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Communicable and Environmental Diseases and Emergency Preparedness 2010-2012 Annual Report

Tennessee. Department of Health.

TN Department of Health

Communicable and Environmental Diseases and Emergency Preparedness

2010-2012 Annual Report

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Available electronically at the Tennessee Department of Health website. In the search box in the top right-hand corner, type "CEDEP Annual Report" and hit Enter. Under Search Results, click on the result entitled "CEDEP Reports".

http://www.tn.gov/health

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

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SECTION I.
INTRODUCTION

A. Purpose of Report

Communicable and Environmental Diseases and Emergency Preparedness (CEDEP) is one of the thirteen divisions/offices within the Tennessee Department of Health. The twelve other divisions/offices in the department include the following: Administrative Services; Community Health Services; Family Health and Wellness; Health Disparities; Health Licensure and Regulation; Health Planning; Human Resources; Information Technology Services; Laboratory Services; Patient Care Advocacy; Policy, Planning and Assessment; and Quality Improvement. The seven rural health regions also report to the department.

CEDEP 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 CEDEP 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 CEDEP over a period of years.

Surveillance (i.e., the tracking of infectious disease incidence and prevalence) is at the heart of the work of CEDEP. 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 2003 through 2012 and builds upon the 2000, 2001, 2002, 2003, 2004-2005, 2006, 2007, 2008, and 2009 annual reports that were previously published by CEDEP.

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 revised annually from 2010-2012. Important additions to the list include a number of healthcare associated pathogens, carbon monoxide poisoning, neonatal abstinence syndrome, and Middle East Respiratory Syndrome. 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 five categories of reporting notifiable diseases: (1A & 1B) immediate telephone reporting, followed with a written report; (2) written report only; (3) special confidential reporting of HIV/AIDS; (4) laboratory reporting of all blood lead test results; and (5) monthly reporting via the National Healthcare Safety Network and the Emerging Infections Program. 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 CEDEP at 615-741-7247/800-404-3006. It can also be downloaded from the CEDEP website at http://tn.gov/health. Under "Immunizations, Disease Prevention", click on "List of Reportable Diseases", then "Reporting Forms" and "PH-1600". CEDEP, 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 events 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 (T.C.A. §68 Rule 1200-14-01-.02). See matrix for additional details.

Category 1A: Requires immediate telephonic notification (24 hours a day, 7 days a week), followed by a written report using the PH-1600 within 1 week.

[002] Anthrax (*Bacillus anthracis*)[B]
[005] Botulism-Foodborne (*Clostridium botulinum*)[B]
[004] Botulism-Wound (*Clostridium botulinum*)
[505] Disease Outbreaks (e.g., foodborne, waterborne, healthcare, etc.)
[023] Hantavirus Disease
[096] Measles-Imported
[026] Measles-Indigenous
[095] Meningococcal Disease (*Neisseria meningitidis*)
[516] Novel Influenza A
[032] Pertussis (Whooping Cough)
[037] Rabies: Human
[112] Ricin Poisoning[B]
[132] Severe Acute Respiratory Syndrome (SARS)
[107] Smallpox[B]
[110] Staphylococcal Enterotoxin B (SEB) Pulmonary Poisoning[B]
[111] Viral Hemorrhagic Fever[B]

Category 1B: Requires immediate telephonic notification (next business day), followed by a written report using the PH-1600 within 1 week.

[006] Brucellosis (*Brucella* species)[B]
[502] *Burkholderia mallei* infection[B]
[010] Congenital Rubella Syndrome
[011] Diphtheria (*Corynebacterium diphtheriae*)
[123] Eastern Equine Encephalitis Virus Infection
[506] Enterobacteriaceae, Carbapenem-resistant
[507] *Francisella* species infection (other than F. *tularensis*)[B]
[053] Group A Streptococcal Invasive Disease (*Streptococcus pyogenes*)
[047] Group B Streptococcal Invasive Disease (*Streptococcus agalactiae*)
[054] *Haemophilus influenzae* Invasive Disease
[016] Hepatitis, Viral-Type A acute
[513] Influenza-associated deaths, age <18 years
[520] Influenza-associated deaths, pregnancy-associated
[515] Melioidosis (*Burkholderia pseudomallei*)
[102] Meningitis-Other Bacterial
[031] Mumps
[033] Plague (*Yersinia pestis*)[B]
[035] Poliomyelitis-Nonparalytic
[034] Poliomyelitis-Paralytic
[119] Prion disease-variant Creutzfeldt Jakob Disease
[109] Q Fever (*Coxiella burnetii*)[B]
[040] Rubella
[041] Salmonellosis: Typhoid Fever (*Salmonella* Typhi)
[131] *Staphylococcus aureus*: Vancomycin non-sensitive – all forms
[075] Syphilis (*Treponema pallidum*): Congenital
[519] Tuberculosis, confirmed and suspect cases of active disease (*Mycobacterium tuberculosis* complex)
[113] Tularemia (*Francisella tularensis*)[B]
[108] Venezuelan Equine Encephalitis Virus Infection[B]

Category 2: Requires written report using form PH-1600 within 1 week.

[501] Babesiosis
[003] Botulism-Infant (*Clostridium botulinum*)
[121] California/LaCrosse Serogroup Virus Infection
[007] Campylobacteriosis (including EIA or PCR positive stools)
[503] Chagas Disease
[069] Chancroid
[055] *Chlamydia trachomatis*-Genital
[057] *Chlamydia trachomatis*-Other
[009] Cholera (*Vibrio cholerae*)
[001] Cryptosporidiosis (*Cryptosporidium* species)
[106] Cyclosporiasis (*Cyclospora* species)
[504] Dengue Fever
[522] Ehrlichiosis/Anaplasmosis – Any
[060] Gonorrhea-Genital (*Neisseria gonorrhoeae*)
[064] Gonorrhea-Ophthalmic (*Neisseria gonorrhoeae*)
[061] Gonorrhea-Oral (*Neisseria gonorrhoeae*)
[062] Gonorrhea-Rectal (*Neisseria gonorrhoeae*)

[B]Possible Bioterrorism Indicators

[133] Guillain-Barré syndrome
[058] Hemolytic Uremic Syndrome (HUS)
[480] Hepatitis, Viral-HbsAg positive infant
[048] Hepatitis, Viral-HbsAg positive pregnant female
[017] Hepatitis, Viral-Type B acute
[018] Hepatitis, Viral-Type C acute
[021] Legionellosis (*Legionella* species)
[022] Leprosy [Hansen Disease] (*Mycobacterium leprae*)
[094] Listeriosis (*Listeria* species)
[024] Lyme Disease (*Borrelia burgdorferi*)
[025] Malaria (*Plasmodium* species)
[521] Powassan virus infection
[118] Prion disease-Creutzfeldt Jakob Disease
[036] Psittacosis (*Chlamydia psittaci*)
[105] Rabies: Animal
[122] St. Louis Encephalitis Virus Infection
[042] Salmonellosis: Other than *S.* Typhi (*Salmonella* species)
[517] Shiga-toxin producing *Escherichia coli* (including Shiga-like toxin positive stools, *E. coli* O157 and *E. coli* non-O157)
[043] Shigellosis (*Shigella* species)
[039] Spotted Fever Rickettsiosis (*Rickettsia* species including Rocky Mountain Spotted Fever)
[130] *Staphylococcus aureus*: Methicillin resistant Invasive Disease
[518] *Streptococcus pneumoniae* Invasive Disease (IPD)
[074] Syphilis (*Treponema pallidum*): Cardiovascular
[072] Syphilis (*Treponema pallidum*): Early Latent
[073] Syphilis (*Treponema pallidum*): Late Latent
[077] Syphilis (*Treponema pallidum*): Late Other
[076] Syphilis (*Treponema pallidum*): Neurological
[070] Syphilis (*Treponema pallidum*): Primary
[071] Syphilis (*Treponema pallidum*): Secondary
[078] Syphilis (*Treponema pallidum*): Unknown Latent
[044] Tetanus (*Clostridium tetani*)
[045] Toxic Shock Syndrome: Staphylococcal
[097] Toxic Shock Syndrome: Streptococcal
[046] Trichinosis
[101] Vancomycin resistant enterococci (VRE) Invasive Disease
[114] *Varicella* deaths
[104] Vibriosis (*Vibrio* species)
[125] West Nile virus Infections-Encephalitis
[126] West Nile virus Infections-Fever
[124] Western Equine Encephalitis Virus Infection
[098] Yellow Fever
[103] Yersiniosis (*Yersinia* species)

Category 3: Requires special confidential reporting to designated health department personnel within 1 week.

[500] Acquired Immunodeficiency Syndrome (AIDS)
[512] Human Immunodeficiency Virus (HIV)
[525] All CD4+ T-cell and HIV-1 Viral Load testing results from those laboratories performing these tests

Category 4: Laboratories and physicians are required to report all blood lead test results within 1 week.

[514] Lead Levels (blood)

Category 5: Events will be reported monthly (no later than 30 days following the end of the month) via the National Healthcare Safety Network (NHSN – see http://tn.gov/health/topic/hai for more details); *Clostridium difficile* infections (Davidson County residents only) will also be reported monthly to the Emerging Infections Program (EIP).

[523] Healthcare Associated Infections, Catheter Associated Urinary Tract Infections
[508] Healthcare Associated Infections, Central Line Associated Bloodstream Infections
[509] Healthcare Associated Infections, *Clostridium difficile*
[524] Healthcare Associated Infections, Dialysis Events
[510] Healthcare Associated Infections, Methicillin resistant *Staphylococcus aureus* positive blood cultures
[511] Healthcare Associated Infections, Surgical Site Infections

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 or Positive Specimens 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 or positive specimens of the following organisms to the Department of Health, Laboratory Services, for confirmation, typing and/or antibiotic sensitivity including, but not limited to:

Salmonella species, including *S. Typhi*

Shigella species

Corynebacterium diphtheria

Brucella species

Mycobacterium species

Legionella species

Clostridium tetani

Listeria species

Plasmodium species

Vibrio species

Francisella species

Yersinia pestis

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

Clostridium botulinum

*Haemophlius influenzae**

*Neisseria meningitidis**

*Streptococcus pneumoniae**

*Group A Streptococcus**

Bacillus anthracis

Burkholderia mallei

Burkholderia psuedomallei

Vancomycin-resistant *Staphlyococcus aureus* (VRSA)

Vancomycin-intermediate *Staphlyococcus aureus* (VISA)

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

Information for Sending Cultures

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

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

Tennessee Department of Health

Laboratory Services

630 Hart Lane

Nashville Tennessee 37216-2006

Phone 615-262-6300

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

Tennessee Department of Health

Laboratory Services

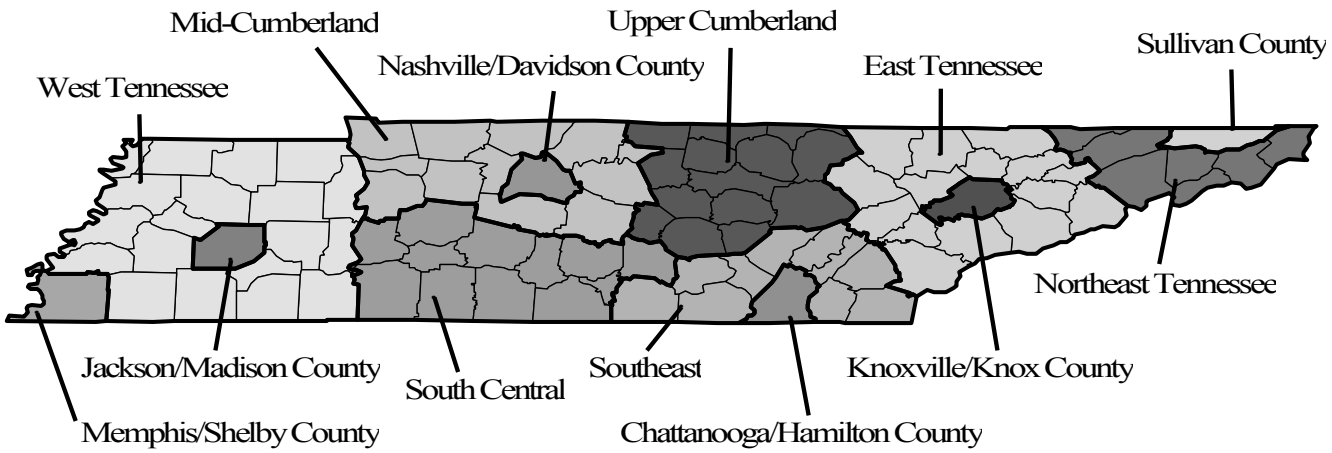
PO Box 305130

Nashville Tennessee 37230-5130

G. Tennessee Department of Health Regions

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

Tennessee's Department of Health Regions



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

Tennessee Department of Health	Address	City	Zip Code	Phone
Communicable and Environmental Disease Services	425 5th Avenue North, 1st Fl. CHB	Nashville	37243	615-741-7247
State Laboratory	630 Hart Lane	Nashville	37243	615-262-6300
Tennessee Department of Health Regions/Metros	**Address**	**City**	**Zip Code**	**Phone**
Chattanooga/Hamilton County (CHR)	921 East Third Street	Chattanooga	37403	423-209-8180
East Tennessee Region (ETR)	1522 Cherokee Trail	Knoxville	37920	865-546-9221
Jackson/Madison County (JMR)	804 North Parkway	Jackson	38305	731-423-3020
Knoxville/Knox County (KKR)	140 Dameron Avenue	Knoxville	37917-6413	865-215-5090
Memphis/Shelby County (MSR)	814 Jefferson Avenue	Memphis	38105-5099	901-544-7715
Mid-Cumberland Region (MCR)	710 Hart Lane	Nashville	37247-0801	615-650-7000
Nashville/Davidson County (NDR)	311 23rd Avenue North	Nashville	37203	615-340-5632
Northeast Region (NER)	1233 Southwest Avenue Extension	Johnson City	37604-6519	423-979-3200
South-Central Region (SCR)	1216 Trotwood Avenue	Columbia	38401-4809	931-380-2527
Southeast Region (SER)	540 McCallie Avenue, Suite 450	Chattanooga	37402	423-634-5798
Sullivan County (SUL)	PO Box 630, 154 Blountville Bypass	Blountville	37617	423-279-2638
Upper Cumberland Region (UCR)	1100 England Drive	Cookeville	38501	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
John Dunn, DVM, PhD	Deputy State Epidemiologist	john.dunn@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
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I. Emerging Infections and the Emerging Infections Program

An important emphasis of CEDEP 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.

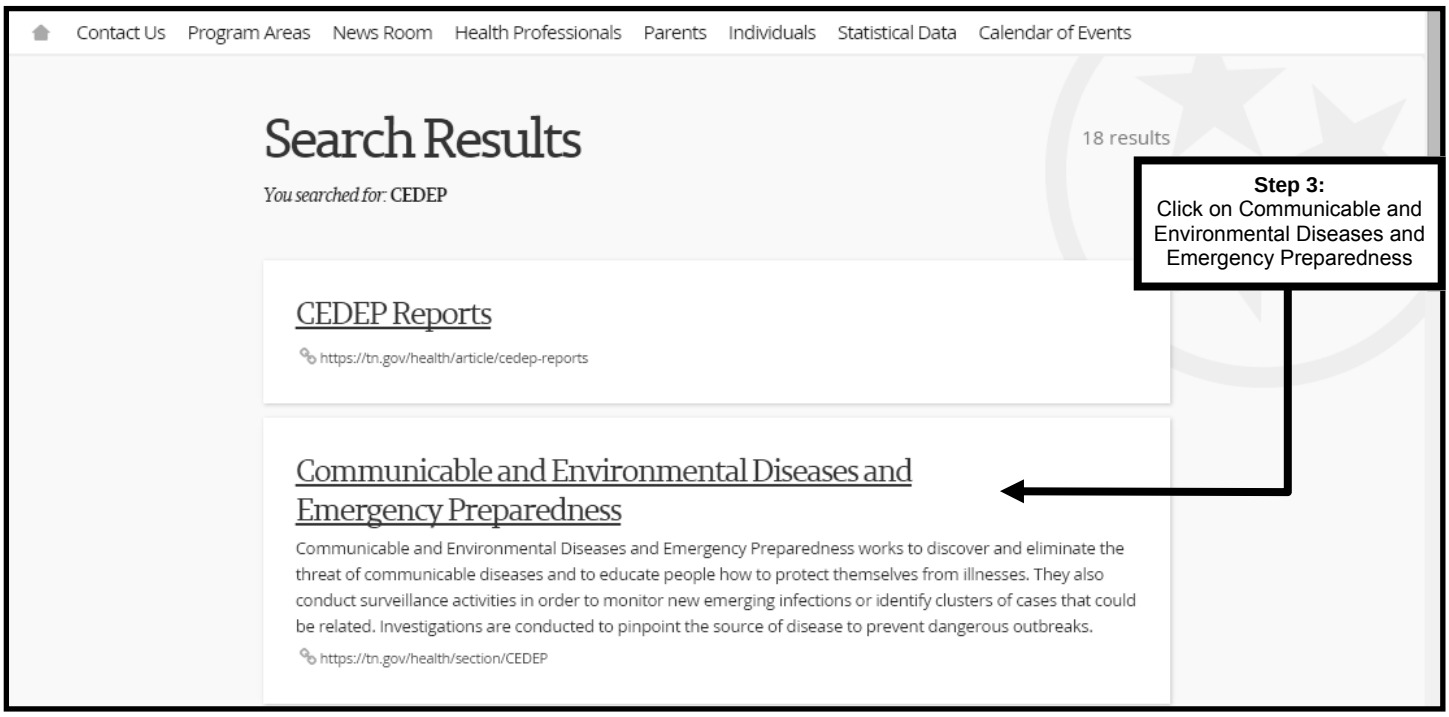
Currently, the EIP Network consists of ten sites: California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon and Tennessee.

The Tennessee Emerging Infections Program (EIP) is a collaborative effort of CEDEP, 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 became 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)], invasive bacterial infections [Active Bacterial Core Surveillance (ABCs)], *Clostridium difficile* Infection (CDI), HPV Impact Project, and influenza surveillance and vaccine effectiveness.

J. Communicable and Environmental Diseases and Emergency Preparedness Website

Further tabulations of data regarding disease surveillance in Tennessee are available at the CEDEP website. To access the web site, go to http://www.tn.gov/health. In the search box in the top right-hand corner, type "CEDEP" and hit Enter. Under Search Results, click on the result entitled "Communicable and Environmental Diseases and Emergency Preparedness".



K. Tennessee Population Estimates, 2012

The following statewide population estimates were prepared by the Tennessee Department of Health, Division of Policy, Planning and Assessment, 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	3,108,157	<1	81,018	45-49	454,446
Female	3,252,913	1-4	333,920	50-54	462,838
RACE /SEX	**POPULATION**	5-9	408,066	55-59	421,782
White Male	2.535.288	10-14	410,141	60-64	367,200
White Female	2,616,900	15-19	432,643	65-69	290,055
Black Male	506,318	20-24	427,190	70-74	211,324
Black Female	567,211	25-29	418,113	75-79	153,603
Other Male	66,551	30-34	415,309	80-84	109,299
Other Female	68,802	35-39	421,642	85+	114,215
TOTAL	**6,361,070**	40-44	428,266		

L. Tennessee's Department of Health Regions: Counties and Population, 2012

East (Population 755,909)					
County	Population	**County**	**Population**	**County**	**Population**
Anderson	74,373	Grainger	23,739	Morgan	20,896
Blount	126,119	Hamblen	63,551	Roane	54,680
Campbell	41,882	Jefferson	53,483	Scott	23,253
Claiborne	32,519	Loudon	47,280	Sevier	88,941
Cocke	36,767	Monroe	47,563	Union	20,863
Mid-Cumberland (Population 1,087,454)					
County	Population	**County**	**Population**	**County**	**Population**
Cheatham	42,222	Montgomery	159,209	Sumner	162,422
Dickson	49,744	Robertson	68,589	Trousdale	8,287
Houston	8,238	Rutherford	256,765	Williamson	184,323
Humphreys	19,067	Stewart	14,151	Wilson	114,437
Northeast (Population 350,502)					
County	Population	**County**	**Population**	**County**	**Population**
Carter	59,965	Hawkins	59,665	Washington	119,361
Greene	68,054	Johnson	18,753		
Hancock	6,822	Unicoi	17,882		

South Central (Population 394,681)					
County	Population	**County**	**Population**	**County**	**Population**
Bedford	48,083	Lawrence	42,709	Maury	84,148
Coffee	54,707	Lewis	12,208	Moore	6,372
Giles	30,076	Lincoln	34,084	Perry	7,813
Hickman	26,100	Marshall	30,958	Wayne	17,423
Southeast (Population 328,349)					
County	Population	**County**	**Population**	**County**	**Population**
Bledsoe	13,565	Marion	54,721	Rhea	31,803
Bradley	99,041	McMinn	28,455	Sequatchie	14,042
Franklin	43,112	Meigs	12,423		
Grundy	14,925	Polk	16,262		
Upper Cumberland (Population 342,749)					
County	Population	**County**	**Population**	**County**	**Population**
Cannon	14,269	Jackson	11,419	Smith	20,104
Clay	8,201	Macon	23,208	Van Buren	5,511
Cumberland	55,798	Overton	21,377	Warren	42,263
DeKalb	19,366	Pickett	5,069	White	25,521
Fentress	18,154	Putnam	72,489		
West (Population 546,645)					
County	Population	**County**	**Population**	**County**	**Population**
Benton	16,726	Gibson	49,169	Lauderdale	28,360
Carroll	29,843	Hardeman	30,007	McNairy	26,362
Chester	16,893	Hardin	26,955	Obion	32,747
Crockett	15,191	Haywood	19,725	Tipton	62,952
Decatur	11,495	Henderson	27,955	Weakley	33,906
Dyer	39,039	Henry	32,672		
Fayette	39,245	Lake	7,403		
Metropolitan Regions (Population 2,554,781)					
County	Population	**County**	**Population**	**County**	**Population**
Davidson	602,257	Knox	429,161	Shelby	949,665
Hamilton	318,632	Madison	100,816	Sullivan	154,250

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, 2012, MMWR 2014; 61, No.53.

