testing capacity for influenza samples. During the 2009 response, 3,764 influenza PCR tests were performed. The state laboratories also provided surge support for Texas and Arkansas. The laboratories maintained communication with 250 commercial and hospital laboratories in the state while constantly providing situational awareness, reagents and resources, and clinical and testing guidance to public health.

Epidemiology and surveillance:

EP staff provided twice weekly summary reports on influenza activity and an iDashboard data display to department staff from multiple data sources:

- Laboratory test results (percent positive, subtype)

- HRTS (admissions, ventilators, deaths)
- Department of Education (absenteeism, dismissal)
- Sentinel Provider Network (ILI, specimens)
- Flu Information Line (call volume and type)
- Antiviral and personal protective equipment countermeasure inventory (distribution)
- Vaccine (distribution)
- Safety and adverse event monitoring
- Guillain-Barre Syndrome surveillance

General Emergency Preparedness (EP) Program Activities—2009

All-Hazard Planning

Tennessee adheres to an all-hazard approach to preparedness and response. The EP program continues to foster a multi-state all-hazards planning partnership with Alabama, Florida, Georgia, North Carolina, South Carolina, Kentucky and Mississippi, focused on ensuring public health preparedness for and response to all-hazard disaster events. This partnership allows the state to improve all-hazards response capacities through the development of standards and the identification and use of best practices.

Strategic National Stockpile

The EP program plans for, monitors, and deploys assets of the SNS, a national repository of antibiotics, vaccines, antitoxins, chemical antidotes, and medical/surgical items. SNS assets are designed to supplement and resupply state and local public health resources, as well as other health care agencies in the event of a national emergency. A high priority in the development of SNS plans is the inclusion of detailed processes concerning receiving, staging, storing and distributing assets from the SNS.

RSS warehouse exercise, Memphis: Staff use the Tennessee Countermeasure Response Network to generate orders to be picked up and shipped to regional hospitals.

In 2005, PHEP received the highest rating from the CDC for its level of preparedness to receive the 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. TDH received a TAR score of 92 points from CDC in 2009.

Medical Reserve Corps

Medical Reserve Corps (MRC) serves as the department's volunteer organizational structure. EP has implemented the Emergency System for the Advanced Registration of Volunteer Health Professionals (ESAR-VHP) guidance and has recruited medical and general volunteers to support the TDH, hospitals, and medical care providers in a public health emergency. In order to coordinate the mobilization of these community volunteers, regional health departments have dedicated regional volunteer coordinators across the state. During 2009, the EP program deployed the Tennessee Volunteer Mobilzer, a web-based application which allowed for electronic registry, notification, and deployment of volunteers.

Public Health Laboratory

The TDH Laboratory Services has worked to improve networks among the state's clinical and hospital laboratories. A database of contact information for hospital and clinical labs has been developed, and information is shared with them as necessary. Training continues to be provided to hospital and sentinel laboratories across the state. These trainings include isolation and diagnosis of potential bioterrorism 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 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 bioterrorism agents or other potential outbreaks. Aberration detection systems utilize different electronic data sources across Tennessee, including 911 call centers, ambulance dispatch volume, chief complaint information from hospital emergency departments, and work or school absenteeism.

BioSense

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

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* (anthrax) 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 was 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 and post-exposure prophylaxis (PEP) of workers and interruption of the flow of contaminated letters or packages into the postal stream. Key program staff members are notified in the event of any detection of possible contamination.

Communications

Redundant communications systems are employed by the EP program 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 staff have redundant methods available to communicate statewide, including e-mail, pagers, cell phones, facsimile machines, HAM radios, and high frequency radios. The Tennessee Health Alert Network (T-HAN), a robust computerized call-down system contains 2 separate notification applications. One application is specific to contacting public health employees and key responders. The Volunteer Mobilizer application is now being used for statewide volunteer contact and is used for credentialing medical professionals prior to and during emergency deployment. TDH successfully completed PHIN Certification for Direct Alerting in July of 2009. Direct Alerting is one of the standards which fall under PHIN Certification. PHIN Certification provides an objective assessment to evaluate the compliance of public health information systems with the latest PHIN requirements. The goal of PHIN Certification is to support the development and implementation of applications and information systems that comply with PHIN requirements to ensure public health partners can securely, effectively, and efficiently exchange data. PHIN Certification is designed to provide strategic targets, report capabilities, and demonstrate progress.