SECTION II.
TENNESSEE REPORTED CASES, 2003-2012

Reported Cases, by Year of Diagnosis, Tennessee, 2003-2012

DISEASE	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
AIDS	600	694	809	284	582	*	*	*	*	*
Botulism, Foodborne	0	0	0	0	1	0	0	0	0	0
Botulism, Infant	1	1	0	1	1	1	1	0	3	1
Brucellosis	0	1	0	1	2	1	0	1	2	0
California/LaCrosse Encephalitis	14	13	2	7	14	6	9	11	12	9
Campylobacteriosis	448	438	403	443	448	481	512	391	407	452
Chlamydia	21,034	22,513	23,041	25,303	26,969	28,001	29,710	28,326	31,085	32,531
Cryptosporidiosis	41	55	44	47	137	47	78	54	91	72
E. coli 0157:H7	34	48	45	88	54	54	38	48	59	67
Ehrlichiosis	31	20	24	35	39	91	32	66	69	70
Giardiasis	187	251	225	246	297	215	233	55	0	0
Gonorrhea	8,717	8,475	8,619	9,687	9,584	8,767	7,925	7119	7663	9111
Group A *Streptococcus*	167	144	152	160	149	154	162	201	182	123
Group B *Streptococcus*	264	245	368	379	302	319	362	356	402	384
Haemophilus influenzae	58	53	93	72	92	101	114	97	108	101
Hepatitis B Surface Antigen Positive, Pregnant	109	115	191	146	191	184	154	0	0	0
Hepatitis A	202	96	149	69	59	35	13	14	25	22
Hepatitis B, Acute	212	221	153	173	149	155	140	152	216	264
Hepatitis C, Acute	23	35	28	28	38	33	30	51	93	150
Hemolytic Uremic Syndrome	15	25	16	31	23	23	19	19	18	17
HIV	549	586	665	697	792	*	*	*	*	*
HIV Disease	*	*	*	*	*	997	923	860	855	869
Legionellosis	37	44	40	50	40	45	66	68	92	58
Listeriosis	9	16	12	14	16	14	15	14	6	7
Lyme Disease	19	25	18	30	42	29	9	33	34	30
Malaria	7	13	14	9	19	17	8	13	21	14
Measles (indigenous)	0	0	1	0	1	0	1	0	0	0
Meningicoccal Disease	30	23	27	25	21	21	15	13	9	7
Meningitis, Other Bacterial	28	28	16	4	3	5	12	18	35	14
Methicillin-Resistant *Staphylococcus aureus*	*	946	1,972	2,005	1,973	1,990	1998	1868	1775	1863
Mumps	5	4	3	11	4	4	3	3	1	2
Penicillin-Resistant *Streptococcus pneumoniae*	133	153	163	154	199	234	129	57	0	0
Penicillin-Sensitive *Streptococcus pneumoniae*	493	534	807	837	722	874	953	318	1	0
Pertussis	82	179	213	179	75	120	130	235	106	315
Rocky Mountain Spotted Fever	74	99	139	260	186	233	189	308	262	696
Rubella	0	0	0	0	0	0	0	0	0	0
Salmonellosis, Non-Typhoidal	736	776	820	844	849	905	793	1071	1009	1055
Shigellosis	396	571	507	200	363	968	375	260	202	203
Syphilis, Congenital	2	9	19	8	4	10	14	11	9	2
Syphilis, Early Latent	227	206	205	233	294	310	333	331	256	258
Syphilis, Late Latent	461	400	359	434	442	475	498	492	382	424
Syphilis, Neurological	6	7	8	0	0	0	0	0	0	0
Syphilis, Primary	43	24	62	80	109	123	121	72	72	61
Syphilis, Secondary	93	106	155	169	259	288	282	204	207	207
Tetanus	0	2	0	1	1	0	0	0	0	0
Toxic Shock *Staphylococcus*	1	2	1	4	0	6	4	4	1	3
Toxic Shock *Streptococcus*	1	0	0	0	0	0	0	0	0	0
Trichinosis	2	0	1	0	0	0	0	0	0	0
Tuberculosis	285	277	299	277	234	282	219	190	172	170
Tularemia	3	2	7	0	2	2	2	3	3	2
Typhoid Fever	3	4	4	1	1	4	4	8	3	3
Vancomycin Resistant *Enterococci*	802	406	278	388	287	310	321	294	235	214
Yersiniosis	24	26	18	29	13	21	23	21	24	15

Number of Reported Cases of Selected Notifiable Diseases with Rates per 100,000 Persons, by Age Group, Tennessee, 2012

DISEASE		<1Y	1-4	5-14	15-24	25-44	45-64	≥65
	Total population	81,018	333,920	818,207	859,833	1,683,330	1,706,266	878,496
Campylobacteriosis	Number	40	69	55	69	133	159	111
	Rate	49.4	20.7	6.7	8.0	7.9	9.3	12.6
Chlamydia	Number	0	2	341	23719	8020	466	14
	Rate	0.0	0.6	41.7	2758.6	476.4	27.3	1.6
Gonorrhea	Number	0	2	90	5737	2905	366	18
	Rate	0.0	0.6	11.0	667.2	172.6	21.5	2.0
Group A Streptococcus	Number	2	5	1	10	22	45	38
	Rate	2.5	1.5	0.1	1.2	1.3	2.6	4.3
Hepatitis A	Number	0	0	0	6	7	5	5
	Rate	0.0	0.0	0.0	0.7	0.4	0.3	0.6
HIV Disease	Number	3	0	6	243	411	232	15
	Rate	3.7	0.0	0.7	28.3	24.4	13.6	1.7
Meningococcal Disease	Number	2	0	2	2	0	1	1
	Rate	2.5	0.0	0.2	0.2	0.0	0.1	0.1
Pertussis	Number	52	31	50	25	54	77	30
	Rate	64.2	9.3	6.1	2.9	3.2	4.5	3.4
Spotted Fever Rickettsiosis	Number	3	9	68	92	300	472	297
	Rate	3.7	2.7	8.3	10.7	17.8	27.7	33.8
Salmonellosis, Non-Typhoid	Number	114	141	122	74	164	249	204
	Rate	140.7	42.2	14.9	8.6	9.7	14.6	23.2
Shigellosis	Number	5	62	68	19	25	16	8
	Rate	6.2	18.6	8.3	2.2	1.5	0.9	0.9
Syphilis, Early Latent	Number	0	0	0	77	130	50	1
	Rate	0.0	0.0	0.0	9.0	7.7	2.9	0.1
Syphilis, Late Latent	Number	0	1	0	62	202	137	23
	Rate	0.0	3.0	0.0	72.1	120.0	80.3	26.2
Syphilis, Neurological	Number	0	0	0	0	0	0	0
	Rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syphilis, Primary	Number	0	0	0	24	29	7	1
	Rate	0.0	0.0	0.0	2.8	1.7	0.4	0.1
Syphilis, Secondary	Number	0	0	1	75	91	40	0
	Rate	0.0	0.0	0.1	8.7	5.4	2.3	0.0

Section III.
Disease Summaries

A. Foodborne and Waterborne Diseases

Tennessee FoodNet and FoodCORE Programs

Programmatic Overview

The Foodborne Diseases Active Surveillance Network (FoodNet) is the principal foodborne disease component of the Centers for Disease Control and Prevention's (CDC) Emerging Infections Program (EIP). FoodNet is a collaborative project amongst CDC, 10 states (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New York, New Mexico, Oregon and Tennessee), U.S. Department of Agriculture's Food Safety Inspection Service (USDA-FSIS), 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 (U.S.).

Foodborne diseases under surveillance include infections caused by bacteria such as *Salmonella*, *Shigella*, *Campylobacter*, Shiga toxin-producing *Escherichia coli* (STEC), *Listeria*, *Yersinia*, and *Vibrio* (including *Vibrio* species, *Grimontia hollisae* and *Photobacterium damselae*), and parasites such as *Cryptosporidium* and *Cyclospora*. In 1995, FoodNet surveillance began in five locations: California, Connecticut, Georgia, Minnesota and Oregon. From 1997-2004 the surveillance area, or catchment, expanded numerous times, 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 47.5 million or 15.2% of the U.S. 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 U.S.
- To monitor trends in the burden of specific foodborne illness 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.

Although CDC had a well-established mechanism through FoodNet to determine the burden of foodborne illness, they did not have such a mechanism for foodborne disease outbreak response. In 2009, CDC funded a pilot project to improve state and local responses to foodborne disease outbreaks. This project was launched in three centers with support from the USDA-FSIS and the Association of Public Health Laboratories (APHL). It was so successful that in 2010, CDC expanded the project to additional centers. In 2011, the project was renamed FoodCORE — Foodborne Diseases Centers for Outbreak Response Enhancement. Currently seven centers participate (Connecticut, New York City, Ohio, South Carolina, Tennessee, Utah, and Wisconsin), covering about 14% of the U.S. population.

Activities

There were four primary activities of the FoodNet program during this three year period: active laboratory-based surveillance, surveys of clinical laboratories, epidemiologic studies and FoodNet working group calls.

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, 137 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 STEC infections] is conducted. The result is a comprehensive and timely database of foodborne illness in a well-defined population.

Survey of clinical laboratories: From 2010-2012, a number of laboratory surveys were carried out to determine the current testing methods used in each of the clinical laboratories in the state, including details such as test type and brand name. These surveys focused on the following pathogens: *Campylobacter*, *Cryptosporidium*, *Listeria*, *Salmonella*, STEC, *Shigella*, *Vibrio* and *Yersinia*. Surveys will continue to be administered on, at least, an annual basis, if not more frequently, to document testing changes. With the increase in culture-independent diagnostic testing (CIDT), this is becoming very important, as not all tests are equal.

Epidemiologic studies: There were three epidemiologic studies that Tennessee participated in during this period in review. In 2006, Tennessee began enrolling cases to participate in the *E. coli* O157 Cohort Study. The goal was to assess risk factors for HUS among patients with E. coli O157 infections, including potential exposures to various antibiotics. The study concluded in December 2010, with 163 cases enrolled. Additionally in 2006, Tennessee took the lead on the E. coli O157 Genomics Study for FoodNet. The goal was to identify potential genomic predictors of developing HUS following infection with STEC. Tennessee was able to enroll 142 cases over the four year study period. Specimens were being sequenced at Vanderbilt University. In August 2012, we began enrolling cases and controls in a study to identify behavioral, environmental, dietary, and medical risk factors for non-O157 STEC infection and to describe clinical and microbiological features of illnesses caused by different types of non-O157 STEC. Data collection is ongoing.

FoodNet working group calls: Surveillance officers in central office participate on a variety of different national working groups throughout the month. Some of the topics have been addressed were attribution, case exposure assessment, CIDT, special study analyses, geospatial analyses, norovirus, STEC/HUS and outbreaks.

Impact

Foodborne diseases are common; an estimated 48 million cases occur each year in the U.S. 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. 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.

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.

With the addition of the FoodCORE program in Tennessee, we have been able to identify clusters of cases more easily as many of the interviews are being completed centrally. The handful of students that complete these interviews are able to pick up on these commonalities.

John Dunn, Deputy State Epidemiologist, reflected on the approach, “This model has been successful in Tennessee and other states in rapidly responding to foodborne illness outbreaks. It’s great to work with energetic, resourceful students and to give them hands-on experience that ultimately strengthens our public health workforce.”

Foodborne and Waterborne Bacterial Diseases

Campylobacteriosis

Background

Campylobacteriosis is one of the most commonly reported gastrointestinal illnesses, not only in the United States, but in Tennessee as well. The causative agent is primarily *Campylobacter jejuni*, followed by *Campylobacter coli* and other less common species. Most persons infected with the bacte-

rium develop diarrhea, cramping, abdominal pain and fever within two to five days after exposure. Illness typically lasts one week.

Incidence

From 2003-2008, rates (per 100,000 persons) of disease averaged about 7.4 cases. However with the ever-increasing adoption of culture-independent diagnostic testing (CIDT) methods (e.g., EIA and PCR) in clinical laboratories, the rates of campylobacteriosis have consistently been going up since 2009, with a mean annual rate of 8.5 cases (**Figure 1**).

Those at greatest risk of developing infection are those under the age of five years. From 2010-2012, the overall rate of disease in this population was 70.3 cases (culture-confirmed: 52.7 cases; culture-independent: 17.6 cases). However when you look at this age group more closely, the driving force is those children under the age of one (49.2 cases).

Trends

There has always been some regional variation in regards to campylobacteriosis in Tennessee. Those persons living in the southern or eastern part of the state consistently have had higher rates of disease, as compared to those living in the north or west.

During this reporting period, the highest rates (per 100,000 persons) of disease were reported in Northeast Region (22.2 cases), followed by East Tennessee Region (11.1 cases), Southeast Region (10.9 cases) and South Central Region (10.1 cases). Whereas, the lowest rates of the state were reported in Nashville/Davidson County metropolitan area with 4.1 cases.

However when you look at rates of disease by testing method, this regional variation begins to shift (**Figure 2**). It wasn't until 2009 that Tennessee began to receive *Campylobacter* reports that were tested using CIDT methods. Cases detected by these methods have increased more than 23-fold from 2009 to 2012. The uptake of these testing methods has been more spread out across the state.

In 2010, the largest proportion of cases reported using CIDT methods was among younger age groups. In fact, 34% of those CIDT cases were under the age of 5 years, as compared to 23% of those culture cases. This trend has since shifted to a much older group (≥65 years) being tested using CIDT methods versus culture [2011-2012 Mean Proportion (CIDT: 23%; Culture: 13%)].

Figure 1. Incidence of Campylobacteriosis, by Year, Tennessee, 2003-2012.

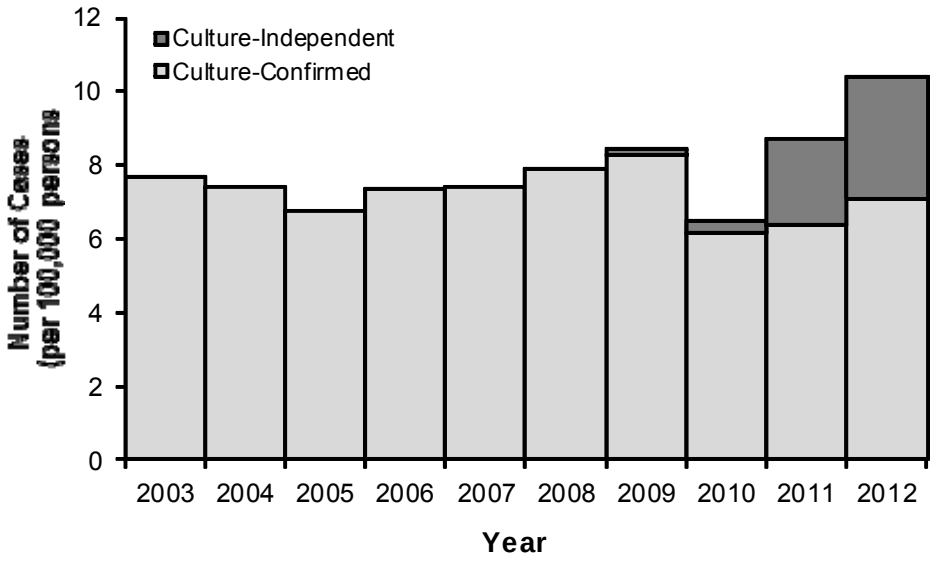
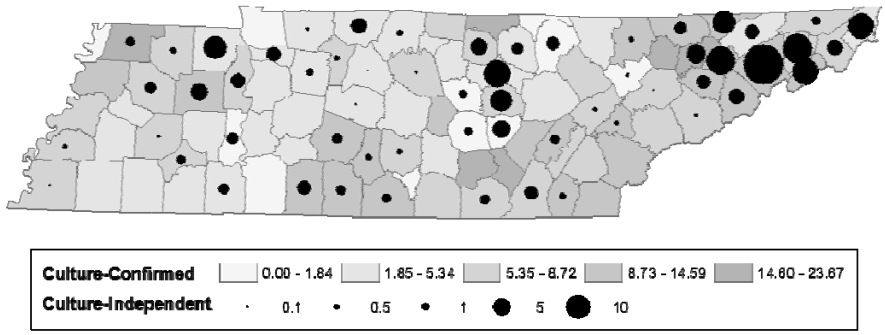


Figure 2. Mean Incidence of Campylobacteriosis, by Test Method, Tennessee, 2010-2012.



Program Activities

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.

Typically, interviews for campylobacteriosis are conducted at the regional or local level. However during this time period, FoodNet participated in a pilot study examining the frequency of

selected exposures among reported cases of campylobacteriosis and salmonellosis. To insure that cases were interviewed in the same manner and to reduce the additional burden on the regional and local staff, the FoodCORE program agreed to conduct the interviews centrally.

Preventive Measures

There are five simple prevention measures for campylobacteriosis:

- Wash hands carefully
- Keep your food preparation areas clean
- Avoid unpasteurized milk
- Cook your food to the appropriate temperatures
- Be careful when dealing with animals

Listeriosis

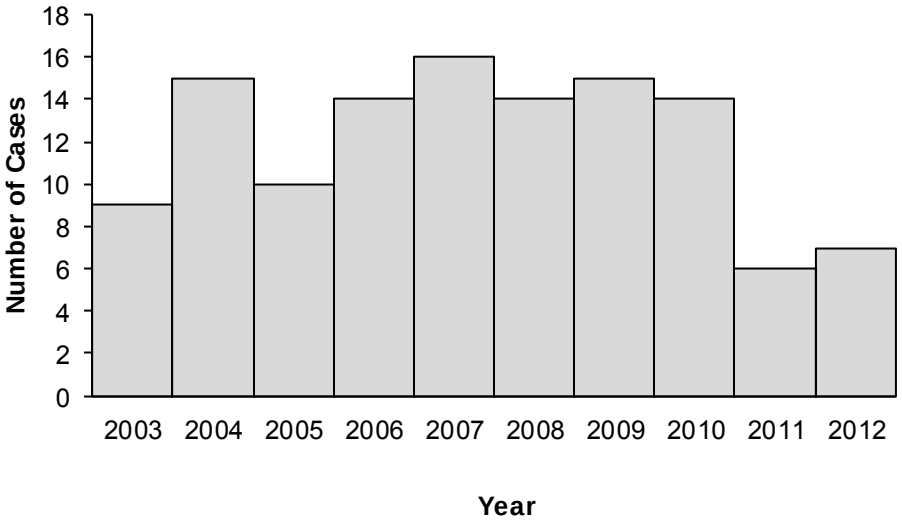
Background

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, of that number, listeriosis accounts for 500 deaths and 2,300 hospitalizations, the highest rate of hospitalization of any foodborne disease. *L monocytogenes* can cause meningitis, other severe neurological sequelae, spontaneous abortion, and infection in newborn infants. The primary vehicle is food.

Incidence/Trends

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. Immunosppressed persons and pregnant females are most susceptible to infection. In Tennessee, listeriosis became a reportable disease in 1996.

Figure. Number of Cases of Listeriosis, Tennessee, 2003-2012.



That year 6 cases were reported; the next year the number jumped to 14. In 1998, a multistate outbreak of listeriosis resulted from post-processing contamination in a hot dog manufacturing plant in another state. Tennessee Department of Health staff assisted in early identification of that outbreak. The numbers of cases in Tennessee have decreased since 2011.

Tennessee reported 14 cases in 2010, 6 cases in 2011, and 7 cases in 2012 **(Figure)**.

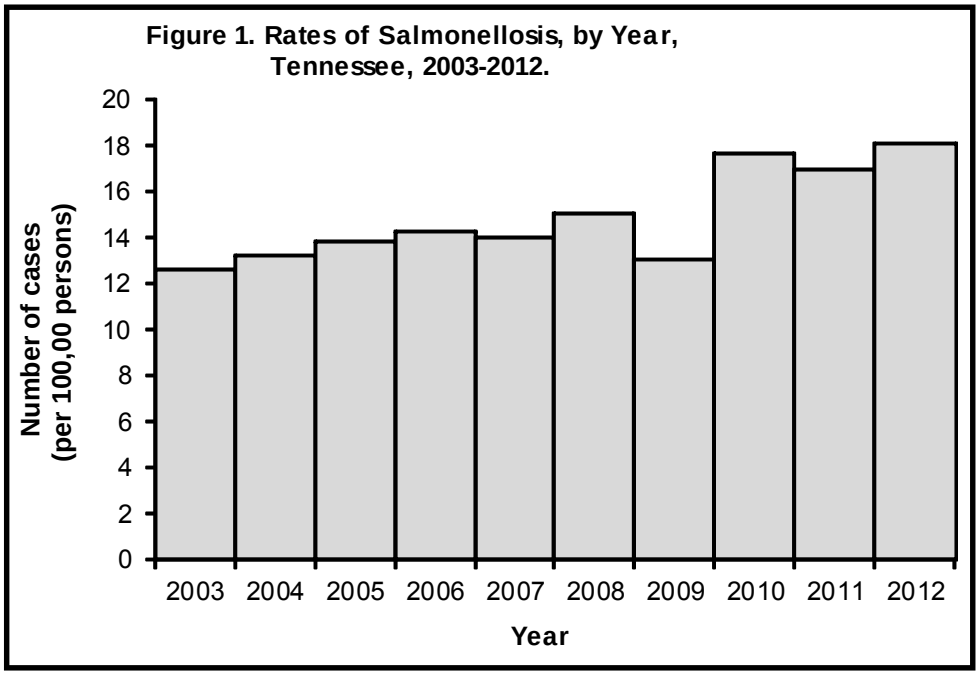
Salmonellosis

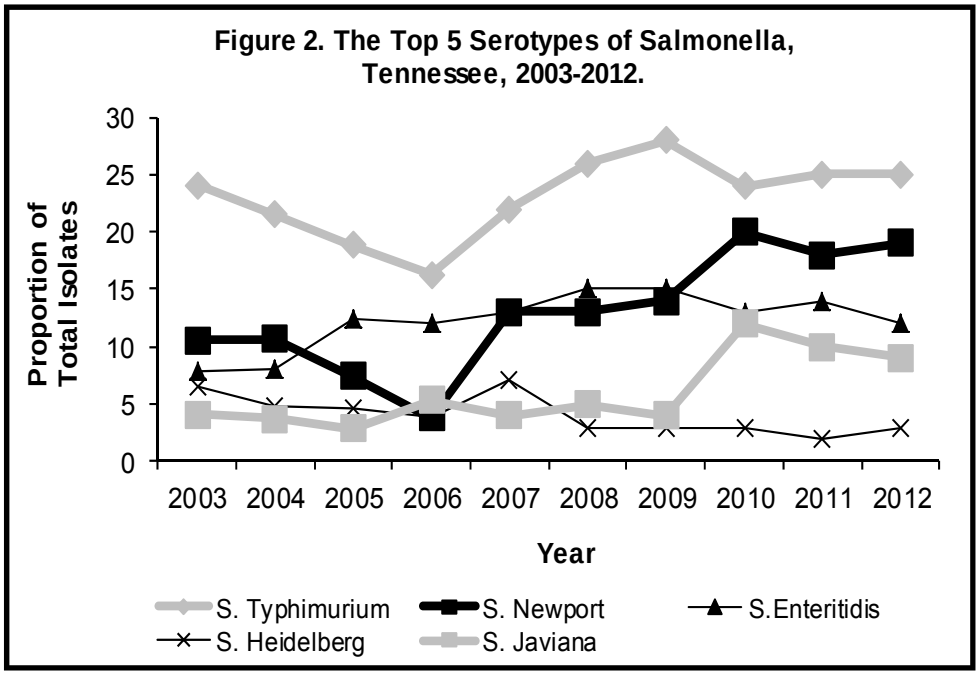
Background

Salmonellosis is a gastrointestinal infection caused predominately by non-Typhi *Salmonella* serotypes, gram negative enteric bacteria. Salmonellosis usually appears 6 to 72 hours after eating contaminated food and lasts for 4 to 7 days. Although the illness is regarded as a relatively mild disease, severe illness and death can occur in some cases particularly in infants, elderly and those with weakened immune systems. In the United States, *Salmonella* causes an estimated 1.2 million illnesses annually with more than 23,000 hospitalizations and 450 deaths.

Incidence

Since 2000, the incidence of salmonellosis has increased in Tennessee and the highest number ever was 1,149 cases in 2012 (**Figure 1**). The average incidence rate in 2010-2012 was 17.5 cases per 100,000 persons, similar to the 2010 national rate of 18 cases per 100,000 persons. This represents a 30% increase from the 2000-2009 average rate of 13.5 cases per 100,000 in Tennessee. Both Tennessee and national rates are still higher than the National Health Objective 2020 for incidence of salmonellosis (11.4 per





100,000 persons).

The rates of salmonellosis varied by region in 2010-2012. West Tennessee reported the highest rate of Salmonella infections (43 cases per 100,000 persons) followed by two metropolitan regions, Jackson/Madison and Memphis/Shelby Counties, with 24 and 21 cases per 100,000 persons, respectively. The other four metropolitan regions reported the lowest rates of salmonellosis (7-13 cases per 100,000 persons) during the same time period.

Trends

From 2010 to 2012, salmonellosis reports followed a typical seasonal trend with two thirds of cases occurring during the summer and fall (69% of cases were reported during the months of May through October). In 2012, salmonellosis peaked in July with 185 (16%) cases.

As always, *Salmonella* was isolated in 2010-2012 most frequently from children under 5 years of age, who accounted for 28% of all salmonellosis cases. During this time period, the incidence rates of salmonellosis were 156 cases per 100,000 infants under the age of one and 57 cases per 100,000 children 1-4 years of age.

The four most common serotypes of *Salmonella* (*S.* Typhimurium including *S.* I 4,[5],12:i:-, *S.* Newport, *S.* Enteritidis, and *S.* Javiana) accounted for 70%, 68% and 65% of all *Salmonella* isolates sent to Tennessee Department of Health State Laboratory in 2010, 2011, and 2012, respectively (**Figure 2**). Fourteen cases of *S.* Typhi were reported in 2010-2012 including at least nine cases linked to travel to endemic areas or were a part of an expanded immigrant family.

Program Activities

CDC is monitoring the emergence of the antimicrobial resistance among *Salmonella* isolated from humans. Nationwide, from 2002-2011, 3% of these isolates were resistant to ceftiofur (third generation cephalosporin) and 2% to nalidixic acid (quinolones), both are the main antimicrobials used for treatment of severe salmonellosis. In Tennessee, 2 % of the isolates were resistant to these antimicrobials. Resistance to ampicillin, chloramphenicol, streptomycin, sulfonamide, and tetracycline (ACSSuT) was reported in 6% of *Salmonella* isolates nationwide compared with 7% of Tennessee isolates.

Tennessee is also participating in the Retail Food Study since 2002 in collaboration with FDA, CDC, and nine other state health departments to monitor the prevalence and antimicrobial resistance of *Salmonella* isolated from retail meat. The *Salmonella* isolated from chicken breast and ground

turkey in Tennessee during 2002-2011 were susceptible to nalidixic acid compared to consistent resistance among 0.4-5% of the isolates submitted from other states. On the other hand, the resistance to third generation cephalosporines rose in retail chicken (10-34%) and ground turkey (8-22%) overall in 2002-2011. In Tennessee, this resistance pattern was only seen in 2005 (14% of chicken breast and 11% of ground turkey) and rose to 38% of chicken breast in 2010 and 22% of ground turkey in 2011.

Approximately 94% of salmonellosis is transmitted by food consumed in the United States. Tennessee was involved in many multistate outbreaks of salmonellosis linked with contaminated food in 2010-2011. The biggest of these was the national outbreak of S. Enteritidis that led to a massive recall of approximately 500 million eggs. Other multistate outbreaks were linked to the consumption of salami products made with contaminated imported black and red pepper (S. Montevideo), alfalfa sprouts (S. Newport and S. I 4,[5],12:i:-), ground turkey (S. Heidelberg) and a commercially distributed frozen chicken and rice entrée (S. Chester). Eighteen states were affected by the *Salmonella* Chester outbreak and Tennessee was one of only two states that collected food from ill cases which helped to better identify the source. Some of the multistate outbreaks during this time period were linked to non-food exposures like African dwarf frogs (S. Typhimurium), frozen rodents used as reptile feed (S I 4,[5], 12:i:-), and chicks and ducklings (S. Altona and S. Johannesburg) and exposures to clinical and teaching microbiology laboratories (S. Typhimurium).

Preventive Measures

To improve surveillance and responses to foodborne outbreaks, Tennessee was selected among 5 states since 2010 for the CDC Foodborne Diseases Centers for Outbreak Response Enhancement (FoodCORE). The FoodCORE team in Tennessee conducts centralized rapid interviews to collect demographic, clinical, risk factors, and other information for *Salmonella* cases in almost all regions. In addition, TN is a part of the "CDC Case Exposure Assessment Working Group" and volunteered to participate in two pilot studies in 2011-2012 to develop "standard data elements" that may help to more quickly generate hypotheses in *Salmonella* clusters and outbreaks.

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

Background

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

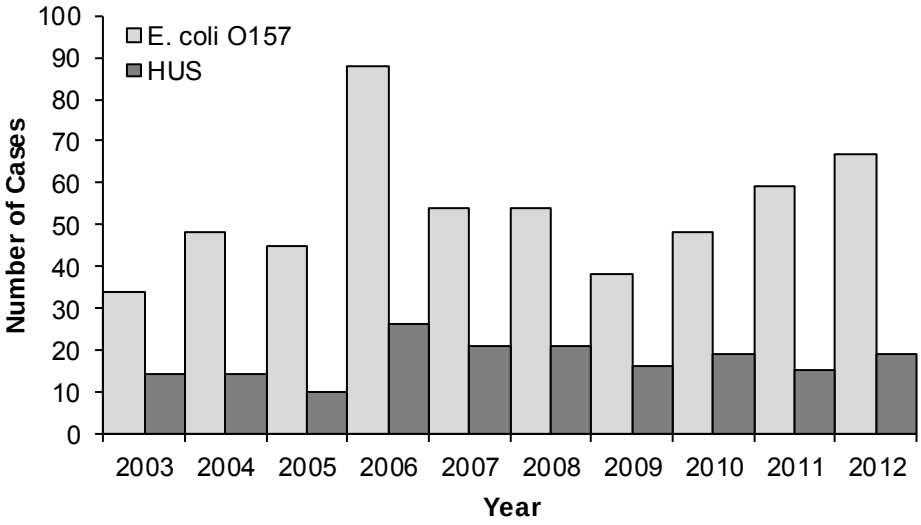
Shiga toxin-producing *E. coli* (STEC) is a group of *E. coli* that causes dysentery (bloody diarrhea). STEC possess several virulence factors, including Shiga toxin. Shiga-toxin, also called verotoxin, is essentially identical to a toxin produced by *Shigella dysenteriae*. Livestock, especially cattle, are thought to be the primary reservoir for STEC. Reservoir species are clinically unaffected. Transmission has been associated with foods like ground meat, produce, and water, as well as direct contact with STEC-colonized animals and their environment. Enterohemmorhagic *E. coli* (EHEC) are diarrheagenic *E. coli* which are subsets of Shiga toxin-producing *E. coli* (STEC). In the United States and in Tennessee, EHEC are important pathogens causing sporadic illness and outbreaks. The most commonly isolated EHEC is *E. coli* O157. Identification is facilitated by certain biochemical properties 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. In 2008-2010 Tennessee was 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 U.S. may be due to non-O157 serotypes, though most of these likely go unreported due to limitations in laboratory testing. The most common non-O157 STEC serotypes in the U.S. include O26:H11, O111, O103, O121, and O145. Tennessee is participating in a multistate case-

control study to identify risk factors for non-O157 infection, and to describe clinical and microbiologic features of the illness.

Most clinical laboratories have the capacity to identify *E. coli* O157 by culture, isolating sorbitol-negative *E. coli*. All positive STEC infections including *E. coli* O157 are reportable to 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.

Figure. Culture-Confirmed *E. coli* O157 and HUS, Tennessee, 2000-2012.



Incidence

In 2010-2012, 449 cases of STEC were reported to the Tennessee Department of Health. Of these, **(Figure)** 174 were culture confirmed *E. coli* 0157, 128 were culture-confirmed non-O157 STEC, and 6 was culture-confirmed STEC with O antigen undetermined. In 2010-12, 53 cases of HUS were reported in persons less than 18 years of age **(Figure)**. Of these, laboratory evidence of a preceding STEC infection was obtained in 42 cases (79%).

Program Activities

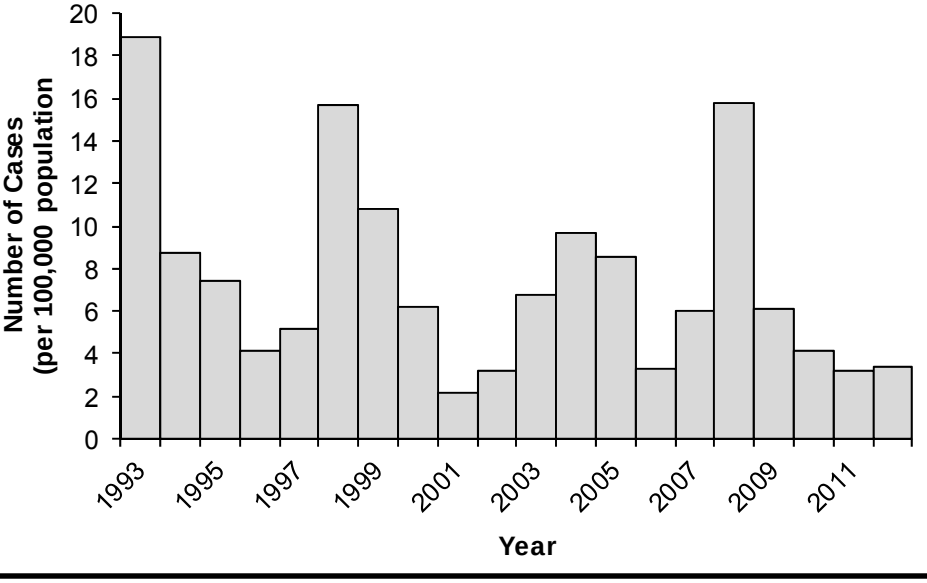
As a FoodNet site, Tennessee continues to be engaged in studies to better characterize STEC infections and outcomes.

Shigellosis

Background

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 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 infec-

Figure. Incidence of Shigellosis, by Year, Tennessee, 1993-2012.



tion.

Incidence
The **figure** shows the incidence of shigellosis cases from 1993-2012 in Tennessee.

Trends
Even though the number of cases reported in Tennessee has varied over the years, the rate of disease has declined overall. However, major increases in incidence occurred in 1993 (18.9 cases per 100,000 persons), 1998 (15.7 cases per 100,000 persons), 2004 (9.7 cases per 100,000), and 2008 (15.8 persons per 100,000 persons) and are indicative of the four to six year cyclical nature of shigellosis in Tennessee **(Figure)**.

Program Activities
Currently, active laboratory surveillance is being conducted statewide for *Shigella* by the FoodNet program.

The spread of *Shigella* from an infected person to other persons can be prevented by frequent and careful handwashing with soap and water. 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 48 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.

Vibriosis and Cholera

Background
Both cholera and vibriosis are gastrointestinal illnesses caused by bacteria found in the Vibrionaceae family. Cholera is specifically caused by two toxigenic serotypes of *Vibrio cholerae* called *V. cholerae* O1 and *V. cholerae* O139. Vibriosis is caused by all other non-cholera *Vibrio* species, *Grimontia hollisae* and *Photobacterium damselae*. This bacterium is naturally found in marine coastal waters, but is in low numbers as to not pose any health risk. However in the warmer months, these bacteria multiply which cause gross contamination in shellfish and water.

Most persons infected with the bacterium develop diarrhea, vomiting, primary septicemia or wound infections within 5 to 92 hours after exposure. Illness typically lasts two to five days. Treatment is not necessary in most cases. However, cases should drink plenty of liquids to replace fluids lost through diarrhea.

Incidence
From 2003-2011, rates (per 100,000 persons) of vibriosis averaged about 0.12 cases; whereas, rates of cholera averaged about 0.01 cases. However in 2012, rate of vibriosis nearly doubled.

Those at greatest risk of developing infection are children, immunocompromised persons and persons with chronic liver disease.

Trends
Typically, there are anywhere from three to ten cases reported each year in Tennessee (vibriosis and cholera combined). However in 2012, there were 17 cases reported, which is the most ever reported. Of those, there were a variety of species identified, as compared to previous years. From 2010-2012, the top two species reported were *V. parahaemolyticus* and *V. vulnificus* **(Table)**.

Program Activities
Active laboratory surveillance for cholera and vibriosis is carried out statewide by the FoodNet program. Isolates for *Vibrio* (including *Vibrio* species, *Grimontia hollisae* and *Photbacterium damselae*) are required by state law to be sent in to the state laboratory.

In addition to the routine surveillance form, a national case report form must be completed and submitted to CDC's Cholera and Other Vibrio Illness Sur-

Table. Reported Species Among Cases of Vibriosis and Cholera, Tennessee, 2010-2012.

Species	2010	2011	2012
V. alginolyticus	1	3	2
V. cholerae, non-O1/non-O139	0	1	3
V. cholerae O1/O139	0	0	1
V. fluvialis	1	0	3
G. hollisae	0	0	1
V. mimicus	0	0	1
V. parahaemolyticus	3	6	2
V. vulnificus	0	1	4

veillance (COVIS) Team. This form asks for more detailed information regarding isolate characteristics, clinical presentation, medical history, travel history, and food and environmental exposures. When shellfish is implicated, additional traceback efforts are initiated by Tennessee Department of Agriculture or the Food and Drug Administration.

Preventive Measures
There are a number of basic preventive measures one can take to reduce their risk of infection with vibriosis.

- Seafood should be cooked adequately and, if not ingested immediately, should be refrigerated.
- Uncooked mollusks and crustaceans should be handled with care.
- All children, immunocompromised people, and people with chronic liver disease should avoid eating raw oysters or clams.

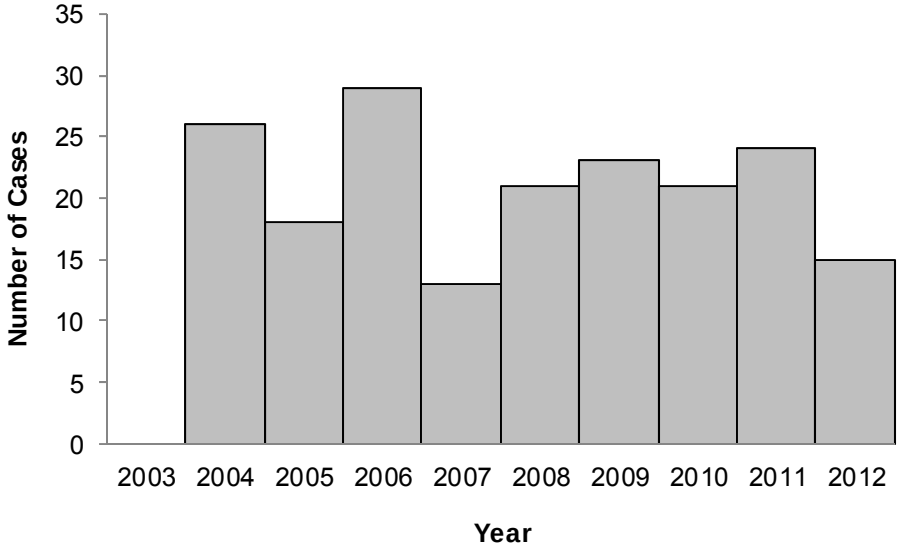
As for cholera, an oral vaccine was recently developed and is licensed and available in other countries (Dukoral from SBL Vaccines). The vaccine appears to provide somewhat better immunity and have fewer adverse effects than the previously available vaccine. However, CDC does not recommend cholera vaccines for most travelers, nor is the vaccine available in the United States.

Yersiniosis

Background
Yersinia is transmitted via is a gram negative, rod-shaped bacteria. The common agent for infection is *Yersinia enterocolitica.* Others include *Y. pseudotuberculosis* and *Y. pestis.* The main animal reservoir is pigs. Yersinia is often acquired by eating contaminated food. It is often associated with the production and consumption of chitterlings (pork intestines). Symptoms include fever and diarrhea. Most infections are uncomplicated and resolve completely.

Incidence
Based on data from 2003-present, we generally see 10-30 cases annually **(Figure)**. *Yersinia* cases are seen most commonly in the African-American population during Christmas due to the preparation of chitterlings during this time of year.

Figure. Number of Yersioniosis Cases, Tennessee, 2003-2012.



Program Activities
The Tennessee Department of Health has preventive literature available for distribution.

Preventive Measures
The Tennessee Department of Health monitors for outbreaks and provides targeted information.

Foodborne and Waterborne Parasitic Diseases

Thousands of people are diagnosed with parasitic diseases in the U.S. each year. A portion of those diagnosed are among those who have travelled to or lived in areas outside the U.S. where parasites may exist in greater abundance. However, many species of parasites are endemic to the U.S. Those at risk for contracting a parasitic illness are those who come into contact with or accidentally ingest a parasite that is capable of living and reproducing inside the human body.

Many parasitic diseases have traditionally been considered exotic or foreign to the U.S. and have not been included in differential diagnoses in Tennessee. Only two enteric parasitic diseases are reportable in Tennessee, cryptosporidiosis and cyclosporiasis. These two diseases are caused by the ingestion of the parasites often from food or water contaminated with human or animal feces. Food may become contaminated by poor hygienic behaviors of ill foodworkers, failure to properly

wash or cook fruits and vegetables, or failure to properly butcher and cook meats. Surface water may be contaminated when animal feces enters natural waterways or when sewage treatment facilities have a lapse in treatment resulting in untreated or partially treated human feces entering waterways. Groundwater may be contaminated by failing onsite septic systems, by improper placement of drain field to water wells or by infiltration of contaminated surface water to groundwater. Municipal water can become contaminated from a lapse of filtration or chemical treatment at the treatment facility or within the distribution system through water line breaks or storage tank breaches.

Cryptosporidiosis

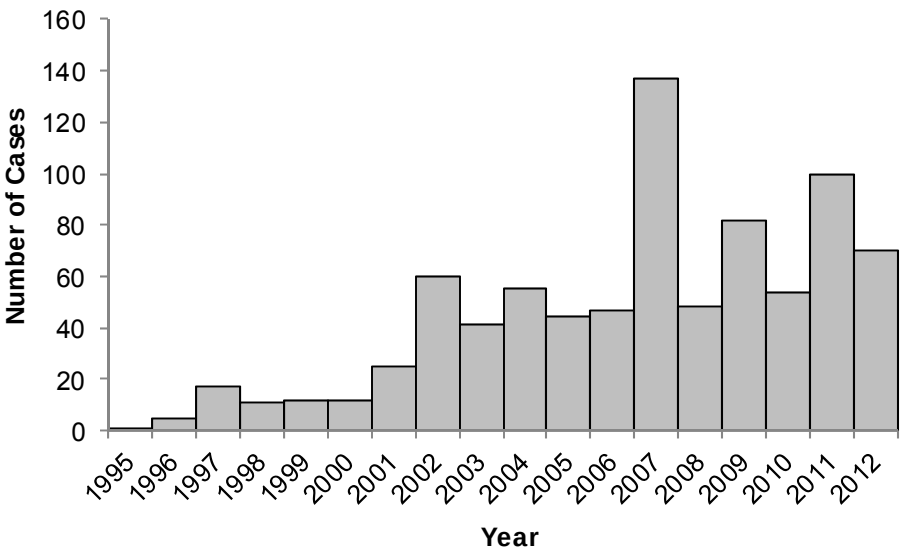
Background

Cryptosporidiosis is a gastrointestinal illness caused by the protozoal parasite *Cryptosporidium* affecting both animals and humans. Human infection is commonly associated with person to person transmission, accidental ingestion, and consumption of contaminated food or water.

Often considered a waterborne parasite, *Cryptosporidium* can exist in soil and water for long periods of time. People enjoying the many streams and lakes of Tennessee may accidentally consume water containing *Cryptosporidium*. This is especially a concern when young children are swimming in natural water bodies. Oocysts encyst when in harsh environments making them capable of surviving routine chlorine disinfection in treated recreational water venues such as swimming pools, splash parks, and hot tubs and are of particular concern in drinking water treatment systems due to their small size and chlorine resistivity. The two species most commonly found in humans are *C. parvum* and *C. hominis*. *C. parvum* has long been recognized in persons, pets, and ruminant animals in agricultural settings.

Asymptomatic infections are common and constitute a source of infection for others. The major symptom associated with cryptosporidiosis is profuse and watery diarrhea, often preceded by anorexia and vomiting. The diarrhea is associated with cramping abdominal pain. In immunocompetent cases, including children, diarrhea usually lasts around 10 days, but can be as short as 1 day and as long as 20 days.

Figure 1. Cryptosporidiosis Cases, Tennessee, 1995-2012.



Incidence

In Tennessee, cryptosporidiosis is a Category 2 reportable disease and must be reported in writing within 1 week of diagnosis. The number of cryptosporidiosis cases in Tennessee has generally risen during recent years. During 1995–2012, 821 cases were reported, ranging from a minimum of 1 case in 1995 to a maximum of 137 cases in 2007. (**Figure 1**). The cases reported in 2007 included those from at least 2 recreational water outbreaks. There have been no known outbreaks since that time.

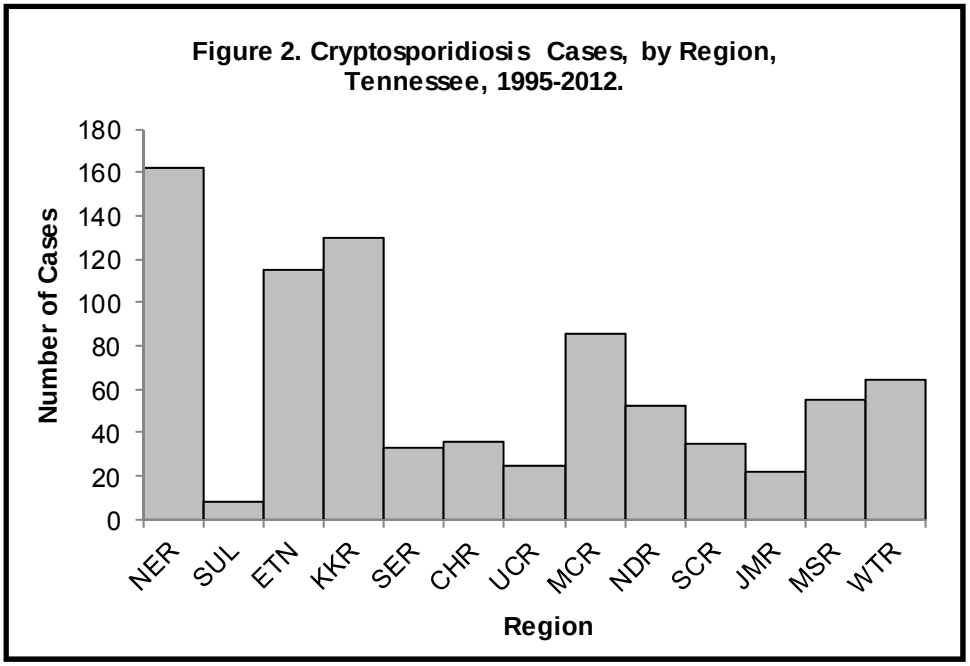
Trends

From January 2010 to December 2012, 224 cases of cryptosporidiosis were reported statewide representing an average incidence rate per 100,000 population of 1.2. The average national incidence rate during 2000-2010 was 2, with the highest incidence rate being 2.9 for 2010.

Program Activities

Cryptosporidiosis case reporting facilitated observation of spatial and temporal patterns of infection. The eastern third of the state has reported higher incidence of cryptosporidiosis than the remainder of the state (**Figure 2**). During 2010-2012, under the CDC Environmental Health Specialist Network grant, a study was underway to investigate this apparent clustering of cryptosporidiosis cases. Discovered through this investigation was a doubling of cases reported by hospitals in the northeast region after

switching to rapid card assays. One pediatric clinic in that region also tests all children presenting with diarrhea for cryptosporidiosis. This increase in testing rate and increased sensitivity of testing methodologies appear to account for some of this increased reporting. Another contributing factor, appears to be more frequent contact with cattle or other animals (when compared to case patient exposures in the rest of the state. As a part of this study, stool samples were subjected to polymerase chain reaction (PCR) testing. Through this testing, *C. parvum* was the only species of *Cryptosporidium* identified in case patients in the northeast region. A subset of stool samples was submitted to the CDC's Parasitic Diseases Laboratory for further genetic subtype identification. A unique subtype of cryptosporidium was found in stool samples from two epi-linked cases.



The availability of the anti-*Cryptosporidium* drug nitazoxanide, approved in 2005, is thought to have made providers more aware of cryptosporidiosis and more likely to pursue diagnosis. New diagnostic techniques, including enzyme immunoassay and rapid card tests, have been documented to have higher sensitivity. The rapid card tests have also been associated with false positive results perhaps leading to the recent increase in case reporting from facilities that have recently switched to these tests.

Preventive Measures

In 2010, waterborne outbreak training was conducted in 5 sites across the state which included environmental health specialists, epidemiologists, nurses, medical doctors and veterinarians from the state and regional health departments as well as environmental specialists and managers from the Tennessee Department of Environment and Conservation. A drinking water cryptosporidiosis outbreak scenario was used in breakout sessions. This training reinforced the roles of each department and increased collaboration between departments at the regional level. To help prevent cryptosporidiosis and other waterborne illnesses, the Tennessee Department of Health distributes information on recreational water safety each year.

Cyclosporiasis

Background

Cyclosporiasis is an intestinal infection caused by the parasite, *Cyclospora cayetanens.* This disease was first described in humans in New Guinea in 1977 as being caused by "a large *Cyrptosporidium*" until taxonomic classification was made in 1993. Cyclosporiasis became nationally notifiable in 1999 and became reportable in Tennessee in 2002.

The only known host of this single celled parasite is humans. Non-infective oocysts are shed intermittently in stool. The oocysts sporulate in the environment, making direct person to person infection unlikely. Infection in humans occurs by ingestion of fecally contaminated food or water. Oocysts of this organism persist in the environment and may endure after iodine or chlorine disinfection on fresh produce or in drinking water. Inside the gastrointestinal tract, the sporocysts excyst and migrate to the lining of the small intestine where they reproduce and form oocysts.

Symptoms of cyclosporiasis begin an average of 7 days (range 2 days to ≥2 weeks) after ingestion and may include watery diarrhea, loss of appetite, weight loss, cramping, bloating, nausea, vomiting, and fatigue. Cyclospora infection is diagnosed by examining stool specimens; however, diagnosis can be difficult because oocysts maybe shed intermittently or in low amounts. Cyclospora oocysts are autofluorescent, appearing blue or green against a black background under ultraviolet light. Alternately, acid-fast staining or

polymerase chain reaction (PCR) is used to identify Cyclospora oocysts in stool specimen.

Incidence

Cyclospora is endemic to tropical and subtropical areas. The overall U.S. incidence of *Cyclospora* infections is low with an average incident rate of 0.08 per 100,000 people during 2000–2010 which represents 1,841 cases nationwide. During 1995–2000, large outbreaks of cyclosporiasis in North America were associated with the consumption of fresh raspberries from Central America. 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.

Trends

In Tennessee, cyclosporiasis is a Category 2 reportable disease and must be reported in writing within 1 week of diagnosis. During 2002–2012, a total of 19 cyclosporiasis cases were reported. Regionally, the middle Tennessee regions have reported 8 of the 19 cases, 5 from the MidCumberland Region and 3 from Nashville Davidson. From January 2010 to December 2012, 5 cases were reported statewide; 1 from Knox County, 2 from Chattanooga/Hamilton Region, and 2 from the Nashville/Davidson Region.

Program Activities

The recommended treatment is a combination of two antibiotics, trimethoprim- sulfamethoxazole. No highly effective alternative antibiotic regimen has been identified for patients who do not respond to the standard treatment or have a sulfa allergy. Most people with healthy immune systems will recover without treatment, although if not treated symptoms can last for several weeks.

Preventive Measures

As with other foodborne diseases, the department promotes proper cleaning and cooking of raw vegetables and meats.

Foodborne Outbreaks

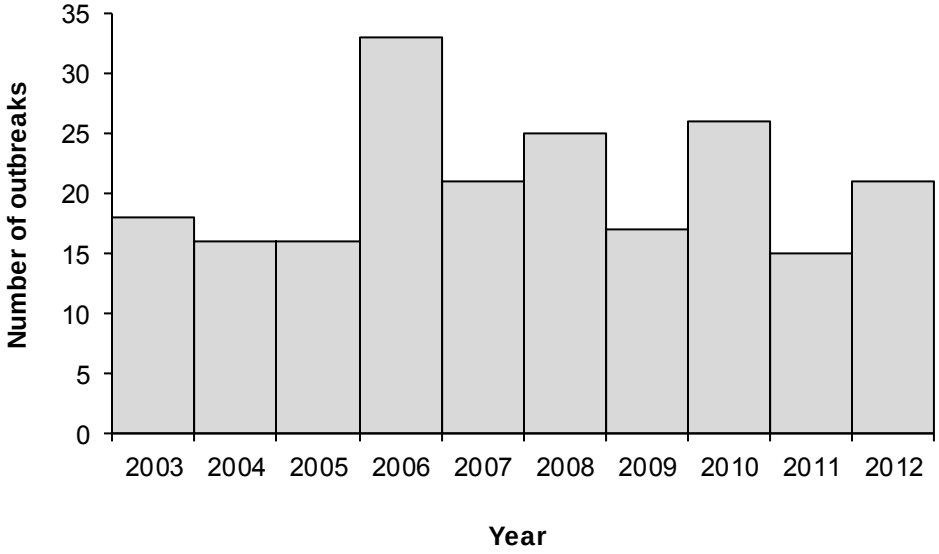
Programmatic Overview

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

Activities

From 2010-2012, 26, 15, and 21 foodborne outbreaks were reported, respectively (**Figure**). The increasing use of pulsed-field gel electrophoresis (PFGE) to determine relatedness of bacterial isolates continues to improve the recognition and investigation of suspected local and multi-state outbreaks. In 2010, a cluster of *Salmonella* Enteritidis with an indistinguishable PFGE pattern was identified. When cases in this cluster were interviewed, epidemiologists discovered that they had all consumed eggs prepared by the same food truck. The environmental health inspection cited violations including pooling of eggs. Education was provided to the food truck owners and the eggs were traced back to a farm in the Southeast. Another useful tool in outbreak investigations is the polymerase chain reaction (PCR) test. This test has markedly improved our ability to confirm norovirus as a common etiology in foodborne disease outbreaks. In 2012 over 100 people associated with a hockey tournament became sick with norovirus. Risk factor analyses indicated that exposure to common areas of the hotel tournament attendees stayed at, specifically the pool table room, the swimming pool area, and the restaurant areas were associated with illness. Given that people were ill prior to arrival at the hotel, and the evidence of vomiting in an open area of the hotel, most likely exposure to contaminated areas

Figure. Reported foodborne disease outbreaks in Tennessee, 2003-2012.



and close contact between team members created the potential for widespread person-to-person transmission in this gathering of young people and their families. It was concluded that this was a person to person outbreak of norovirus gastroenteritis.