Exercise Program

In 2009, EP staff, in cooperation with the Tennessee Office of Homeland Security (OHS) and Tennessee Emergency Management Agency (TEMA), planned a comprehensive exercise program. Tennessee exercises preparedness plans to strengthen overall defenses. The training and exercise program highlights the cooperation between the OHS, TEMA, and TDH.

Exercises are held in each Grand Division of the state of Tennessee (11 Tennessee Office of Homeland Security Jurisdictional Districts) 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 EP program continues to focus on emergency response plans that incorporate risk communication and dissemination strategies for health information. Populations and persons with functional needs and persons with disabilities and activity or access limitations continue to be the targets of future refinements of the program's communication plan.

Memphis full scale exercise: Public Health, Emergency Management, fire, and law enforcement respond to a simulated chemical attack.

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 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 in good standing in another state to practice in Tennessee to the same extent as if the practitioner was licensed in Tennessee. During the H1N1 response, duly registered and deployed volunteers were afforded these protections for the first time.

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. THPP is authorized through the Pandemic and All-Hazards Preparedness Act. For fiscal year 2009, THPP received $7,103,056 in grant funding. The THPP preparedness goals for the use of this funding by hospitals are as follows: integrating public and private medical capabilities with public health and other first responder systems; increasing the hospital preparedness and response capabilities; increasing the surge capacity of healthcare facilities; preparing to provide the medical needs of at-risk individuals; coordinating federal, state, and local planning; developing healthcare partnerships; improving interoperable communications; upgrading bed-tracking systems; recruiting volunteers; improving the hospitals' fatality management and evacuation plans; and improving the decontamination and isolation capabilities of hospitals.

THPP continues to develop and sustain the statewide and national all-hazards electronic and communication response tools needed by hospitals for regional and statewide disaster medical response and recovery. The disaster response tools include the Hospital Available Beds for Emergencies and Disaster (HAvBED) System, the ESAR-VHP, and 8 Regional Medical Communication Centers that serve as a statewide medical interoperable communication system.

SECTION VII.

Epidemic Intelligence Service

Dr. Rendi Murphree, Tennessee's Epidemic Intelligence Service (EIS) Officer, consults with a colleague from NIOSH during her investigation of elephant-to-human transmission of tuberculosis.

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 applied epidemiologic studies and investigations.

The Tennessee Department of Health has been hosting EIS officers since 1970. Rendi Murphree, PhD began her assignment in Tennessee during 2009.

Examples of recent EIS investigations in Tennessee include:

- *Pertussis Among Children of a Small Mennonite Community*
- *Cluster of Tuberculin Skin Test Conversion among Employees of a Tennessee Elephant Sanctuary*
- *Outbreak of Salmonellosis Associated with Pulled Pork*
- *Evaluation of LaCrosse Encephalitis Surveillance in East Tennessee*
- *Investigation of Acute Gastronenteritis among Students at an Elementary School*

Epidemic Intelligence Service Officers, 1970-2009
Tennessee Department of Health

Years	Name	Years	Name
1970-1971	G. Doty Murphy, MD	1990-1992	Peter A. Briss, MD
1971-1972	David L. Freeman, MD	1992-1994	Steven M. Standaert, MD
1972-1974	Bernard Guyer, MD	1995-1997	Allen S. Craig, MD
1974-1976	David S. Folland, MD	1997-1999	Timothy F. Jones, MD
1976-1977	R. Campbell McIntyre, MD	1999-2001	Joseph F. Perz, DrPH
1977-1979	Timothy J. Dondero, MD	2001-2003	David L. Kirschke MD
1980-1982	Tracy L. Gustafson, MD	2003-2005	Rose Devasia, MD
1982-1984	Michael D. Decker, MD, MPH	2005-2007	L. Rand Carpenter, DVM
1984-1986	William T. Brinton, MD	2007-2009	Jennifer MacFarquhar, RN, MPH, CIC
1986-1988	Melinda Wharton, MD	2009-	Rendi Murphree, PhD, MS
1988-1990	Ban Mishu, MD		

Section VIII.

Publications by CEDS and Tennessee EIP Authors, 2009

Brenda Eggert, Director or CEDS Administration, gets ready for her annual appearance as Mrs. Claus for the CEDS Christmas Party.

Source: Tennessee Department of Health.

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