Impact

Several foodborne outbreak investigations highlighted the importance of these activities and the measures taken by public health professionals to prevent additional outbreaks. Also the use of laboratory tools such as PFGE and PCR allow public health staff to identify and solve outbreaks in a more timely manner.

B. Invasive Diseases

Active Bacterial Core Surveillance (ABCs)

Programmatic Overview

Active Bacterial Core surveillance is a core component of the Centers for Disease Control and Prevention (CDC's) Emerging Infections Programs network, a collaboration between CDC, state health departments, and universities. ABCs is an active laboratory- and population-based surveillance system for invasive bacterial pathogens of public health importance. For each case of invasive disease in the surveillance population, a case report with basic demographic information is completed and bacterial isolates are sent to CDC and other reference laboratories for additional laboratory evaluation. ABCs also provides an infrastructure for further public health research, including special studies aiming at identifying risk factors for disease, post-licensure evaluation of vaccine efficacy and monitoring effectiveness of prevention policies.

ABCs was initially established in four states in 1995. It currently operates among 10 EIP sites across the United States, representing a population of approximately 41 million persons. At this time, ABCs conducts surveillance for six pathogens: group A and group B *Streptococcus* (GAS and GBS), *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Neisseria meningitidis*, and methicillin-resistant *Staphylococcus aureus*.

Activities

In Tennessee, the ABCs Program is coordinated through Vanderbilt University. The ABCs surveillance area comprises the major metropolitan areas of the state (Nashville, Memphis, Knoxville, Chattanooga, Jackson) and 15 surrounding counties. In January 2010, the ABCs surveillance area was increased for all pathogens from 11 to the current total of 20 counties; this increased the population under surveillance from 3.1 million to 3.8 million. All 59 hospitals in the 20-county surveillance area actively participate.

A new 13-valent pneumococcal conjugate vaccine (PCV13, Pfizer) was licensed in February 2010. Post-licensure evaluation of PCV13 effectiveness is important to ensure that the vaccine performs as expected among children. This project provided our principal motivation to expand our ABCs surveillance area from 11 to 20 counties, adding eight counties surrounding Knoxville and one county between Nashville and Memphis which is a semi-urban population center, thus increasing our population under surveillance by 600,000 persons and increasing the power of the study. In another attempt to increase the power of the case control study, we are presently including *all* cases that reside throughout the state in Tennessee who met case definition for PCV13 and are identifying controls.

Under the leadership of Dr. Lindegren, we are participating in an ABCs Group A Strep genomics working group to design a study to determine the genetic factors associated with the development of severe invasive Group A streptococcal infection, specifically necrotizing fasciitis (NF) and streptococcal toxic shock syndrome (STSS). We will collaborate with external partners for genotyping to determine associations between genetic variants hypothesized to play a role in inflammation and immune regulation with STSS and NF. Identifying genetic variants will enable future targeted prevention efforts using vaccine or other modalities and more aggressive treatment.

We participate in activities investigating population host factors that are potential risks for ABCs infections such as diabetes, obesity and co-infections. Geocoding for all ABCs projects is underway using ArcGIS software. Tennessee provides leadership for the geocoding working group analytic agenda, and conducts spatial epidemiologic analyses using geocoded surveillance data linked to census data, including measures of poverty, crowding, and access to care, along with other geographic data sources, on behalf of the EIP network.

Population-based, active, laboratory surveillance to determine species distribution and antifungal resistance of *Candida* species causing bloodstream infections (BSI) is being conducted in nine counties that incorporate Knoxville (Knox County) and surrounding counties. Prospective data and isolate collection began on January 1, 2011. Results of surveillance, including antifungal susceptibility results are being communicated to each hospital's microbiology laboratory director and to the Infection Preventionist.

Vanderbilt ABCs has trained numerous MPH students and both pediatric and adult infectious disease fellows, all of whom have worked on ABCs and EIP data. Many of these projects have resulted in presentations at scientific meetings and publications.

Impact

ABCs data have been used to track disease trends and permitted the discovery and quantification of the herd effect that accompanied pediatric conjugate pneumococcal vaccination. The emergence of serogroup Y meningococcal disease also was documented. ABCs data have formed the basis of revised CDC guidelines recommending the use of universal screening of pregnant women for Group B streptococcal infection.

Other EIP Surveillance Activities

Clostridium difficile Infections (CDI) Active Surveillance

Emerging Infections Program (EIP) C. *difficile* Infection (CDI) Surveillance is a special ABCs study in Tennessee which in addition to nine other states comprise CDC's Emerging Infections Programs network. Tennessee EIP CDI Surveillance is a population- and laboratory-based active surveillance system among Davidson County, Tennessee residents. A convenience sample of both community- and healthcare facility- associated strains are obtained from cases with CDI in Davidson County and are sent to partner reference labs for toxigenic culture and then sent to the Centers for Disease Control and Prevention (CDC) for molecular investigation. Data from this project will help inform future policy and prevention strategies to reduce C. *difficile* disease. Specifically, the goals of EIP C. *difficile* surveillance project are to determine the burden of C. *difficile* disease in the United States, identify the proportion of infections associated with medical care, measure trends of disease over time, determine which strains of C. *difficile* are causing disease, and in what proportions. In addition, the project provides infrastructure for further research including studies to identify risk factors, to determine population targets for vaccines, and to monitor the efficacy of prevention strategies.

Legionellosis Active Surveillance

As a means to evaluate the current passive surveillance system and to describe the incidence and epidemiologic characteristics of legionellosis, states participating in the Emerging Infections Program (EIP) were invited to add active surveillance for legionellosis to their existing EIP activities. Tennessee began active surveillance for legionellosis in June 2011.

Invasive Group A Streptococcal Disease

Background

Group A Streptococcal Disease refers to infection with *Streptococcus pyogenes* (Group A B-hemolytic streptococcus). Group A Streptococcus (GAS) is a bacterium often found in the throat and on the skin and may cause no symptoms of illness (colonization). Most infections are relatively mild such as "strep throat" or impetigo. Severe GAS diseases may occur when bacteria get into parts of the body where bacteria usually are not found (e.g., blood, muscle, or the lungs). When bacteria get into normally sterile sites and cause infection it is termed as "invasive" GAS disease. Two of the most severe but less common forms of invasive GAS diseases are necrotizing fasciitis (frequently referred to in the lay media as "flesh eating bacteria") and streptococcal toxic shock syndrome (STSS).

GAS spreads through direct contact with mucus membrane from nose or throat of persons who are colonized or infected or through contact with infected wounds or sores on the skin.

Incidence

The average incidence of Group A Invasive Disease in Tennessee ranged between 2.4 to 3.2 per 100,000 in the last 8 years with the exception of 2012, where the lowest incidence (1.9 per 100,000) was observed. The highest incidence rate of 3.2 per 100,000 was observed in 2010. In contrast to the earlier years' data that revealed highest rate of infection among the African American population, recent data indicate that there is no major difference in the rate of infection among African American and White populations in Tennessee. In 2011, the incidence rate of invasive GAS infection was 2.3 and 2.4 per 100, 000 among African Americans and Whites, respectively.

In 2012, the highest incidence rates were seen in Knox County, Sullivan County, East region, Upper Cumberland region and Memphis/Shelby County (**Figure**).

Figure. Incidence Rate of Invasive Group A Streptococcal Infections per 100,000 Population, Tennessee, 2012.

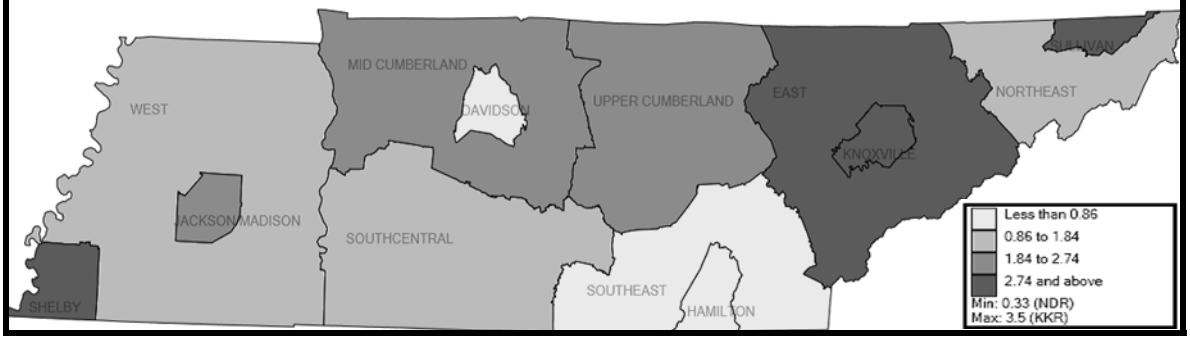


Table. Incidence rate* of Invasive Group A Streptococcal Infections by Age Group, Tennessee, 2010-2012.

	2010		2011		2012	
Age group (in years)	Number of cases	Incidence Rate	Number of cases	Incidence Rate	Number of cases	Incidence Rate
<5	12	2.94	6	1.48	6	1.45
5 to 9	6	1.46	8	1.95	1	0.25
10 to 14	3	0.72	0	0.00	1	0.24
15 to 19	4	0.91	6	1.41	5	1.16
20 to 24	2	0.47	7	1.59	6	1.40
25 to 34	13	1.58	19	2.27	13	1.56
35 to 44	25	2.93	23	2.73	7	0.82
45 to 54	32	3.45	21	2.28	20	2.18
55 to 64	27	3.44	32	3.92	24	3.04
65+	76	8.79	65	7.39	38	4.21
All ages	200	3.15	187	2.92	121	1.90

*Incidence rates are expressed per 100,000 population

Trends

Invasive Group A Streptococcal infection occurs more frequently among elderly, young children, the immune compromised and persons with chronic and debilitating diseases. Persons with skin lesions and injecting drug users are other groups at higher risk of the infection.

The age adjusted rate of invasive GAS in Tennessee over the last three years revealed that the incidence rate has been persistently higher among those aged above 45 years and the rate was low among those aged 10 to 14 years of age (**Table**).

The rate of invasive GAS disease has been stable for the last seven years, with the exception of 2012 which had the lowest rate (1.9 per 100,000). Surveillance of invasive GAS will continue to determine the distribution of the disease, emergence and prevalence of new serotypes, and to identify risk factors for community and health care onset GAS infection.

Program Activities

Surveillance is conducted for invasive GAS infections. Surveillance data are used to define trends and look for possible outbreaks, particularly in healthcare settings. Case investigations are monitored by the Healthcare-Associated Infections (HAI) Program.

Preventive Measures

The Tennessee Department of Health promotes the following to reduce the spread of all types of GAS infection: good hand washing, especially after coughing and sneezing and before preparing foods or eating. Persons with sore throats should be seen by a doctor who can perform tests to find out whether the illness is strep throat. If the test result shows strep throat, the person should stay home from work, school, or daycare until 24 hours after taking an antibiotic. All wounds should be kept clean and watched for possible signs of infection such as redness, swelling, drainage, and pain at the wound site. A person with signs of an infected wound, especially if fever occurs, should immediately seek medical care. It is not necessary for all persons exposed to someone with an invasive group A strep infection (i.e. necrotizing fasciitis or strep toxic shock syndrome) to receive antibiotic therapy to prevent infection. However, in certain circumstances, antibiotic prophylaxis may be appropriate.

Invasive Group B Streptococcal Disease

Background

Group B Streptococcal infection (GBS) is caused by the bacteria *Streptococcus agalactiae*. It emerged as the leading infectious cause of neonatal morbidity and mortality in the United States during the 1970s. Transmission from mother to infant occurs shortly before or during delivery. It can be acquired in the nursery from hospital personnel via hand contamination. It also can be acquired in the community from healthy colonized people. Persons at greatest risk of developing infections are newborns, pregnant women and non-pregnant adults who have underlying medical conditions such as diabetes mellitus, chronic liver or renal diseases, malignancy or other immuno-compromising conditions and adults above 65 years of age.

Infection in newborns is classified in two distinct categories: early onset in (0-6 days old) and late onset disease (7-89 days old). Early onset disease is characterized by signs of systemic infection, respiratory distress, apnea, shock, pneumonia and less often meningitis. Late onset occurs at 3-4 weeks of age (7-89 days) and commonly manifests with bacteremia or meningitis. Preterm infants are more likely to develop early onset diseases when compared to full term infants. The late onset disease usually occurs in infants who have history of prolonged hospital stay. About 4% of infants with early onset infections die from their illness.

Figure 1. Cases and Incidence of Invasive Group B Streptococcus Infections, by Year, Tennessee, 2007-2012.

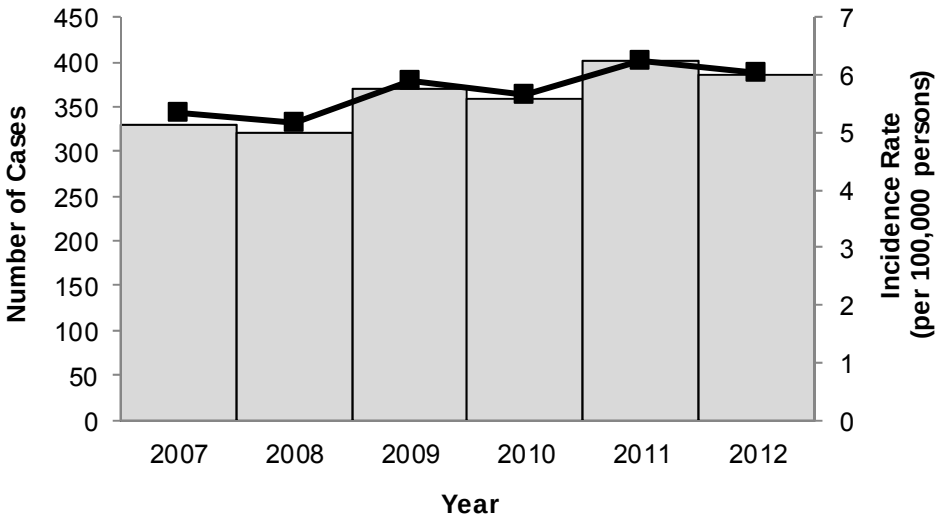
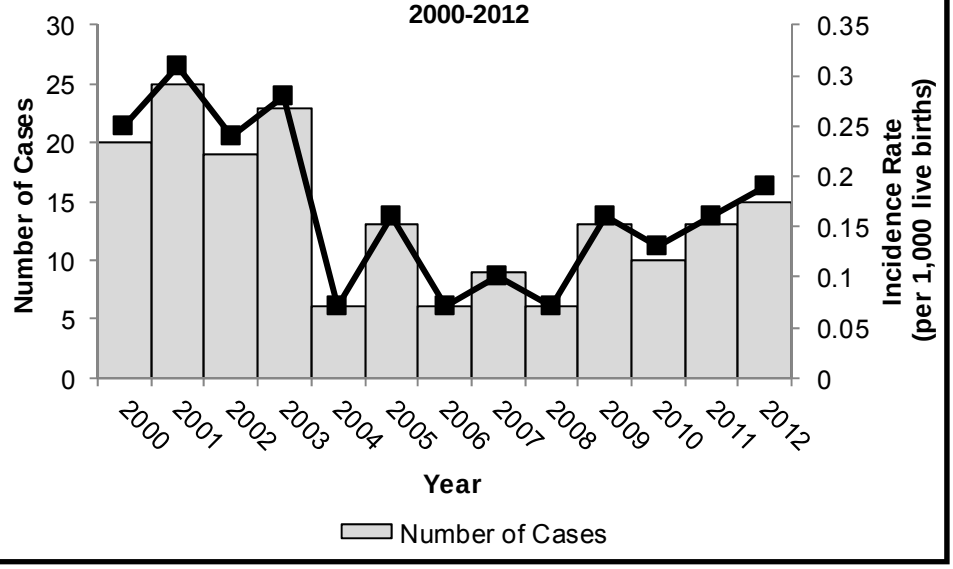


Figure 2. Cases and Incidence of Early Onset Invasive Group B Streptococcal Infection by Year, Tennessee, 2000-2012



Incidence

In Tennessee the number of cases reported among the general population appears to be stable at a rate of around 5 to 6 per 100,000 population. Number of cases and incidence rates per 100,000 population are shown in **Figure 1**.

Trends

The national prevention strategy recommends screening of pregnant women for group B streptococcal colonization at 35 to 37 weeks of gestation and providing antibiotic prophylaxis at the time of labor or rupture of membrane when tested positive. This prevention policy was introduced in 1996, resulting in a significant impact on the incidence of early onset disease. The incidence of early-onset GBS disease in the United States has declined since 1993 by 84% (from 1.7 cases per 1,000 live births in 1993 to 0.26 cases per 1,000 live births in 2011) , coinciding with increased prevention activities. However, the incidence rate of late-onset GBS disease remained stable since 1990 at approximately 0.3 cases per 1,000 live births despite imple-

mentation of the prevention guidelines.

In Tennessee, the incidence of early onset invasive GBS disease remarkably decreased from an incidence rate of 0.28 per 1,000 live births in 2003 to 0.19 per 1,000 live births in 2012 coinciding with the implementation of CDC's recommended prevention strategies across the State (**Figure 2**). After consistently low incidence rates in 2004 to 2008, rates have begun to increase. This is primarily due to a decrease in screening and antibiotic preventive therapy in healthcare settings combined with lack of or no access to prenatal care.

Program Activities

Tennessee Department of Health conducts surveillance for Invasive Group B Streptococcal infection and promotes implementation of CDC's recommendations for the prevention of Perinatal Group B Streptococcal Disease http://www.cdc.gov/groupbstrep/index.html. The 2010 prevention guidelines recommend screening of pregnant women at 35 to 37 weeks of gestation. Emphasis is given to areas with history of lower screening rates and high disease incidence. Efforts to decrease GBS disease in infants are consistent with the Tennessee Department of Health's goal of lowering infant morbidity and mortality. Case investigations are monitored by the Healthcare-Associated Infections (HAI) Program.

Preventive Measures

Prevention of GBS infections includes screening pregnant women at 35 to 37 weeks of gestation providing intrapartum antibiotic prophylaxis at the time of labor or rupture of membrane for those who test positive and for others (previous delivery of infant with GBS disease, women with GBS bacteriuria during current pregnancy, unknown GBS status at ≤37 weeks gestation, have an intrapartum temperature >100.4°F or rupture of membranes for ≥18 hours. Penicillin is the preferred agent.

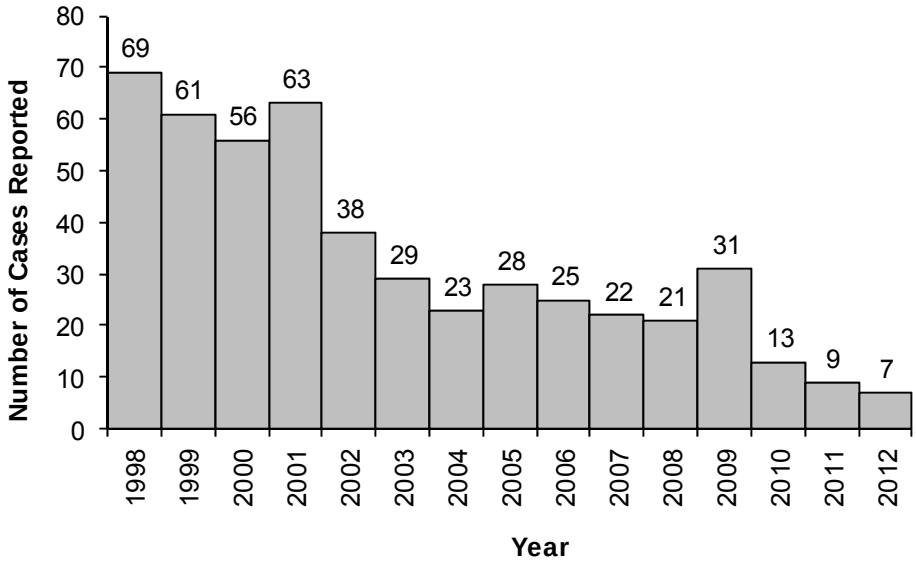
Meningococcal Disease

Background

Invasive infection usually results in meningococcemia, meningitis, or both. Onset often is abrupt in meningococcemia, with fever, chills, malaise, prostration, and a rash that initially can be macular, maculopapular, or petechial. The progression of disease often is rapid. The signs and symptoms of meningococcal meningitis are indistinguishable from signs and symptoms of acute meningitis caused via *Streptococcus pneumoniae* or other meningeal pathogens.

The case fatality rate for invasive meningococcal disease in all ages is between 9-12% even with antibiotic treatment; meningococcemia has a case fatality rate of up to 40%. Invasive meningococcal infections can be complicated by arthritis, myocarditis, pericarditis, and endophthalmitis. Sequelae associated with meningococcal disease occur in 11%–19% of patients and include hearing loss, neurologic disability, digit or limb amputation, and skin scarring.

Figure. Number of Cases of invasive *Neisseria meningitis* Infections Reported in Tennessee, 1998-2012.



Neisseria meningitidis is a gram-negative diplococcus with at least 13 serogroups. Strains belonging to groups A, B, C, Y, and W-135 are implicated most commonly in invasive disease worldwide. Approximately 73% of cases among adolescents and young adults are caused by serogroups C, Y, or W135 and potentially are preventable with available vaccines. In children under age 5 years, about 60% of cases are caused by serogroup B and are not preventable with vaccine. Transmission occurs from person-to-person through droplets from the respiratory tract. The incubation period is 1–10 days and often less than 4 days. The peak attack rate occurs in children younger than 1 year of age, with a second, smaller peak at about

age 16-21 years and another peak among adults age 65 and older. Freshman college students who live in dormitories have a higher rate of disease compared with individuals who are at the same age and are not attending college.

Although about 97% of cases are sporadic and isolated, outbreaks have occurred in communities and institutions, including child care centers, schools, colleges, and military recruit camps. Culture or polymerase chain reaction-based (PCR) can be used as epidemiologic tools during a suspected outbreak to detect concordance among strains. The Tennessee Department of Health Laboratory Services has PCR assays that can be used to serogroup *N. meningitidis* in cerebral spinal fluid (CSF), petechial or purpural lesion scrapings, synovial fluid and other usually sterile body fluids.

Incidence

Since 1997, the number of reported cases in Tennessee has continued to decline. The number and incidence rate of cases (0.2 cases per 100,000 persons in 2010, 0.14/100,000 in 2011, and 0.11/100,000 in 2012) has dropped over the past three years **(Figure)**.

Program Activities

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

Preventive Measures

Meningococcal vaccine is recommended for persons at increased risk for meningococcal disease which include the following:

1. All adolescents 11 through 18 years of age, with a routine dose at age 11-12 and a booster dose after the 16th birthday
2. College freshman living in on-campus housing
3. Microbiologists who are routinely exposed to isolates of *N. meningitidis*
4. Military recruits
5. Persons who travel to and U.S. citizens who reside in countries in which *N. meningitidis* is hyperendemic or epidemic (see http://www.cdc.gov/travel).
6. Persons with terminal complement component deficiency
7. Persons with functional or anatomic asplenia
8. Persons in a defined high-risk group during an outbreak of sufficient size.

Methicillin Resistant *Staphylococcus aureus* Invasive Disease (MRSA) — Passive Surveillance

Background

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

Table. Invasive MRSA disease cases and rate (per 100,000 persons) by year, Tennessee, 2007-2012.

Year	# of Cases	Rate
2007	1,985	32.6
2008	2,005	32.6
2009	1,998	32.2
2010	1,885	29.7
2011	1,782	27.8
2012	1,871	29.4

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

Invasive MRSA disease was made re-

portable in Tennessee in June 2004 and is defined as isolation of MRSA from a normally sterile site (i.e., specimen source is blood, cerebrospinal fluid [CSF], pleural, pericardial, peritoneal,joint fluid or bone). Skin infections and isolates from sputum, wound, urine, and catheter tips are not counted; repeat isolates within 30 days are not counted.

Trends

Incidence of reported invasive MRSA disease has decreased slightly since 2009, but remained relatively stable around 30 cases per 100,000 population (29.7 cases per 100,000 population in 2010; 27.8 cases per 100,000 population in 2011; 29.4 cases per 100,000 population in 2012). The total number of reported cases has remained stable during this period as well (1,885 cases reported in 2010; 1,782 cases in 2011; 1,871 cases in 2012) **(Table)**.

Program Activities

The Tennessee Department of Health monitors the incidence of invasive MRSA as a measure of effectiveness of infection prevention across the spectrum of healthcare. Case investigations are monitored by the Healthcare-Associated Infections (HAI) Program.

Preventive Measures

Thorough hand cleansing is the single most important preventative measure for avoiding the transmission of MRSA, especially when visiting someone in a hospital or long-term care facility. Do not share personal items such as towels or razors with another person because MRSA can be transmitted through contaminated items. Cover all wounds with a clean bandage, and avoid contact with other people's soiled bandages. If you share sporting equipment, clean the equipment with antiseptic solution before using it. Avoid common whirlpools or saunas if another participant has an open sore. Make sure that shared bathing facilities are clean. Additional information may be found at the following website: www.cdc.gov/mrsa.

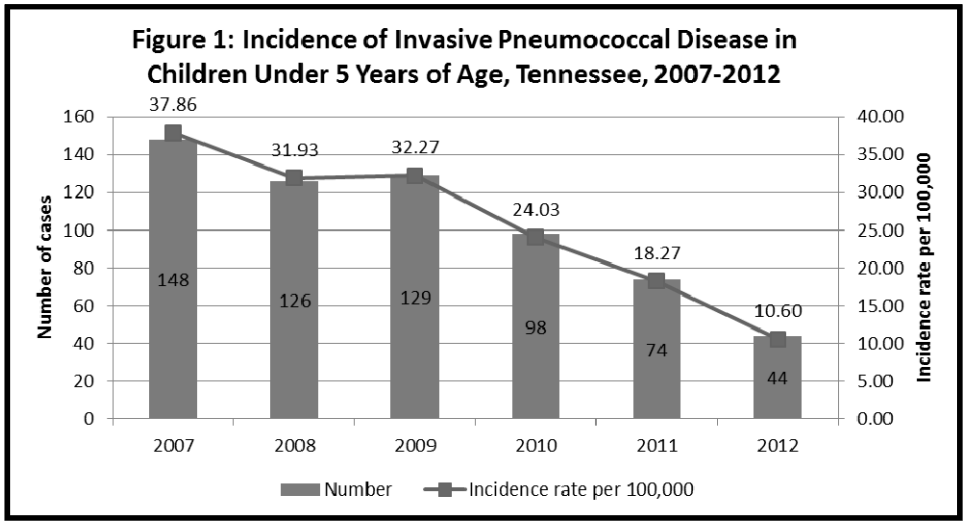
General recommendations for caregivers of MRSA infected people:

- Caregivers should wash their hands with soap and water after physical contact with the infected or colonized person and before leaving the home.
- Non-disposable towels used for drying hands after contact should be used only once. Disposable towels are preferred.
- Disposable gloves should be worn if contact with body fluids is expected and hands should be washed after removing the gloves.
- Linens should be changed and washed on a routine basis, especially if they are soiled.
- The patient's environment should be thoroughly cleaned on a routine basis, especially when soiled with body fluids.

Streptococcus pneumoniae Invasive Disease

Background

Pneumococcal infections are caused by *Streptococcus pneumoniae*, a gram-positive, catalase-negative organism commonly referred to as pneumococcus. *S. pneumoniae* is the most common cause of community-acquired pneumonia (CAP), bacterial meningitis, bacteremia, and otitis media, as well as an important cause of sinusitis, septic arthritis, osteomyelitis, peritonitis, and endocarditis and an infrequent cause of other less common diseases.



Pneumococcal infections are most common during winter and early spring months. Persons at high risk for the infection are the elderly, children under 2 years old, blacks, American Indians, Alaska Natives, children who attend daycare centers, nursing homes, and persons with underlying medical conditions (e.g., HIV infection and sickle-cell disease). Approximately 10% of all patients with invasive pneumococcal disease die as a result of their illness; however, this percentage is higher for patients with underlying medical conditions and the elderly.

Reports of drug resistant *S. pneumoniae* (DRSP) infection (including strains resistant to penicillin, extended spec-

trum cephalosporins and other drugs) have been increasing in the United States since the 1980s. With the widespread use of antimicrobials, the prevalence of resistance to each new drug class has increased. Recent trends have shown an increasing prevalence of *S. pneumoniae* with intermediate or high-level resistance to penicillin and other commonly used antibiotics. Many penicillin-resistant strains of *S. pneumoniae* are also resistant to other antimicrobials such as erythromycin, trimethoprim-sulfamethoxazole, and many of the cephalosporins.

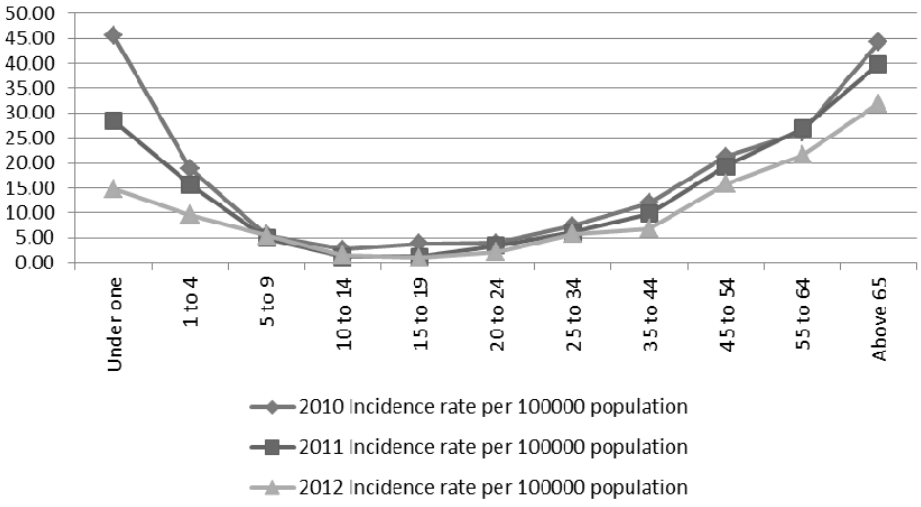
Incidence

Invasive Pneumococcal Disease (IPD) is reportable in Tennessee. The incidence rate of IPD (Figure 1) shows a declining trend in Tennessee coinciding with the introduction of routine childhood pneumococcal vaccination. The incidence rate in 2012 was 10.6 per 100,000, which is a greater than threefold reduction from 2007. When compared to the national incidence rate of 12.9 cases per 100,000 population (based on most recent data available-2011), the incidence of IPD in Tennessee is slightly lower.

Trends

In addition to the decline in IPD for all age groups in Tennessee, a decrease of IPD among high risk groups also has been observed. This includes children under five years of age and adults above sixty years of age. As indicated in Figure 2 below, the rate of infection decreased among these high risk groups from year 2010 through 2012.

Figure 2. Incidence Rate of Invasive Pneumococcal Disease Per 100,000 Population, by Age Group,Tennessee, 2010-2012



Program Activities

Prevention messages and antibiotic stewardship activities are conducted to inform public health officials, legislators, healthcare partners, and the public. Surveillance for IPD is conducted and data are used to draw a clearer picture of trends in Tennessee and to provide information for decision makers by evaluating the effectiveness of the current pneumococcal vaccine in preventing IPD.

Preventive Measures

There are no routine control measures other than recommended age-appropriate immunization. PCV13 (Prevnar) and PPV23 (Pneumovax) protect against 90% of invasive disease. See CDC's Immunization Schedule (http://www.cdc.gov/vaccines/) for specific recommendations.

C. Hepatitis

Hepatitis A

Background

Hepatitis A, caused by infection with the hepatitis A virus (HAV), has an incubation period of approximately 28 days (range: 15–50 days). HAV replicates in the liver and is shed in high concentrations in feces from 2 weeks before to 1 week after the onset of clinical illness including fever, malaise, jaundice, loss of appetite and nausea. HAV infection produces a self-limiting disease that does not result in chronic infection or chronic liver disease.

Acute liver failure from hepatitis A is rare (overall case-fatality rate: 0.5%). The risk for symptomatic infection is directly related to age, with >80% of adults having symptoms compatible with acute viral hepatitis and the majority of young children having either asymptomatic or unrecognized infection. Antibody produced in response to HAV infection persists for life and confers protection against reinfection.

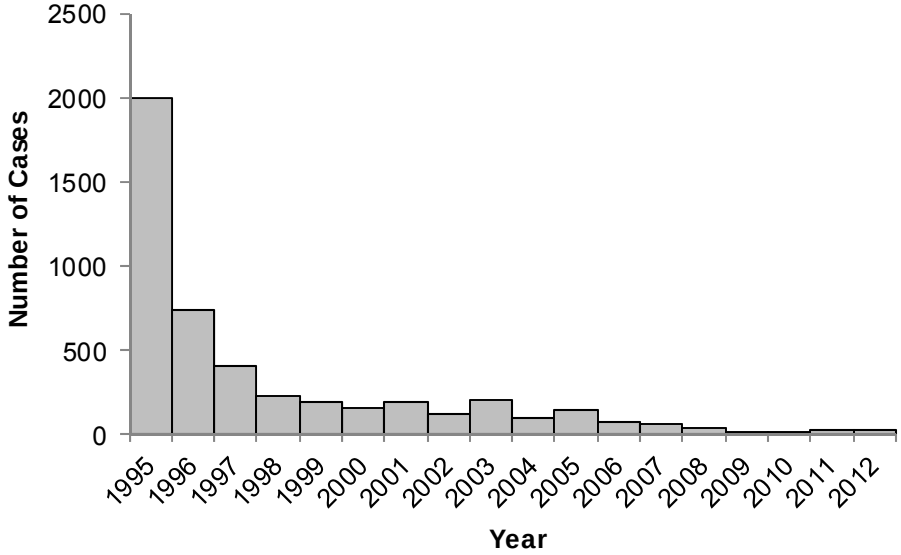
HAV infection is primarily transmitted by the fecal-oral route, by either person-to-person contact or consumption of contaminated food or water. Although viremia occurs early in infection and can persist for several weeks after onset of symptoms, bloodborne transmission of HAV is uncommon.

In the United States, nearly half of all reported hepatitis A cases have no specific risk factor identified. Among adults with identified risk factors, the majority of cases are among men who have sex with other men, persons who use illegal drugs, and international travelers.

Incidence

The **figure** shows the incidence of Acute Hepatitis A cases from 1995-2012 in Tennessee.

Figure. Acute Hepatitis A Cases, 1995-2012, Tennessee.



Trends

In Tennessee, an epidemic of acute hepatitis A was centered in Shelby County in 1995 and accounted for three quarters of the nearly 2,000 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 in Tennessee dramatically dropped over the past 10-15 years and continues to decline over time with the lowest number of cases ever reported in the state in 2010.

Program Activities

The Centers for Disease Control and Prevention (CDC) now routinely recommends that all children be vaccinated against hepatitis A between 12 and 24 months of age. In 2010, the Tennessee Department of Health implemented a requirement for all toddlers aged 18 months or older to have a single dose of hepatitis A vaccine in order to attend a child care facility. That rule also phased in a requirement for complete vaccination against hepatitis A among all children entering kindergarten, beginning in the fall of 2011.

Preventive Measures

Vaccination is the most effective means of preventing HAV transmission among persons at risk for infection. Hepatitis A vaccination is recommended for all children, for persons who are at increased risk for infection, for persons who are at increased risk for complications from hepatitis A, and for any person wishing to obtain immunity.

Because transmission of HAV during sexual activity probably occurs because of fecal-oral contact, measures typically used to prevent the transmission of other STDs (e.g., use of condoms) do not prevent HAV transmission.

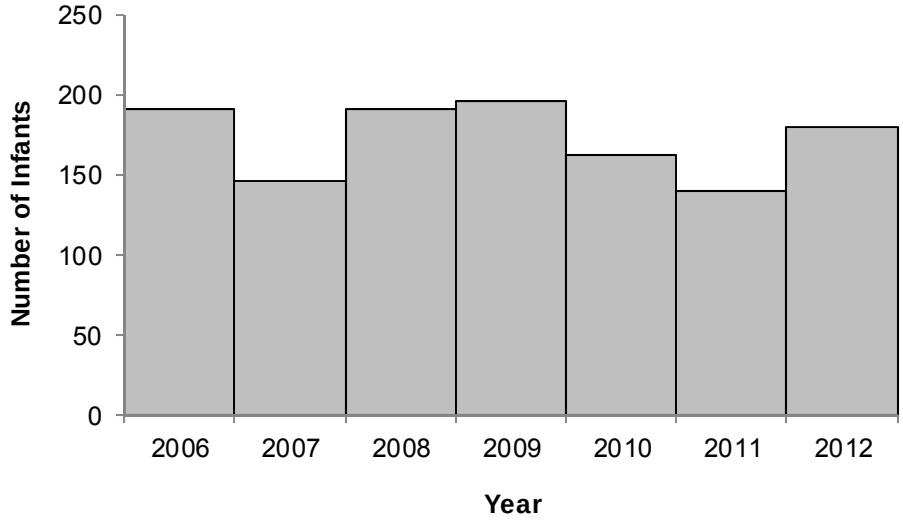
Perinatal Hepatitis B

Background
Children born to women actively infected with hepatitis B virus (HBV), as indicated by having a serologic test that indicates they are hepatitis B surface antigen (HBsAg) positive, are at high risk of becoming chronic carriers of hepatitis B virus.

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 pregnant woman with no test results available at the time of delivery is to be tested at that time. The law requires that an infant born to an HBsAg positive mother receive, in a timely manner, the appropriate treatment as recognized by the Centers for Disease Control and Prevention (CDC).

Incidence
The **figure** shows the number of infants reported as being born to an HBsAg positive mother from 2006 to 2012. Over the same time period, three infants in 2009 and one in 2010 born to HBsAg positive mothers eventually tested HBsAg positive. Based upon the population of the state, the CDC estimates that approximately 300 women actively infected with hepatitis B virus give birth each year in Tennessee. For this reason, the increase in infants identified in 2012 is interpreted as an improvement in detection, rather than an increase in the actual number of infants at risk.

Figure. Reported Number of Infants Born to Hepatitis B Surface Antigen Positive Women, 2006-2012, Tennessee.



Trends
Nearly 90% of the global population lives in areas with high or moderate levels of chronic HBV infection. In these areas (China, Southeast Asia, Africa), the lifetime risk of infection exceeds 60% with most infections acquired at birth and are asymptomatic. In the U.S., Western Europe and Australia, infection rates are low in groups where routine immunization has been implemented.

Program Activities
The Tennessee Department of Health (TDH) receives the test results and counsels all pregnant women who are reported to the Department as HBsAg positive. TDH also identifies and vaccinates their at-risk contacts, and ensures that the delivering hospital has a record of the mother's status and that it has hepatitis B immune globulin (HBIG) and vaccine available to administer to the infant at delivery. Following delivery, a TDH regional coordinator follows the infant to ensure it receives all three doses of HBV vaccine on time and that the infant receives post-vaccination serologic testing at an appropriate age, in order to confirm that the infant was not infected and that the vaccine has produced protective immunity.

Preventive Measures
The risk of perinatal infection of an exposed infant is reduced by 90-95% if the infant is administered hepatitis B immune globulin and hepatitis B vaccine within 12 hours of life, and if that infant then goes on to complete the vaccine series on time.

Acute Hepatitis B Virus Infection

Background
Hepatitis B is caused by an infection with the hepatitis B virus (HBV). HBV is transmitted by percutaneous or mucus membrane exposure to infectious blood or body fluids. HBV can be transmitted to an infant during childbirth by an infected mother. The virus is found in highest concentrations in blood and in lower concentrations in other body fluids (e.g., semen, vaginal secretions and wound exudates).

Symptoms begin an average of 90 days (60-150 days) after exposure to HBV. HBV infection is an established cause of acute and chronic hepatitis and cirrhosis. Acute infection can, but does not always, lead to chronic infection. Approximately 90% of infected infants and 25%-50% of infected children aged 1-5 years become chronically infected in contrast to 5% of adults. In 2012, the CDC estimated 2 billion persons worldwide have been infected with HBV, and more than 350 million persons have chronic, lifelong infections.

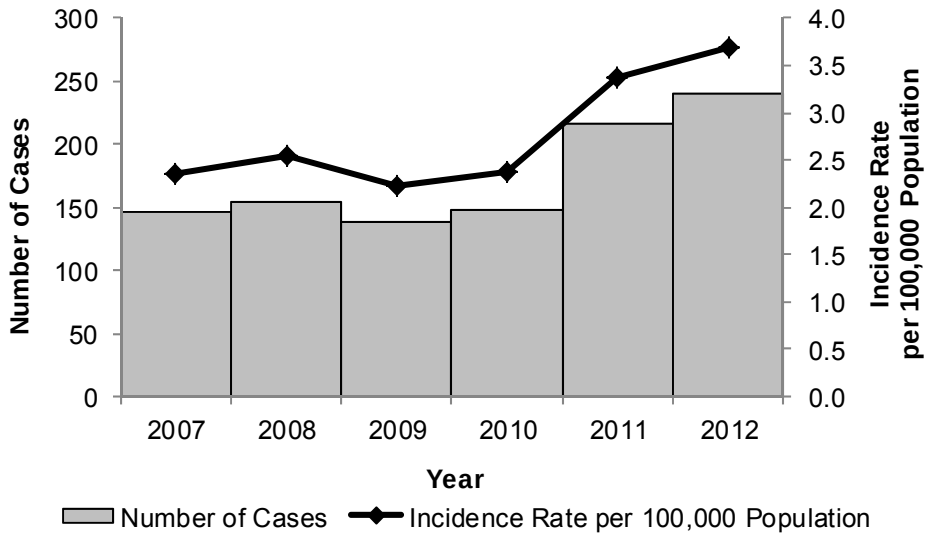
HBV can survive outside the body for at least 7 days and is still capable of causing infection. Any blood spills – including dried blood, which can still be infectious – should be cleaned using 1:10 dilution of one part household bleach to 10 parts of water for disinfecting the area. Gloves should be used when cleaning up any blood spills.

In Tennessee, population-based surveillance for acute viral hepatitis B is performed statewide. Acute viral hepatitis B infection is reportable to the Tennessee Department of Health (TDH) within one week of identifying a case. Surveillance is conducted to facilitate prevention and control activities (including identification of persons who should receive post-exposure prophylaxis), detect outbreaks, define disease trends and risk factors, and evaluate effectiveness of public health interventions.

Incidence

In Tennessee, the number of reported acute HBV cases has increased each year since 2010 (**Figure 1**). In 2011, 192 new cases of acute HBV infection were reported with an incidence rate of 3.00/100,000 population. This is the highest rate for Tennessee since 2005 and the third highest in the nation.

Figure 1. Acute Hepatitis B Cases and Incidence, 2007-2012, Tennessee.



The incidence of acute viral hepatitis B is generally higher in rural Tennessee than in metropolitan communities. During the last three years, highest incidence rates were observed in East, North East, and Upper Cumberland public health regions, as well as Knox and Shelby Counties (**Figure 2**).

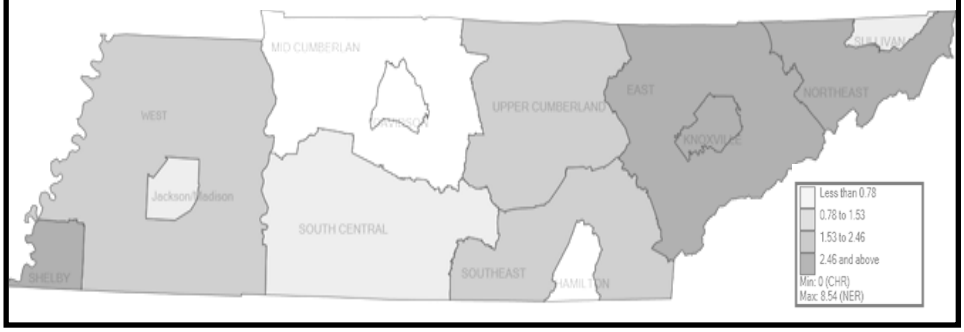
Trends

Individuals who have not received the hepatitis B vaccine are at highest risk for acute hepatitis B virus (HBV) infection. Risk factors identified in Tennessee for the transmission of hepatitis B virus infection includes history of sexually transmitted diseases, multiple sexual partners, intravenous drug use and use of other street drugs, tattooing in unregulated centers and history of incarceration. Persons with diabetes are also at increased risk of HBV infection.

Program Activities

Public health authorities in Tennessee conduct surveillance, investigation, and control activities for acute HBV infections. Individuals who are identified as at-risk (household and sexual contacts) during public health investigations are offered Hepatitis B vaccination and counseled on prevention of disease transmission. Vaccination and prevention messaging are offered in public health clinics across the state. Routine screening of all pregnant women for HBsAg and immunoprophylaxis of infants born to HBsAg positive mothers is recom-

Figure 2. Incidence Rates of Acute Hepatitis B Infection (per 100,000 persons), 2012, .



mended to prevent perinatal transmission. Infants born to infected mothers are enrolled in the Perinatal Hepatitis B Prevention Program to ensure appropriate follow-up.

In areas with high incidence of HBV infection, additional efforts are underway to decrease the number of new HBV infections. This includes a HBV vaccination pilot in correctional settings and public health clinics offering STD services. Prevention education campaigns are underway for at-risk populations, and correctional facilities, public health and medical clinic staff.

Preventive Measures

The best method for prevention is vaccination. This includes all children under age 19, along with other at-risk groups (see CDC's recommendations regarding hepatitis B vaccine at http://www.cdc.gov/vaccines/vpd-vac/hepb). To prevent perinatal infections, screening of pregnant women for HBV and, if positive, vaccination and immunoprophylaxis of the infant are necessary.

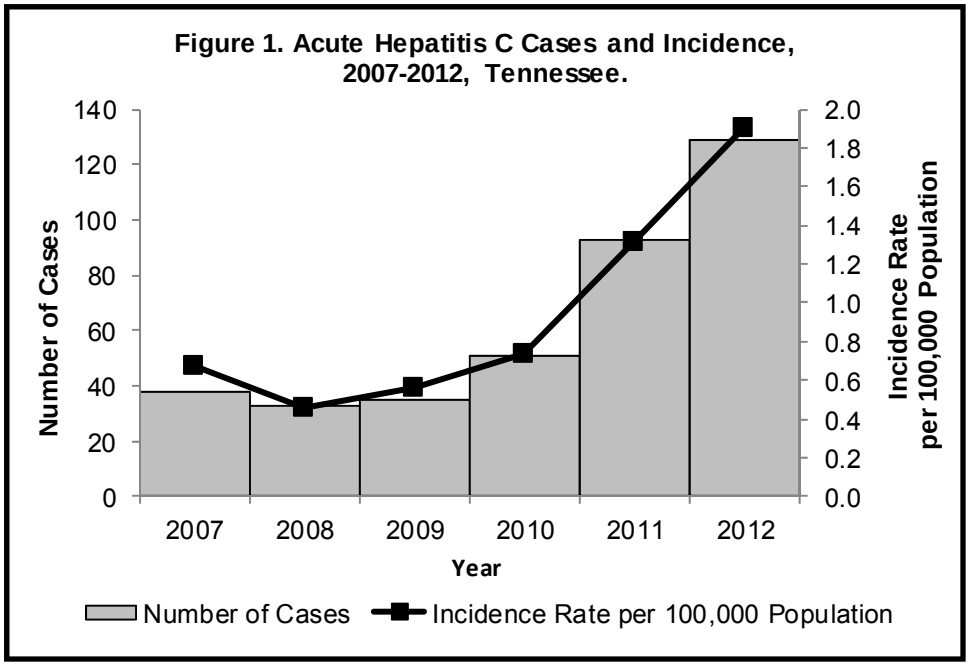
Other preventive measures include:

- use of condoms to prevent sexual transmission;
- not sharing personal items such as razors, diabetic lancets and glucose meters;
- stop drug use or use clean needles and syringes and do not share paraphernalia;
- offer vaccination to at-risk individuals identified through public health investigations (household and sexual contacts of an infected person);
- encourage vaccination of persons at risk for occupational exposure (medical, dental, EMS, police, fire, laboratory professionals, etc.).

Hepatitis C Virus

Background

Hepatitis C virus (HCV) infection is the most common chronic bloodborne infection in the United States; approximately 3.2 million persons are chronically infected. Sixty to 70% of persons newly infected with HCV typically are asymptomatic or have a mild clinical illness. Chronic HCV infection develops in 70%–85% of HCV-infected persons; 60%–70% of chronically infected persons have evidence of active liver disease. The majority of infected persons might not be aware of their infection because they are not clinically ill. However, infected persons serve as a source of transmission to others and are at risk for chronic liver disease or other HCV-related chronic diseases decades after infection.



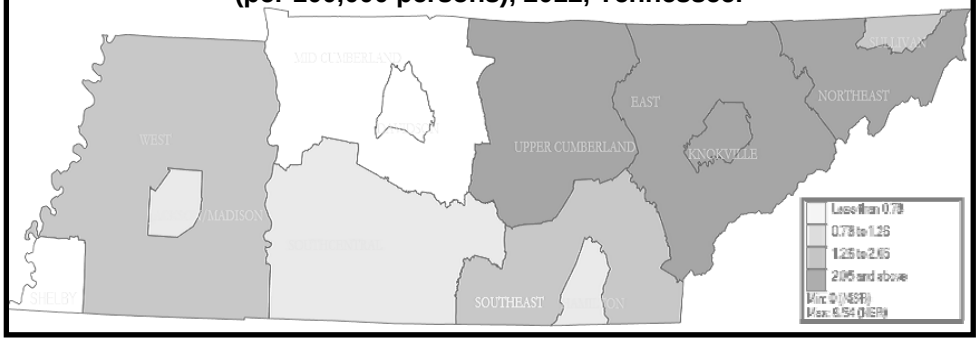
HCV is most efficiently transmitted through large or repeated percutaneous exposure to infected blood (e.g., through transfusion of blood from unscreened donors or through use of injecting drugs). Infrequently, occupational, perinatal, and sexual exposures also can result in transmission of HCV. Additional risk factors include long-term hemodialysis, being born to an HCV-infected mother, incarceration, intranasal drug use, getting a tattoo at an unregulated facility, and other percutaneous exposures (such as in health care workers or from having surgery before the implementation of universal precautions).

In the United States HCV is a leading cause of complications from chronic liver disease. The most important risk factor for HCV infection is past or current injection drug use, with most studies reporting a prevalence of 50% or more. Hepatitis C–related end-stage liver disease is the most common indication for liver transplants among U.S. adults, accounting for more than 30% of cases. In 2012 the U.S. Preventive Services Task Force (USPSTF) revised their recommendations to screening for hepatitis C virus (HCV) infection in persons at high risk for infection and offering 1-time screening for HCV infection to adults born between 1945 and 1965.

In Tennessee, population-based surveillance for acute viral hepatitis C is performed statewide.

Acute hepatitis C infection is reportable as a category 2 disease that requires written reporting within 1 week. Chronic hepatitis C is not reportable. Surveillance is conducted to identify disease trends and risk factors for directing and evaluating prevention activities.

Figure 2: Acute Hepatitis C Infection Rate (per 100,000 persons), 2012, Tennessee.



Incidence
The incidence rate of acute hepatitis C in Tennessee has increased in recent years. In 2005, the incidence rate of acute hepatitis C was 0.45/100,000 population. In 2011, the rate spiked to 1.3/100,000, which was the second highest in the nation, as well as the highest incidence rate in the last seven years in Tennessee **(Figure 1)**.

Trends
In 2012, the most common risk factors identified among the reported cases of acute hepatitis C infection includes tattooing (14%), street drug injection (29%) and use of street drugs (35%). Persons 21 to 50 years of age constitute more than 80% of all cases reported in Tennessee in 2012.

Over the last three years, incidence rates of acute hepatitis C are highest in eastern Tennessee. In 2012, Northeast, East, and Knox public health regions had incidence rates of 8.5, 5.5 and 3.29 per 100,000 population, respectively **(Figure 2)**.

Program Activities
Current viral hepatitis prevention infrastructures in Tennessee vary greatly depending on the clinical settings and geographic areas. The 14 Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) Centers of Excellence (COEs) across the state provide hepatitis B and C testing as part of routine care, along with hepatitis B vaccination, prevention messaging, and referral to care as appropriate. Public health staff across the state document morbidity and risk factors, refer infected patients to the healthcare system, provide education on preventing transmission, and encourage vaccination for other forms of viral hepatitis to prevent co-infections.

Preventive Measures
There is no vaccine available for prevention of hepatitis C. Measures to prevent exposure to the virus include:

- use of condoms to prevent sexual transmission;
- not sharing personal items such as razors, toothbrushes, diabetic lancets and glucose meters;
- stop drug use or use clean needles and syringes and do not share paraphernalia;
- offer vaccination to at-risk individuals identified through public health investigations (household and sexual contacts of an infected person);
- encourage vaccination of persons at risk for occupational exposure (medical, dental, EMS, police, fire, laboratory professionals, etc.).

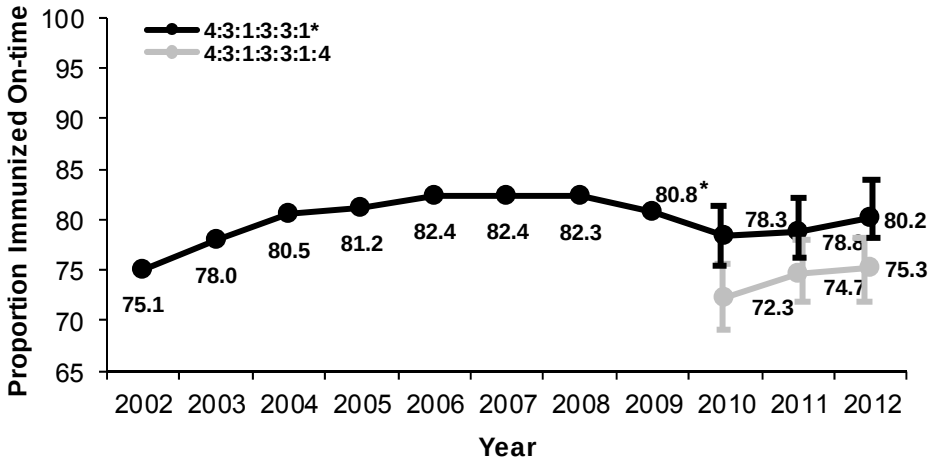
D. Vaccine-Preventable Diseases

Vaccine Preventable Diseases

Programmatic Overview

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 (VPDs). The Tennessee Immunization Program (TIP) 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 influenzae type b (Hib), hepatitis B, and varicella. In recent years, the incidence of these diseases declined markedly in Tennessee. This is largely due to the widespread use of vaccines against these diseases and institutional requirements that ensure that children and adolescents attending day care and schools are adequately protected. With the exception of pertussis, a disease to which neither vaccine nor natural disease results in lifelong immunity, and hepatitis B, a disease against which most adults are not vaccinated, the occurrence of these diseases is very low.

Figure 1. 2012 Immunization Status Survey of 24-Month-Old Children - 4:3:1:3:3:1* and 4:3:1:3:3:1:4 Immunization Level Trends, Tennessee, 2002-2012.



* 2009 measures series containing only 2 doses of HIB vaccine (4:3:1:2:3:1) due to vaccine shortage

Activities

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 daycare centers that are licensed by the Department of Human Services. School and daycare surveys are conducted to determine compliance with state school and daycare immunization requirements.

The survey of 24-month-old children (http://health.state.tn.us/ceds/reports.htm) is the most valuable because it assesses on-time immunization, a marker of optimal protective benefit from vaccination. This survey not only establishes estimates of immunization levels in Tennessee, but it measures regional differences in those levels and identifies certain characteristics of those who do not complete their immunization series on time, thus characterizing a target population on which to focus to further improve immunization levels.

For the purposes of the survey of 24-month-old children, complete immunization is defined as having received four doses of diphtheria-tetanus-pertussis (DTaP) vaccine, three doses of polio vaccine, one dose of measles-mumps-rubella (MMR) vaccine, three doses of Hib vaccine, three doses of hepatitis B vaccine (HBV), one dose of varicella vaccine (VZV) and 4 doses of pneumococcal conjugate vaccine (PCV). Together, these are known as the "4:3:1:3:3:1:4" immunization series. Prior surveys have defined complete immunization of all the vaccines listed with the exception of PCV among children 24 months of age, known as "4:3:1:3:3:1". **Figure 1** compares survey results since 2002 to the more detailed results of the 2010-2012 surveys.

The on-time completion rates of two doses of hepatitis A vaccine (HAV), at least two doses of rotavirus vaccine (RTV) and at least two doses of influenza vaccine (Flu) are also reported in the survey of 24-month-old children.

The 2012 survey identified certain characteristics of children at increased risk of not completing immunizations. Principally, those are:

1. Beginning immunizations at older than 120 days of life;
2. Having two or more living siblings at birth; and
3. Being identified as black race, specifically for influenza vaccine.

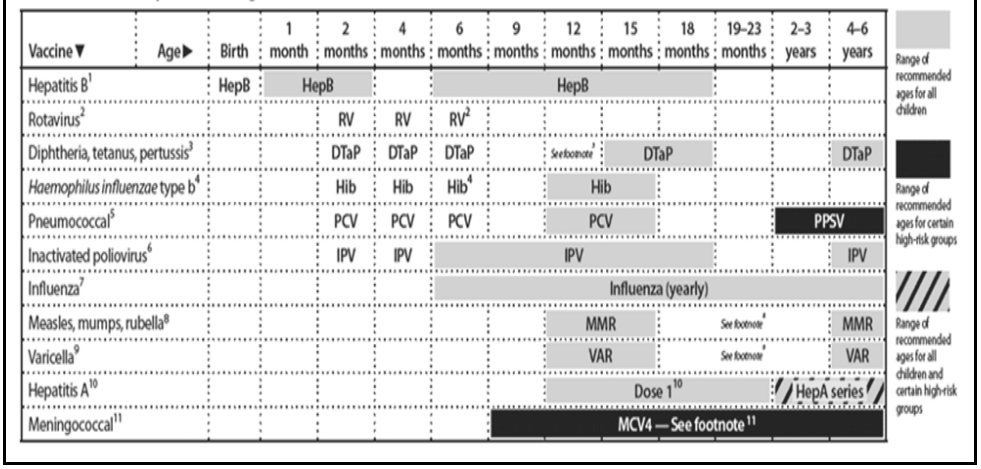
The key findings of the 2012 Immunization Status Survey of 24 Month Old Children include:

1. In the second year of measurement, the hepatitis B birth dose

rate improved significantly from 62.7% to 73.5%, a major step toward the Healthy People 2020 target of 85%. Regional rates vary, but several regions made significant improvements in coverage from 2011 to 2012. This may reflect the implementation of stricter birth dose policies in delivery hospitals and wider acceptance of this routine recommendation among caregivers of neonates.

2. Influenza vaccine 2-dose coverage remains low and unchanged from the previous year at 44.2%. Although the gap between the state average and the public health regions in the western third of the state has narrowed over time, coverage rates in the three regions in the western part of the state remain significantly lower than the statewide coverage rate.
3. The significant racial disparity in influenza vaccine coverage between black and white children continues (32.3% vs. 46.2%). There were no significant racial disparities in the aggregate 4:3:1:3:3:1:4 series rates.
4. Completion of the DTaP and pneumococcal four-dose series continues to be the primary barrier in Tennessee in achieving the Health People 2020 goal of 80% coverage for the 4:3:1:3:3:1:4 series for all children.
5. Children enrolled in TennCare and/or WIC had immunization rates for the 4:3:1:3:3:1:4 series equivalent to children never enrolled in these programs. For most individual vaccines (polio, MMR, varicella, HBV, and HAV), WIC enrollees had a significantly higher percentage of on-time coverage than children who were not enrolled in WIC; however, they had lower influenza coverage. Those receiving TennCare benefits also had lower influenza coverage rates than those not enrolled in TennCare.
6. Rotavirus vaccine coverage continues to exceed the national Healthy People 2020 goal of 80% coverage for the second year in a row. This is a notable contrast to the influenza vaccine coverage, which has been recommended for about the same period of time.

Figure 2. Recommended immunization schedule for persons aged 0 through 6 years – United States, 2012, CDC National Center for Immunization and Respiratory Diseases.



Immunizations are not just for infants and toddlers. There are vaccines designed and recommended to help protect people at every age. Pre-teens and older teens should receive a booster doses of Tdap to protect them against tetanus, diphtheria and pertussis. This is also the time to vaccinate them against meningococcal meningitis and human papillomavirus (HPV). The 2012 Immunization Schedule for children ages 0-6 years is presented at the end of this section and, along with immunization schedules for adolescents and adults, can be accessed at http://www.cdc.gov/vaccines/schedules/index.html **(Figure 2)**.

The website of the Centers for Disease Control and Prevention's National Center for Immunization and Respiratory Diseases (www.cdc.gov/vaccines) contains valuable information for both clinicians and the lay public about vaccines and vaccine-preventable diseases.

Pertussis

Background

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. Ill persons are infectious up to 21 days after symptom onset. Coughing attacks may last for several weeks and convalescence may last for months.

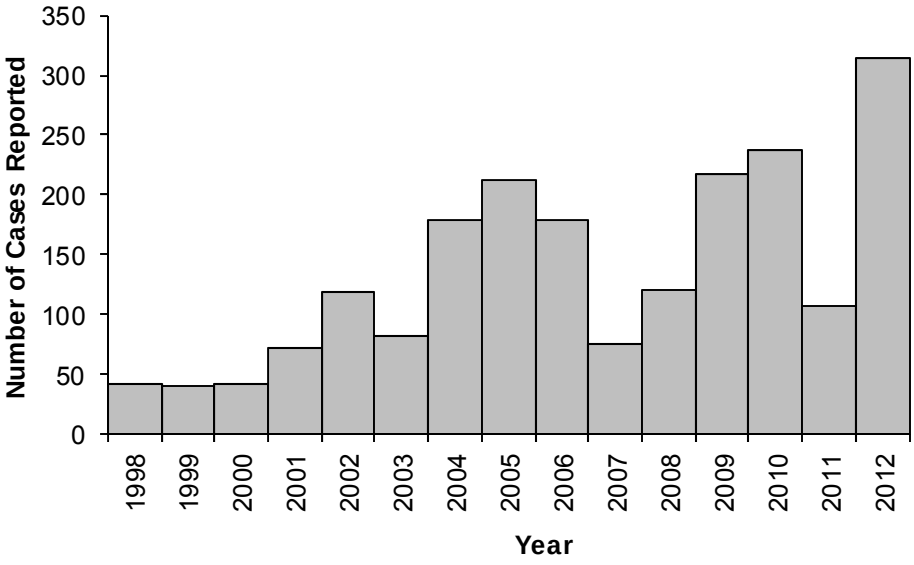
Infants are at greatest risk for complications or death from pertussis, but the disease causes significant illness in adolescents and adults, who account for more than half of all reported cases and are often the source of illness in infants. The most common complica-

tion 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 vaccine-preventable diseases in the United States because neither infection nor vaccination produces long-lasting immunity to disease.

Incidence

The **figure** shows the number of pertussis cases from 1998 to 2012 in Tennessee.

Figure. Number of Cases of Pertussis Reported, Tennessee, 1998-2012.



Trends

Recent 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.

The number laboratory-confirmed and probable (e.g. serology-based or clinically compatible) cases of pertussis identified in Tennessee have fluctuated from year-to-year but overall have trended upward despite high levels of infant immunization. National data suggests newer vaccines are effective in the short term but wane more quickly than older vaccines. With greater awareness of the disease among older children and adults and better testing, reported cases are likely to continue to increase.

Preventive Measures

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") helps boost waning immunity following childhood immunization. The vaccine is recommended for all children at age 11 or 12 and as a single dose for all adults. Effective July 2010, documentation of a Tdap booster dose is required for all children entering 7th grade in Tennessee.

Tetanus

Background

Tetanus is an acute, often fatal disease caused by an exotoxin produced by the bacterium *Clostridium tetani*. It is characterized by generalized rigidity and convulsive spasms of skeletal muscles. The muscle stiffness usually involves the jaw and neck (hence the common name "lockjaw") and then becomes generalized.

C. tetani produces spores which are widely distributed in soil and in the intestines and feces of horses, sheep, cattle, dogs, cats, rats, guinea pigs and chickens. Tetanus spores usually enter the body through a wound. However, tetanus is not communicable from one person to another. Infection is the result of direct inoculation of the body with the spores. Almost all cases of tetanus are in persons who were either never vaccinated or who had completed a primary series of vaccine, but failed to receive a booster in the 10 years preceding the infection.

Complications of tetanus include the following: laryngospasms; fractures of the long bones; hyperactivity of the autonomic nervous system; secondary infections, such as sepsis, pneumonia, decubitus ulcers (due to long hospitalizations, in-dwelling catheters, etc.) and aspiration pneumonias. The fatality rate for tetanus is approximately 11%. The mortality rate is highest in those ≥60 years of age (18%) and unvaccinated persons (22%). In about 20% of cases, no other pathology can be identified and death is attributed to the direct effect of the toxin.

Incidence
In Tennessee, tetanus is a rare disease; a total of 4 tetanus cases have been reported since 2003.

Preventive Measures
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.

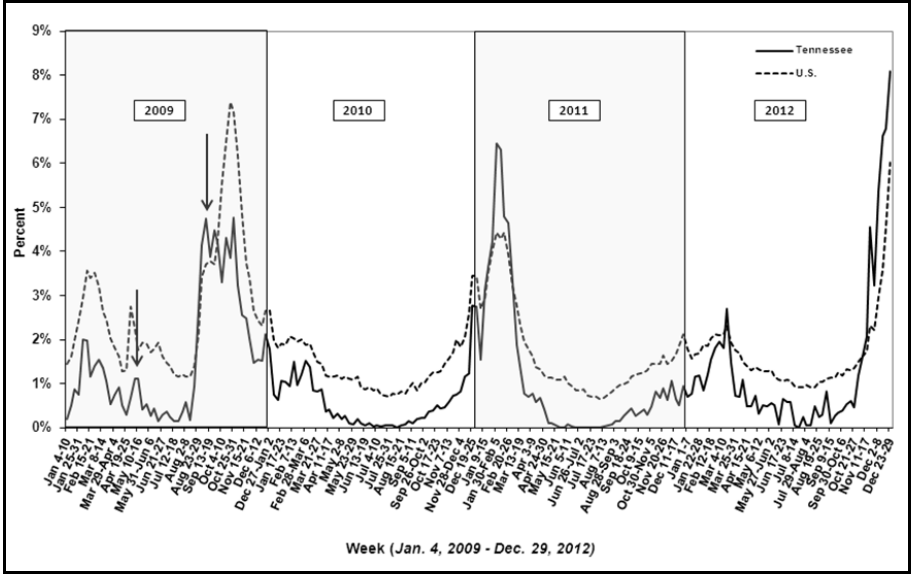
Influenza

Background
Influenza virus causes seasonal epidemics of disease annually, usually 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.

Trends
The **figure** shows the percentage of outpatients with influenza-like illness (ILI) reported weekly from January 2009, just prior to the identification of the 2009 pandemic A(H1N1) influenza strain, through December 2012. 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 (red arrows in figure).

Figure. Percentage of Outpatient Visits Reported by the U.S. and Tennessee Outpatient Influenza-like Illness Surveillance Network (ILINet) as Influenza-like Illness, January 2009-December 2012.



Program Activities
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 outpatients seen each week with influenza-like-illness, defined as fever with cough or sore throat. SPN participants also submit specimens for testing at the State Public Health Laboratory from ILI patients in order to permit further characterization of circulating influenza strains as well as for a number of other respiratory viruses. Although non-specific, the number of persons with ILI rises predictably when influenza virus is circulating in the community.

Since the influenza pandemic in 2009, the Tennessee Emerging Infections Program has worked with 20 middle Tennessee hospitals to perform ILI surveillance among hospitalized patients. Specimens sent by these facilities are tested alongside those collected through the SPN and weekly surveillance reports are shared with participating providers and posted at http://health.state.tn.us/TNflu_report_archive.htm.

Providers interested in contributing to or learning more about the Sentinel Provider Network should contact the Tennessee Immunization Program.

Preventive Measures
Annual vaccination each fall is the best way to prevent seasonal influenza

and is recommended for every person aged 6 months and older. It is most important for persons at higher risk of serious illness and the people who care for them; these groups include the elderly, small children, pregnant women, persons with chronic illnesses, their families and all healthcare providers.

E. Vectorborne and Zoonotic Diseases

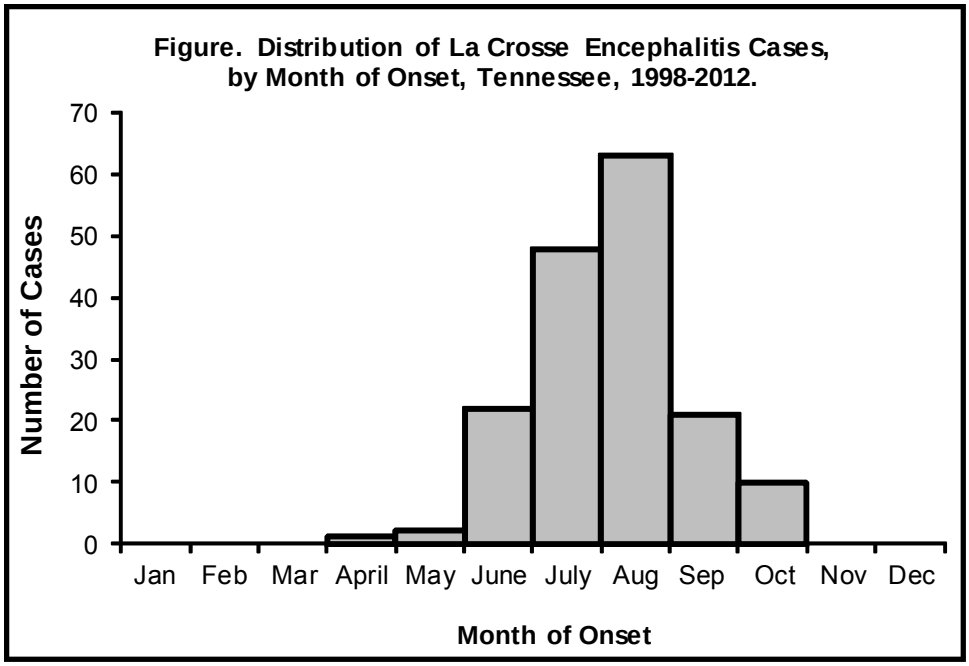
Arboviral Diseases

LaCrosse Encephalitis (LAC)

Background

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

Figure. Distribution of La Crosse Encephalitis Cases, by Month of Onset, Tennessee, 1998-2012.



Incidence

In 2002, 164 cases of La Crosse encephalitis were reported from 16 states in the United States, representing the most reported to CDC in any year since 1964. Due to the similarity of symptoms between LAC and West Nile virus (WNV), this increase in cases is likely due to improved WNV human case surveillance in the United States (MMWR 2003, 51:53). In Tennessee, from 1998-2012, there have been 168 cases with a median of 11 cases per year (average: 11; range: 2-19) reported per year (Table 1). Incidence rates have ranged from 0.02-0.06 per 100,000 population in the United States (1998-2012) and 0.03-0.33 per 100,000 population in Tennessee (1998-2012). Since the disease is endemic in the eastern half of the United States, the incidence rates for the TN population will be higher than the incidence rates of the U.S. population. The incidence rates in TN 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 in Tennessee compared to other years. In Tennessee, the disease primarily occurs from late May through October with peak transmission in August (**Figure**).

Trends

Traditionally, *Ochlerotatus triseriatus* (eastern treehole mosquito) is the primary vector of LAC but in recent years *Aedes albopictus* (Asian tiger mosquito) have been associated with LAC encephalitis cases in eastern Tennessee. The dramatic increase in LAC cases in TN since 1996 has coincided with the arrival of *Ae. albopictus* in the eastern TN region suggesting that this mosquito may become an important accessory vector potentially increasing the number of human cases in endemic foci or expanding the range of the disease.

La Crosse virus can result in mild to severe infections with fatalities rare (CFR <1%) and the ratio of inapparent infection to apparent infections ranges from 26:1 to over 1500:1. The majority of cases (93%) occur in children <15 years of age although adult cases are not uncommon. Although deaths are rarely associated with this disease, Tennessee reported a death of a child in the 1-4 year old age group in 2003, and a death of a child in the 5-14 year old age group in 2012.

Program Activities

La Crosse infections should be considered in patients (particularly children) with fever and signs or symptoms of central nervous system infection (aseptic meningitis or encephalitis) presenting during summer months in Tennessee. Treatment is supportive. The diagnosis can be confirmed by demonstrating a four-fold or greater change in serum antibody titer between acute and convalescent specimens, or enzyme immunoassay anti-

body capture in cerebral spinal fluid (CSF) or serum.

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

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

West Nile Virus/Encephalitis

Background
The natural transmission cycle of West Nile virus (WNV) involves birds and bird feeding mosquitoes. When the viral load builds in the bird population, as the summer progresses there is an increased risk that bird/mammalian (opportunistic mosquitoes) feeding mosquitoes will come in contact with the virus and transmit the virus to the human and equine population. Humans and horses are referred to as dead-end hosts because they do not circulate enough infectious units in the blood system to reinfect a subsequent feeding mosquito.

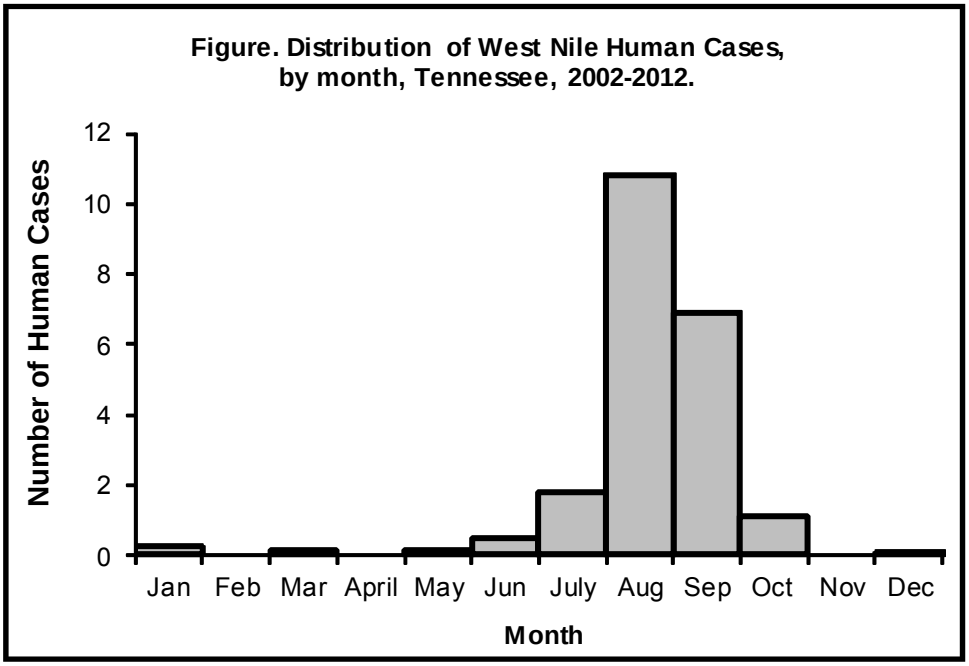
Incidence
The first West Nile horse case occurred in 2001 (1 case) and then in 2002 and 2003 there were 141 and 103 horse cases, respectively. In 2004 there were 17 horse cases that were scattered throughout the state. From 2005-2012 there were 3-8 horse cases annually. This difference is most likely due to increase in awareness of the need for vaccinating horses rather than a reduction of risk in 2004-2012.

The incidence rate of West Nile virus in TN (0.97 per 100,000 population) and the U.S. (1.06 per 100,000 population) were comparable during 2002, the largest outbreak year in TN. Since 2002, infection rates in TN have been going down and have always been lower than the national average infection rate, with the exception of 2011. In 2011, TN had an infection rate of 0.28 compared to 0.23 for the U.S. From 2003 to 20012, the rate of disease in various age groups has followed a pattern of progressively increasing such that the highest rates are usually seen in people 65 years of age and older. About 40% t of the cases in 2004-12 were in people over the age of 65. About 80 % of cases were in people over 40. In 2010, 2 (50%) cases were neuroinvasive compared to 2 (50%) with WN fever. In 2011, 16 cases (89%) had neuroinvasive WN virus and 2(11%) had WN fever. In 2012, 19 cases (58%) were neuroinvasive compared to 14 (42%) with WN fever. In cases from 2004-12, almost 30% of cases occurred in African Americans and the rest in whites.

Trends
Tennessee reported 4 human cases in 2010, 18 cases in 2011, and 33 cases in 2012. Although cases have gone down since 2002 (56 cases) and 2003 (26 cases), in 2012 there were large outbreaks of WNV both nationally and in Tennessee. There were 5,674 cases in the U.S. and 33 cases in TN. Cases are found throughout the state but are mainly focused in Shelby County with 2 (50%) cases in 2010, 11 (61%) cases in 2011, and 15 (45%) cases in 2012. The epidemic curve for human cases occurs from late July through early October with peaks in August and September, which coincides with the primary mosquito vector activity **(Figure)**.

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

Preventive Measures
Prevention efforts should be targeted



to populations at highest risk of severe sequelae. Individuals can reduce their chances of acquiring West Nile virus by taking basic precautions which include personal protective measures such as wearing insect repellents when in mosquito habitats and wearing long pants and sleeves that will provide a physical barrier against mosquitos. Eliminate unwanted containers (tires, trash) or turn containers over as to not collect water (wheelbarrows, kiddie pools) and properly maintain wanted water sources (bird baths, ornamental ponds).

Malaria

Background

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

Incidence

From 1995 to 2012, there have been 245 cases of malaria reported in Tennessee. None of these cases are thought to have been acquired locally but rather have been imported cases, i.e. United States natives traveling to malaria endemic regions or non-natives coming from these regions to the U.S. Although 40 counties have reported cases, most of these have been from Davidson (27%) and Shelby (17%) counties, which have large non-native and native populations that are more likely to travel abroad. Tennessee averages about 13 cases of malaria per year (Table 1), which is comparable to other vector-borne diseases in the state such as La Crosse and West Nile encephalitis. All age groups report malaria in Tennessee and all are susceptible when traveling since, without much exposure in the U.S., we have a very susceptible population. In the U.S. there have been 25,552 cases of malaria from 1995-2012, almost 1% of these from Tennessee. Of the approximately 1,300 cases of malaria per year diagnosed in the U.S., about 73% are from U.S. nationals and 27% are foreign-born. Almost 70% of all U.S. reported malaria cases have a travel history to continental Africa. Between 1957 and 2011, in the United States, 63 outbreaks of locally transmitted mosquito-borne malaria have occurred; in such outbreaks, local mosquitoes become infected by biting persons carrying malaria parasites (acquired in endemic areas) and then transmit malaria to local residents.

Trends

Even though malaria has been eradicated from the U.S., it continues to be a public health concern due the potential of re-introduction. Of the species of Anopheles mosquitoes found in the United States, the three species that were responsible for malaria transmission prior to elimination (Anopheles quadrimaculatus in the east, An. freeborni in the west, and An. albimanus in the Caribbean) are still widely prevalent; thus there is a constant risk that malaria could be reintroduced in the United States. "Airport" malaria refers to malaria caused by infected mosquitoes that are transported rapidly by aircraft from a malaria-endemic country to a non-endemic country. If the local conditions allow their survival, they can bite local residents who can thus acquire malaria without having traveled abroad. Even without established transmission zones of malaria, we still see large numbers of cases annually. Travelers should take the appropriate precautions when traveling to areas with malaria.

Program Activities

The State of Tennessee requires all physicians, hospitals, laboratories, healthcare providers, and other persons knowing of or suspecting malaria to report the case to the health department. The Department of Health then investigates further and uses the na-

tional case definition to determine the case classification for notification to the Centers for Disease Control and Prevention (CDC).

Preventive Measures

The CDC recommends the following for preventing malaria:

- Visit your health care provider 4-6 weeks before foreign travel for any necessary vaccinations, as well as a prescription for an antimalarial drug, if needed. (There are no vaccines against malaria).
- Take your antimalarial drug exactly on schedule without missing doses.
- Wear insect repellent to prevent mosquito and other insect bites. Your insect repellent should contain DEET as its active ingredient. To prevent malaria, wear insect repellent if out of doors between dusk and dawn when the mosquito that transmits malaria is biting.
- Wear long pants and long-sleeved clothing.

Tickborne Diseases

Ehrlichiosis

Background

Ehrlichiosis and Anaplasmosis are acute febrile illnesses caused by *Ehrlichia spp.* and *Anaplasma phagocytophilum,* respectively. The bacteria are transmitted to humans through the bites of infected ticks. *Ehrlichia chaffeensis* and *Ehrlichia ewingii* are both spread by lone star ticks (*Amblyomma americanum*), a commonly found tick in Tennessee. *Anaplasma phagocytophilum* is spread by the black-legged or deer tick (*Ixodes scapularis*). Prior to 2008, ehrlichiosis and anaplasmosis were reported collectively as human monocytic ehrlichiosis and human granulocytic ehrlichiosis. Most cases of ehrlichiosis and anaplasmosis are typically reported between the late spring and summer (May through August).

Incidence

Reports of anaplasmosis and ehrlichiosis have been stable over the past three years. The **table** shows the number of cases and rate per 100,000 population for *Ehrlichia chaffeensis*, *Ehrlichia ewingii*, *Anaplasma phagocytophilum*, and investigations where the specific agent could not be determined. One reported death due to *Ehrlichia chaffeensis* was confirmed in 2012.

Preventive Measures

The best way to prevent any tickborne illnesses is to avoid direct contact with ticks by taking preventative measures. Repellants with at least 20% or more DEET should be used on exposed skin, and will work for several hours repelling ticks and mosquitos. Using commercially available permethrin treatment on clothing or buying pretreated clothing is also effective for repelling ticks and mosquitos.

A thorough check for ticks should be done after spending time outdoors in potential tick habitats. Attached ticks should be removed by gripping the head of the tick with tweezers as close to the skin as possible and pulling steadily upwards in a smooth motion. After removing the tick, the wound should then be disinfected. If a fever begins to develop within two weeks of being bitten by a tick, see a healthcare provider immediately and inform them of the recent tick bite.

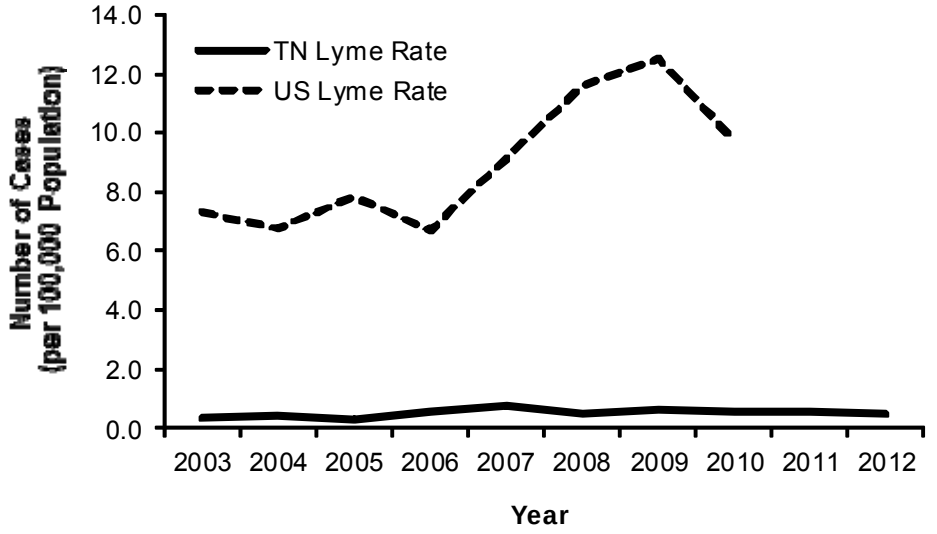
Table 1. Number of Cases and Incidence Rates (per 100,000 Population) of Ehrlichiosis and Anaplasmosis, Tennessee, 2008-2012.

	2008		2009		2010		2011		2012	
	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
Anaplasma phagocytophilum	0	0.0	1	0.0	11	0.2	10	0.2	13	0.2
Ehrlichia chaffeensis	72	1.2	71	1.1	58	0.9	54	0.8	61	1.0
Ehrlichia ewingii	0	0.0	0	0.0	1	0.0	1	0.0	3	0.0
Ehrlichiosis/Anplasmosis, undetermined	14	0.2	16	0.3	7	0.1	14	0.2	6	0.1

Lyme Disease

Background
Lyme disease is caused by *Borrelia burgdorferi*, a spirochetal bacterium. The disease is transmitted to humans by the bite of an infected tick. In the east, the primary vector of Lyme disease is the black-legged or deer tick (*Ixodes scapularis*). Most cases of Lyme disease occur in the New England and eastern mid-Atlantic states, although northern midwest states such as Wisconsin and Minnesota also report high incidences. Early Lyme disease typically involves the appearance of a "bullseye" rash (*erythema migrans*), sometimes accompanied by other generalized symptoms.

Figure 1: Incidence Rate of Lyme Disease (per 100,000 Population), Tennessee and U.S., 2003 - 2010.



Two tiered testing (an EIA/IFA screening test, followed by a western blot test if the screen is positive) is the recommended process for Lyme disease testing. Lyme IgM serologic testing is susceptible to false positives and should not be relied on for diagnosis more than 30 days after symptom onset.

Incidence
As seen in the **figure**, the incidence of reported Lyme disease in Tennessee is much lower than the national average. The majority of cases reported in Tennessee are probable cases, whereas states in regions reporting higher rates of Lyme disease typically have more confirmed cases.

Preventive Measures
The best way to prevent any tickborne illnesses is to avoid direct contact with ticks by taking preventative measures. Repellants with at least 20% or more DEET should be used on exposed skin, and will work for several hours repelling ticks and mosquitos. Using commercially available permethrin treatment on clothing or buying pretreated clothing is also effective for repelling ticks and mosquitos.

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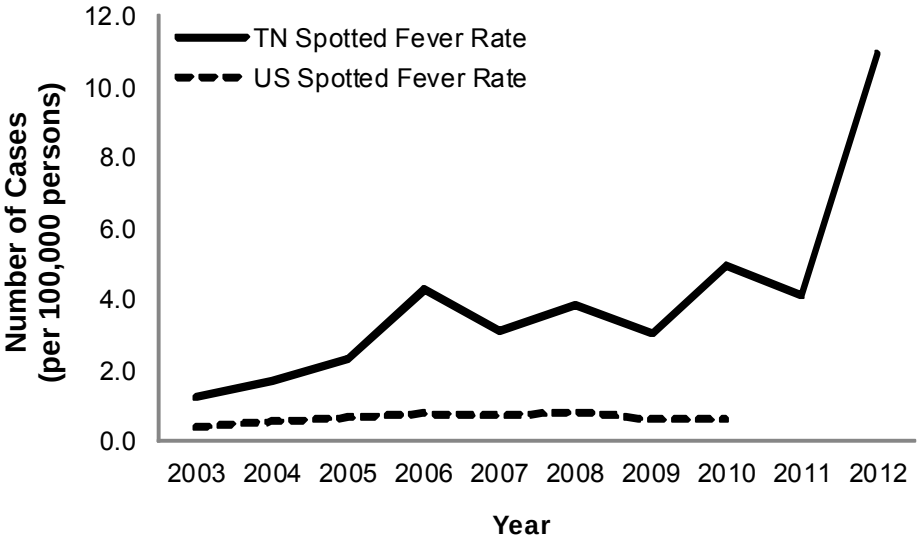
Spotted Fever Rickettsiosis (including Rocky Mountain Spotted Fever)

Background
Rocky Mountain spotted fever (RMSF) has been nationally notifiable since 1944. The disease is caused by the bacterium *Rickettsia rickettsia* and is spread by the bites of infected ticks. The American dog tick (*Dermacentor variabilis*), the Rocky Mountain wood tick (*Dermacentor andersoni*), and the brown dog tick (*Rhipicephalus sanguineus*) are the three principal tick vectors. The treatment of choice for suspected cases of RMSF is doxycycline for patients of all ages. RMSF can cause severe morbidity and mortality if treatment is delayed or not given.
In 2010, the national surveillance definition was updated to "Spotted Fever Rickettsiosis" to allow for the official inclusion of all species of pathogenic spotted fever group rickettsia. In Tennessee, most spotted fever reports received are based on RMSF serologic assays performed at commercial laboratories.

Incidence
In 2010 – 2012, 316, 262, and 697 cases of spotted fever rickettsiosis were reported, respectively. Two deaths, occurring in 2011, were also reported and confirmed by laboratory testing at the Centers for Disease Control and Prevention (CDC). In both instances, the disease was not immediately recognized and appropriate treatment was not given early on when the symptoms were considered mild. The rate of spotted fever reports has been above historical averages over the past three years. Reports of cases have been higher in males, as seen in Table 1.

Figure 1. Rate of Spotted Fever Rickettsiosis, Tennessee and U.S., 2003 - 2012.



Trends
As seen in Figure 1, the incidence of spotted fever rickettsiosis has increased in Tennessee over the past decade, while rates nationally have remained relatively stable. In 2012, an unusually high number of spotted fever cases were reported, possibly due to the milder winter that occurred that year and changes within the surveillance system in Tennessee.

Program Activities
From 2010 – 2012, a study was done in West Tennessee enrolling patients from participating providers that had a clinical history suggestive of Rocky Mountain Spotted Fever. These patients had acute diagnostic testing done at CDC, were followed up, and had convalescent specimens taken at 2 weeks, 1 month, and 1 year after the acute specimen. Final follow up and testing was completed in 2012, and the findings are published.

Preventive Measures
The best way to prevent any tickborne illnesses is to avoid direct contact with ticks by taking preventative measures. Repellants with at least 20% or more DEET should be used on exposed skin, and will work for several hours repelling ticks and mosquitos. Using commercially available permethrin treatment on clothing or buying pre-treated clothing is also effective for repelling ticks and mosquitos.

A thorough check for ticks should be done after spending time outdoors in potential tick habitats. Attached ticks should be removed by gripping the head of the tick with tweezers as close to the skin as possible and pulling steadily upwards in a smooth motion. After removing the tick, the wound should then be disinfected. If a fever begins to develop within two weeks of being bitten by a tick, see a healthcare provider immediately and inform them of the recent tick bite.

Zoonotic Diseases

Rabies

Background
The primary host for the rabies virus in TN is the skunk. Rabies-positive bats are also occasionally found. The incursion of raccoon-variant rabies into eastern TN peaked in 2008 and has since declined significantly.

Incidence
There were 80 cases of animal rabies reported in 2010; 64 cases in 2011; and 49 cases in 2012.

Trends
The decline in cases reported from 2010-12 is attributable to fewer cases found in skunks, which reflects natural cycles of infection. During this period, domestic animal rabies cases were steady at an average of 6 per year. Rabies-positive bats were also steady at an average of 10 per year. Few rabies-positive raccoons were reported, with 5 in 2010; 1 in 2011; and 2 in 2012.

Program Activities
The Vectorborne and Zoonosis group regularly assists with risk assessments for potential rabies exposures, making recommendations for management of biting animals and post-exposure prophylaxis for humans.

Preventive Measures
The Tennessee Department of Health (TDH) continues to support the oral rabies vaccination and enhanced surveillance program administered by the U.S. Department of Agriculture (USDA). This program has been effective at preventing the westward spread of raccoon-variant rabies across TN. The presence of raccoon rabies is associated with greatly increased cases in domestic animals and other wild animal species, as well as human exposures and associated costs.

Other Zoonoses: Brucellosis, Q fever, Tularemia

Background
Brucellosis, Q fever, and tularemia are diseases caused by bacteria that are maintained in animal hosts (primarily livestock for brucellosis and Q fever; rabbits and rodents for tularemia). All 3 diseases occur naturally in TN. Surveillance for these diseases is important because of their potential for causing naturally-occurring outbreaks as well as for use as a bioweapon. *Francisella tularensis*, the causative agent of tularemia, has been classified as a Category A select agent. *Brucella* spp. (brucellosis) and *Coxiella burnettii* (Q fever) are both classified as Category B agents.

Incidence
Q fever, brucellosis, and tularemia occur sporadically in TN, with only a few cases of each reported per year (**Table**).

Table. Number of Cases of Brucellosis, Q Fever and Tularemia, Tennessee, 2010-2012.

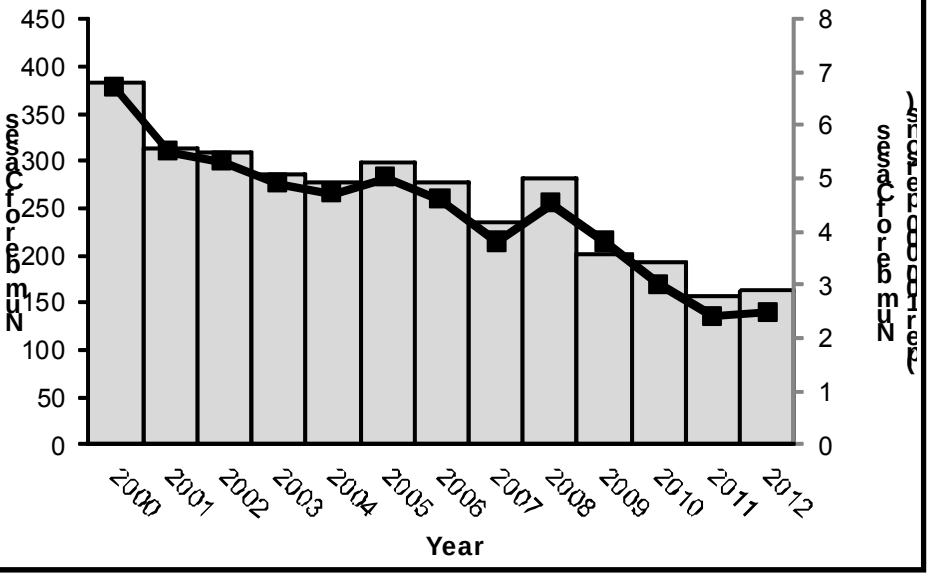
Year	Brucellosis	Q fever	Tularemia
2010	2	6	3
2011	2	0	3
2012	2	1	2

F. Tuberculosis

Tuberculosis (TB)

Background
The Tennessee Department of Health (TDH) TB Elimination Program, in collaboration with local public health departments and health care professionals statewide, is engaged in the following activities: (1) collects and analyzes surveillance data to monitor epidemiologic trends; (2) provides consultation to clinicians and local public health departments to assure appropriate clinical management and adequate therapy for TB patients and persons exposed to TB disease. In addition, TDH collaborates with community-based organizations and voluntary agencies to reach communities affected by TB; facilitates screening of persons at high risk for TB; provides TB-related education for health care providers, public health professionals, and the general public; and coordinates and administers a statewide program to provide TB medications free of charge.

Figure. Tuberculosis Cases and Rates*, Tennessee, 2000-2012.



Incidence
During the period of 2010, 2011 and 20012 the incidence of TB in Tennessee was 193, 156 and 164 cases, respectively, and averaged 171 cases annually. The average annual TB case rate for 2010-2012 was 2.6, below the national average of 3.4 cases/100,000 population for the same period.

Trends
As shown in the **figure**, the reported incidence of TB in Tennessee continues to follow a generally downward trend, decreasing 57.2% from 2000 through 2012. The TB incidence in 2011 (156 cases) is the lowest on record for Tennessee **(Figure)**. However, there are several significant differences in the epidemiology of TB in Tennessee compared to the national epidemiological trends for this period **(Table)**. First, in Tennessee the proportion of foreign-born has been decreasing whereas the proportion of U.S.-born persons with TB has increased. Secondly, the proportion of TB cases of Hispanic origin has decreased while the proportion of African Americans among Tennessee's TB cases has increased. HIV co-infection among TB cases has remained steady with an annual average of 10.9% of TB cases. From 2010-2012, 6.9% of culture-confirmed TB cases exhibited resistance to isoniazid, one of the four firstline anti-TB medications, and multi-drug resistant cases (resistant to at least isoniazid and rifampin) continue to be very rare (<1% annually) in Tennessee.

Program Activities
Specific services provided by the TB Elimination Program include the following:

1. Disease Surveillance/Epidemiology

- Compile standardized case reports for all TB cases reported in Tennessee
- Notify local health departments regarding all newly-reported TB cases in their jurisdictions
- Analyze, summarize, and distribute data regarding the epidemiology of TB in Tennessee to public health agencies statewide and other stakeholders
- Report surveillance data and programmatic outcomes to the Centers for Disease Control and Prevention (CDC)

Conduct or participate in epidemiologic studies regarding TB in Tennessee and nationally; summarize and distribute results to the appropriate audiences

2. Case Management/Contact Investigation

- Through regular contact with physicians and public health nurses, monitor the status of individual TB cases to ensure that appropriate medications are supplied and utilized, that patients receive regular medical follow-up and adhere to drug regimens, that clinical response to therapy is documented according to national guidelines

Table. Select Characteristics of Tuberculosis Cases, Tennessee, 2010-2012.								
Characteristic	2010		2011		2012		2010-2012	
	N=193		N=156		N=164		Mean=171.0	
	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)
Sex								
Female	57	(29.5)	58	(37.2)	54	(32.9)	56.3	(32.9)
Male	136	(70.5)	98	(62.8)	110	(67.1)	114.7	(67.1)
Age (years)								
≤4	11	(5.7)	2	(1.3)	5	(3.0)	6.0	(3.5)
5-15	6	(3.1)	7	(4.5)	6	(3.7)	6.3	(3.7)
16-17	0	(0.0)	3	(1.9)	2	(1.2)	1.7	(1.0)
18-24	12	(6.2)	14	(9.0)	12	(7.3)	12.7	(7.4)
25-44	64	(33.2)	48	(30.8)	51	(31.1)	54.3	(31.8)
45-64	61	(31.6)	48	(30.8)	59	(36.0)	56.0	(32.7)
65+	39	(20.2)	34	(21.8)	29	(17.7)	34.0	(19.9)
Race/Ethnicity								
Asian	25	(13.0)	19	(12.2)	21	(12.8)	21.7	(12.7)
Black/AA	62	(32.1)	54	(34.6)	68	(41.5)	61.3	(35.9)
Hispanic (any race)	37	(19.2)	27	(17.3)	17	(10.4)	27.0	(15.8)
Multi-race	1	(0.5)	1	(0.6)	0	(0.0)	0.7	(0.4)
Native Hawaiian/PI	0	(0.0)	0	(0.0)	2	(1.2)	0.7	(0.4)
White	68	(35.2)	55	(35.3)	56	(34.1)	59.7	(34.9)
Birth Status								
Foreign-born	70	(36.3)	55	(35.3)	52	(31.7)	59.0	(34.5)
U.S.-born	123	(63.7)	101	(64.7)	112	(68.3)	112.0	(65.5)
Status at Diagnosis								
Dead	8	(4.1)	7	(4.5)	3	(1.8)	6.0	(3.5)
Alive	185	(95.9)	149	(95.5)	161	(98.2)	165.0	(96.5)
Site of Disease								
Pulmonary	129	(66.8)	109	(69.9)	111	(67.7)	116.3	(68.0)
Extrapulmonary	37	(19.2)	32	(20.5)	36	(22.0)	35.0	(20.5)
Both	27	(14.0)	15	(9.6)	17	(10.4)	19.7	(11.5)
HIV Status								
Positive	18	(9.3)	20	(12.8)	18	(11.0)	18.7	(10.9)
Negative	167	(86.5)	129	(82.7)	143	(87.2)	146.3	(85.6)
Status Not Known	8	(4.1)	7	(4.5)	3	(1.8)	6.0	(3.5)
Homeless								
Yes	11	(5.7)	11	(7.1)	6	(3.7)	9.3	(5.5)
Drug-Susceptibility*	N=135		N=107		N=113		Ave.=118.3	
INH-monoresistant	11	(8.1)	5	(4.7)	7	(6.2)	7.6	(6.5)
Multi-drug resistant**	3	(2.2)	0	(0.0)	0	(0.0)	1.0	(0.8)

* Drug susceptibility testing is only performed on isolates that are culture-positive
** Resistant to at least Isoniazid (INH) and Rifampin

- Work with local health departments to ensure that complete and timely contact investigations are conducted surrounding infectious TB cases in Tennessee; analyze and summarize the findings of TB contact investigations; provide feedback to local agencies
- Receive and send interstate referrals for TB patients who move between jurisdictions during the course of TB treatment
- Administer grant funding to metropolitan public health departments

Facilitate the provision of culturally-appropriate TB outreach services in the community

3. Consultation/Education

- Medical and public health practice consultation with health care providers and local health departments regarding diagnostic procedures, treatment regimens, clinical monitoring, management of complications, and TB contact investigations
- Disseminate national guidelines and other provider and patient education materials
- Develop state-specific guidelines and recommendations, as indicated
- Ensure that TB-related training and education resources are available and disseminated to local health departments, health care professionals and others

Provide telephone consultation regarding a variety of TB-related issues to health care providers, local public health agencies, long term care facilities, correctional facilities, workplaces, the general public, and others

4. Screening and Follow-up of Immigrants and Refugees at Risk for TB

- Upon notification from the CDC Division of Quarantine and Global Migration, facilitate the evaluation of primary refugees and immigrants identified overseas with TB-related medical findings; review records for TB follow-up needs and assist in referring individuals to local public health agencies for follow-up medical evaluation after arriving in Tennessee
- Track TB screening results and outcome of treatment of TB disease or TB infection among newly arrived refugees and immigrants with TB class conditions

Report programmatic outcomes to CDC

5. TB Medications Service

Provide free medications statewide for persons receiving treatment for TB disease or TB infection

Preventive Measures

1. Early detection and treatment of persons with active TB disease
2. Through timely contact investigation, identifying and treating persons who are infected with M. *tuberculosis* to prevent the progression from TB infection to active TB disease.
3. Implementation of effective TB control programs in health care facilities, homeless shelters and correctional facilities.

G. Healthcare-Associated Infections (HAI)

Catheter-Associated Urinary Tract Infection (CAUTI)

Table. Key Percentiles and 95% Confidence Intervals for Facility-Specific Catheter-Associated Urinary Tract Infection (CAUTI) Standardized Infection Ratios (SIRs) in Intensive Care Units (ICUs) by Reporting Year, Tennessee, 01/01/2012-12/31/2012.

UNIT TYPE	YEAR	No.	SIR	LOWER LIMIT	UPPER LIMIT	10%	25%	50%	75%	90%
Adult/Pediatric ICUs	2012	94	1.46*	1.37	1.56	0.00	0.00	1.12	1.65	2.43

Data reported as of May, 2013.
No.= number of facilities with reporting units; SIR= standardized infection ratio (observed/predicted number of CAUTI);
*= SIR for reporting period is significantly higher than national 2009 SIR of 1.0.

Background

Catheter-associated urinary tract infections (CAUTI) are among the most common healthcare-associated infections reported to National Healthcare Safety Network (NHSN). In the state of Tennessee, CAUTIs have been reportable since January 2012. All hospitals, excluding critical access facilities, must report CAUTIs from adult and pediatric intensive care units (ICUs). As of October 2012, all inpatient rehabilitation facilities and long-term acute care hospitals (LTACs) are required to report CAUTIs from inpatient locations. Monthly reporting of numerator and denominator data is ongoing in each location type unless otherwise specified.

More details on Tennessee's reporting requirements can be found at: https://health.state.tn.us/Ceds/HAI/PDFs/CAUTI_Factsheet_TN.pdf, and the complete NHSN protocol for CAUTI reporting can be found at: http://www.cdc.gov/nhsn/pdfs/pscmanual/7psccauticurrent.pdf

Tennessee's Healthcare-Associated Infections (HAI) reporting requirements are guided by the TN Multi-Disciplinary Advisory Group (MDAG) on HAI. Currently, TN requirements align closely with federal mandates set forth by the Centers for Medicare & Medicaid Services (CMS).

Incidence

The standardized infection ratio (SIR) is used as a summary measure to compare CAUTI data in adult and pediatric ICUs in Tennessee to published national (NHSN) data for 2009 for each location type. The SIR – identical in concept to a standardized mortality ratio – is an indirect standardization method for summarizing the HAI experience across any number of stratified groups of data, and is a ratio of the number of infections observed divided by the number predicted (**Table**).

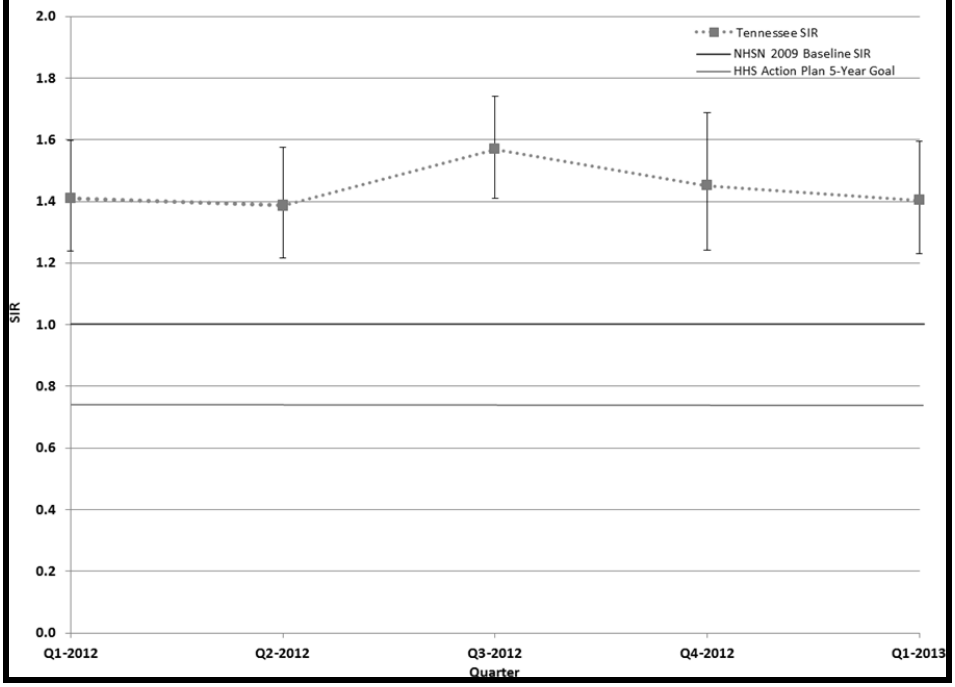
Trends

Figure. Catheter-Associated Urinary Tract Infection (CAUTI) Standardized Infection Ratios (SIRs) for Intensive Care Units (ICUs) by Quarter, Tennessee, 01/01/2012–12/31/2012 [Reference standard: National Healthcare Safety Network (NHSN), 2009]

Program Activities

Tennessee's Report on Healthcare-Associated Infections (https://health.state.tn.us/Ceds/HAI/) is pub-

Figure. Catheter-Associated Urinary Tract Infection (CAUTI) Standardized Infection Ratios (SIRs) for Intensive Care Units (ICUs) by Quarter, Tennessee, 01/01/2012–12/31/2012 [Reference standard: National Healthcare Safety Network (NHSN), 2009].



lished publicly two times per year, and includes facility-specific and state aggregate data on NHSN-reportable HAIs.

TDH provides NHSN reporting assistance to the 89 acute care hospitals involved in the TN Center for Patient Safety (TCPS) CAUTI prevention collaborative. In addition, the HAI program works closely with collaborative partners, such as the Tennessee Hospital Association and QSource, Tennessee Quality Improvement Organization (QIO) to align prevention activities and coordinate data feedback to reporting facilities.

Preventive Measures

Guidelines for the Prevention of Catheter-Associated Urinary Tract Infections were published by the Healthcare Infection Control Practices Advisory Committee (HICPAC) in 2009 and can be found at: http://www.cdc.gov/hicpac/pdf/CAUTI/CAUTIguideline2009final.pdf

Clostridium difficile Infections (CDI) (NHSN)

Background

Clostridium difficile or *Clostridium difficile* infections (CDI) have been increasing in the community and healthcare facilities in recent years. Complications of CDI include uncomplicated diarrhea, pseudomembranous colitis, and toxic megacolon which can, in some instances, lead to sepsis-like syndrome and death. Treatment of patients with CDI can be challenging, and infections can be severe and life-threatening. Since July 1, 2010, The Tennessee Department of Health (TDH) has required certain facilities to report all positive *C. difficile* laboratory assays for inpatients facility-wide (with some exclusions) and for emergency departments to the National Healthcare Safety Network (NHSN).

More details on Tennessee's reporting requirements can be found at: https://health.state.tn.us/Ceds/HAI/PDFs/CDIFF_Factsheet_TN.pdf, and the complete NHSN protocol for CDI reporting can be found at: http://www.cdc.gov/nhsn/PDFs/pscManal/12pscMDRO_CDADcurrent.pdf

Tennessee's Healthcare-Associated Infections (HAI) reporting requirements are guided by the TN Multi-Disciplinary Advisory Group (MDAG) on HAI. Currently, TN requirements align closely with federal mandates set forth by the Centers for Medicare & Medicaid Services (CMS).

Incidence

See the **Table**.

Trends

Incidence of healthcare-onset (HO) CDI has increased from 4.71 events per 10,000 patient days in 2010 to 5.36 and 5.49 events per 10,000 patient days in 2011 and 2012, respectively (**Figure**). Part of this increase is due to changes to more sensitive testing methodologies such as PCR and other nucleic acid amplification testing (NAAT). The prevalence of community-onset (CO) CDI, defined as a positive specimen collected within 3 days of hospital admission, has also increased over the same time period, from 1.98 events per 1,000 hospital admissions in 2010 to 2.35 events per 1,000 hospital admissions in 2011 and 2.76 events per 1,000 admissions in 2012. The prevalence of community-onset healthcare-facility associated (CO-HCFA) CDI, defined as a patient with CO CDI who has been discharged from a healthcare facility in the 4 weeks prior to specimen collection, has remained relatively stable, close to 1 event per 1,000 hospital admissions from 2010-2012.

Program Activities

Tennessee's Report on Healthcare-Associated Infections (https://health.state.tn.us/Ceds/HAI/) is published publicly two times per year, and includes facility-specific data on central line-associated bloodstream infections (CLABSIs) from intensive care units (ICUs) and neonatal ICUs, excluding burn and trauma ICUs, as well as state aggregate HAI data.

The Nashville/Davidson County *Clostridium difficile* Infection Prevention

Table. CDI Incidence and Prevalence, Tennessee, 07/01/2010-12/31/2012.

Year	No. of CO[2] events	No. of CO-HFA[3] events	No. of admissions	CO[2] prevalence rate^	CO-HFA[3] prevalence rate^	No. of HO[4] events	Patient days	HO[4] incidence rate*
2010[1]	740	383	374,365	1.98	1.02	845	1,793,207	4.71
2011	1,818	901	774,502	2.35	1.16	1,955	3,650,574	5.36
2012	2,193	922	795,606	2.76	1.16	2,029	3,697,894	5.49

[1]CDI events reported from July-December 2010; [2]Community-onset *C. difficile* infections; [3]Community-onset healthcare -facility associated *C. difficile* infections; [4]Healthcare-onset *C. difficile* infections; ^Per 1,000 admissions; *Per 10,000 patients days.

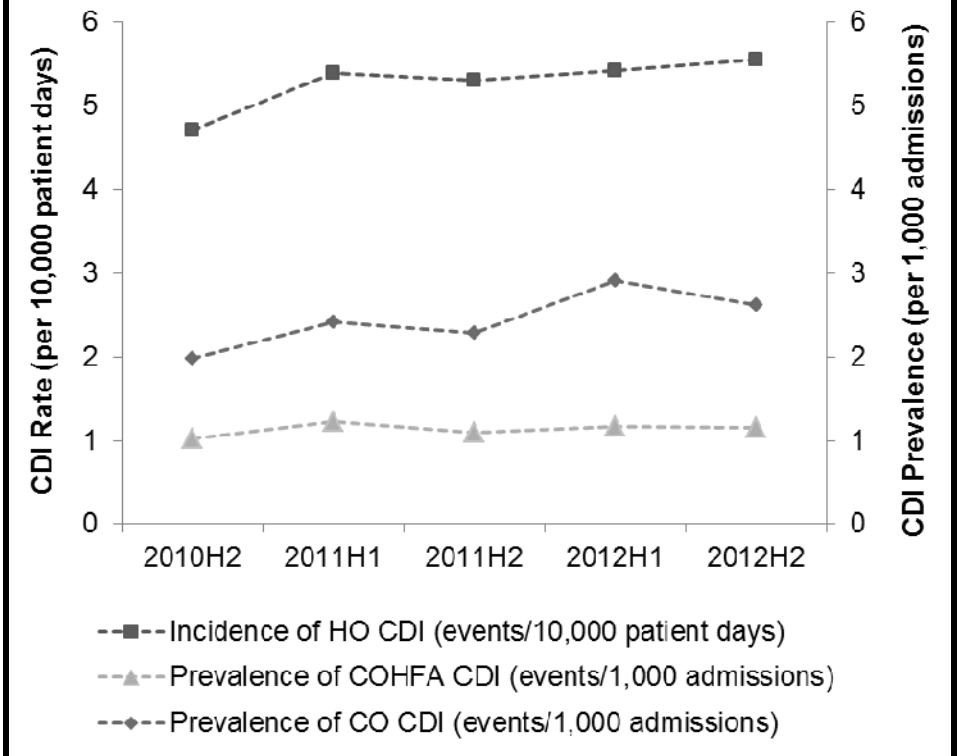


Figure. CDI Incidence and Prevalence by Half Year, Tennessee, 07/01/2010-12/31/2012.

Collaborative (CDI-PC) is an ongoing collaborative led by staff from the TN Department of Health (TDH) and QSource, TN's quality improvement organization, which involves a core group of 10 representatives from 7 facilities across the spectrum of healthcare within Davidson County. Key focus areas include hand hygiene, contact precautions, laboratory testing, environmental cleaning, and transitions of care. TDH and Qsource provide educational support to CDI-PC participants through site visits and monthly webinars.

Preventive Measures

Transfer of the pathogen to the patient via the hands of health-care workers is thought to be the most likely mechanism of exposure. Standard isolation techniques intended to minimize enteric contamination of patients, health-care–workers' hands, patient-care items, and environmental surfaces have been published. Handwashing remains the most effective means of reducing hand contamination. Proper use of gloves is an ancillary measure that helps to further minimize transfer of these pathogens from one surface to another. (CDC. Sehulster L, Chinn RYW. Guidelines for environmental infection control in healthcare facilities. MMWR 2003;52 (RR10);1–42.)

The Healthcare Infection Control Practices Advisory Committee (HICPAC) published *Management of Multidrug Resistant Organisms in Healthcare Settings* in 2006, which can be found at: http://www.cdc.gov/hicpac/pdf/MDRO/MDROGuideline2006.pdf.

Central Line-Associated Bloodstream Infections (CLABSI)

Background

Central line-associated bloodstream infections (CLABSI) are believed to account for a large proportion of bloodstream infections (BSIs) occurring in U.S. hospitals. In the state of Tennessee, CLABSIs have been reportable to the Tennessee Department of Health (TDH) via the National Healthcare Safety Network (NHSN) since January 2008 from adult and pediatric intensive care units (ICUs), since July 2008 from neonatal intensive care units (NICUs), and from long-term acute care hospitals since July 2010. Monthly reporting of numerator and denominator data is ongoing in each location type unless otherwise specified. More details on Tennessee's reporting requirements can be found at: https://health.state.tn.us/Ceds/HAI/PDFs/CLABSI_Factsheet_TN.pdf, and the complete NHSN protocol for CLABSI reporting can be found: http://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf.

Tennessee's Healthcare-Associated Infections (HAI) reporting requirements are guided by the TN Multi-Disciplinary Advisory Group (MDAG) on HAI. Currently, TN requirements align closely with federal mandates set forth by the Centers for Medicare & Medicaid Services (CMS).

Incidence

The standardized infection ratio (SIR) is used as a summary measure to compare CLABSI data in adult, pediatric, and neonatal ICUs in Tennessee to published national (NHSN) data for 2006-8 for each location type. The SIR – identical in concept to a standardized mortality ratio – is an indirect standardization method for summarizing the HAI experience across any

number of stratified groups of data, and is a ratio of the number of infections observed divided by the number predicted (**Table**).

Program Activities

Tennessee's Report on Healthcare-Associated Infections (https://health.state.tn.us/Ceds/HAI/) is published publicly two times per year, and includes facility-specific data on CLABSIs from intensive care units (ICUs) and neonatal ICUs, excluding burn and trauma ICUs, as well as state aggregate HAI data.

TDH provides NHSN reporting assistance to the 87 acute care hospitals, 24 NICUs, and 2 long term acute care (LTACs) involved in the TN Center for Patient Safety (TCPS) CLABSI prevention collaborative. In addition, the HAI program works closely with collaborative partners, such as the Tennessee Hospital Association and QSource, Tennessee Quality Improvement Organization (QIO) to align prevention activities and coordinate data feedback to reporting facilities. In 2010, the HAI program performed on-site targeted validation of CLABSI data in 26 adult and pediatric ICUs and 14 NICUs.

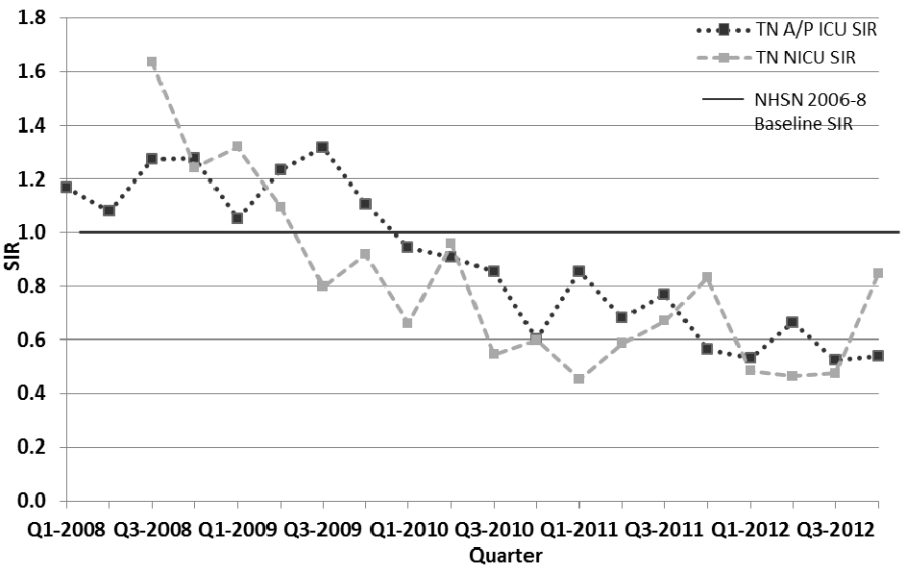


Figure. Central Line-Associated Bloodstream Infection (CLABSI) Standardized Infection Ratios (SIRs) for Intensive Care Units (ICUs) by Quarter, Tennessee, 01/01/2008–12/31/2012 [Reference standard: National Healthcare Safety Network (NHSN), 2006-8].

Preventive Measures

Guidelines for the Prevention of Intravascular Catheter-Related Infections were published by the Healthcare Infection Control Practices Advisory Committee (HICPAC) in 2011 and can be found at: http://www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf .

Table. Key Percentiles and 95% Confidence Intervals for Facility-Specific Central Line-Associated Bloodstream Infection (CLABSI) Standardized Infection Ratios (SIRs) in Intensive Care Units (ICUs) by Reporting Year, Excluding Burn and Trauma ICUs, Tennessee, 01/01/2008–12/31/2012 .

UNIT TYPE	YEAR	No.	SIR	LOWER LIMIT	UPPER LIMIT	10%	25%	50%	75%	90%
Adult/ Pediatric ICUs	2012	94	0.56^	0.50^	0.63^	0.00	0.00	0.19	0.82	1.87
	2011	92	0.72^	0.64^	0.81^	0.00	0.00	0.25	0.90	1.71
	2010	83	0.79^	0.71^	0.88^	0.00	0.00	0.45	0.88	1.67
	2009	79	1.16*	1.06*	1.27*	0.00	0.00	0.70	1.38	2.40
	2008	79	1.20*	1.10*	1.31*	0.00	0.00	0.87	1.45	2.48
Neonatal ICUs	2012	24	0.54^	0.41^	0.70^	0.00	0.00	0.08	0.68	1.51
	2011	24	0.62^	0.48^	0.79^	0.00	0.00	0.21	0.74	0.94
	2010	24	0.69^	0.54^	0.86^	0.00	0.00	0.39	0.93	1.24
	2009	25	1.01	0.84	1.21	0.00	0.00	0.00	0.85	2.20
	2008*	25	1.51*	1.22*	1.85*	0.00	0.00	0.69	1.68	2.49

Data reported as of May, 2013

No.= number of facilities with reporting units; SIR = standardized infection ratio (observed/predicted number of CLABSI); *= SIR for reporting period is significantly **higher** than national 2006-2008 SIR of 1.0; ^= SIR for reporting period is significantly **lower** than national 2006-2008 SIR of 1.0.

Methicillin Resistant *Staphylococcus aureus* (MRSA) – National Healthcare Safety Network (NHSN)

Background

Methicillin-resistant *Staphylococcus aureus* (MRSA) infections are costly and can be severe and life threatening. In the state of Tennessee, cases of invasive MRSA have been reportable to the Tennessee Department of Health (TDH) since July 2004. Beginning July 1, 2010, certain facilities were asked to also report MRSA-positive blood cultures for inpatients facility-wide and for emergency departments. As of July 2012, all hospitals (with the exception of critical access hospitals), regardless of average daily census, were asked to report these events.

More details on Tennessee's reporting requirements can be found at: http://health.state.tn.us/Ceds/HAI/PDFs/MRSA_Factsheet_TN.pdf, and the complete NHSN protocol for MRSA reporting can be found at: http://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO_CDADcurrent.pdf.

Tennessee's Healthcare-Associated Infections (HAI) reporting requirements are guided by the TN Multi-Disciplinary Advisory Group (MDAG) on HAI. Currently, TN requirements align closely with federal mandates set forth by the Centers for Medicare & Medicaid Services (CMS).

Trends

Incidence of healthcare-onset (HO) MRSA has remained steady since MRSA reporting through NHSN began in Tennessee in 2010 (1.14 events per 10,000 patient days in 2010; 1.19 events per 10,000 patient days in 2011; 1.13 events per 10,000 patient days in 2012) (**Table**). The prevalence of community-onset MRSA, defined as a positive blood specimen collected within 3 days of hospital admission, has also remained steady during this period, at 1.6 events per 1,000 admissions (**Figure**).

Program Activities

Tennessee's Report on Healthcare-Associated Infections (https://health.state.tn.us/Ceds/HAI/) is published publicly two times per year, and includes facility-specific and state aggregate data on NHSN-reportable HAIs.

TDH provides reporting assistance to the 113 acute care facilities and 9 long-term acute care facilities which report MRSA to TDH through NHSN, in-

Figure 1. MRSA Incidence and Prevalence by Half Year, Tennessee (07/01/2010-12/31/2012).

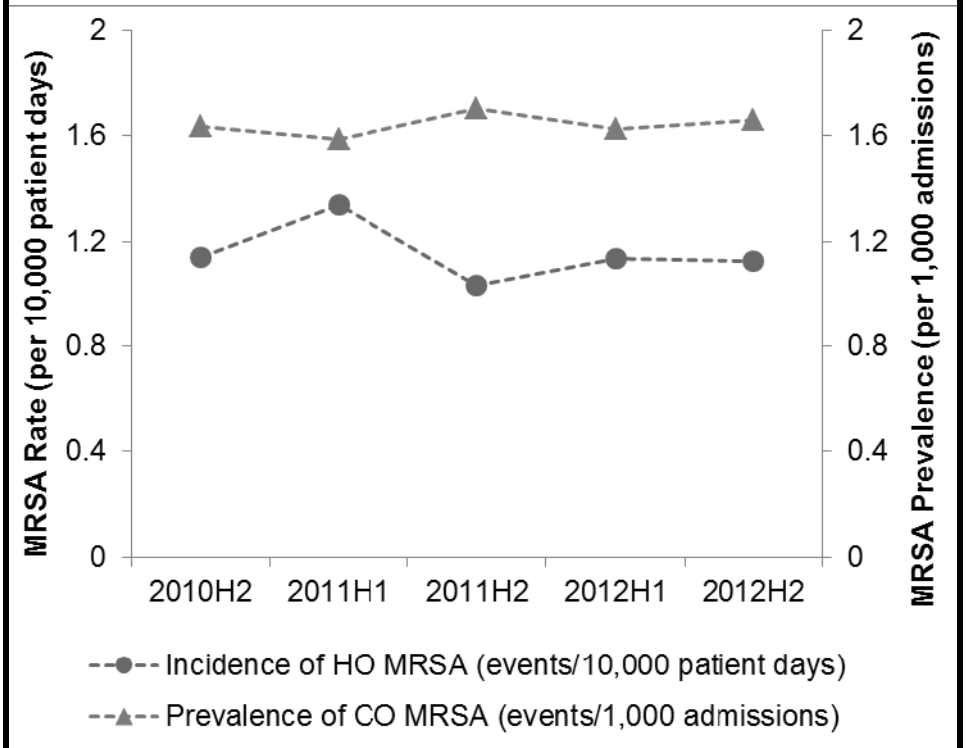


Table. MRSA Incidence and Prevalence, Tennessee (07/01/2010-12/31/2012).

Year	No. of CO[2] events	No. of admissions	CO[2] prevalence rate (per 1,000 admissions)	No. of HO[3] events	Patient days	HO[3] incidence rate (per 10,000 patient days)
2010[1]	675	412,587	1.64	224	1,964,459	1.14
2011	1417	861,108	1.65	471	3,965,483	1.19
2012	1443	878,655	1.64	453	4,014,185	1.13

No.= number of facilities with reporting units; SIR= Standardized infection ratio (observed/predicted number of SSI)
Red highlighting indicates for SIR for reporting period is significantly higher than national 2006-2008 SIR of 1.0
Blue highlighting indicates for SIR for reporting period is significantly lower than national 2006-2008 SIR of 1.0

cluding the 56 acute care facilities which were involved in the Tennessee Center for Patient Safety (TCPS) infection prevention initiative targeting MRSA in 2010 and 2011. Statewide validation of NHSN LabID event data (CDI and MRSA) is planned for 2013-2014.

Preventive Measures

The Healthcare Infection Control Practices Advisory Committee (HICPAC) published Management of Multidrug Resistant Organisms in Healthcare Settings in 2006, which can be found at: http://www.cdc.gov/hicpac/pdf/MDRO/MDROGuideline2006.pdf.

Surgical Site Infections (SSI)

Background

Infections following surgical procedures are called surgical site infections (SSI). In the state of Tennessee, infections following coronary artery bypass graft (CABG) surgeries have been reportable since January 2008. Infections following abdominal hysterectomy procedures (HYST) and those following colon surgery (COLO) have been reportable since January 2012. Infections following hip prosthesis surgeries (HPRO) were reportable from July 2010 through January 2012, and those following cardiac surgery were reportable from July 2011 through January 2012. Monthly reporting of numerator and denominator data is ongoing for each surgical procedure unless otherwise specified.

Table 1. Key Percentiles for Facility-Specific Surgical Site Infection (SSI) Complex A/R Standardized Infection Ratios (SIRs) by Reporting Year, Tennessee 01/01/2010-12/31/2012.

			SIR, 95% CONFIDENCE INTERVAL, AND KEY PERCENTILES							
PROCEDURE	YEAR	No.	SIR	LOWER LIMIT	UPPER LIMIT	10%	25%	50%	75%	90%
CABG[1]	2012	26	0.72	0.55	0.93	0.00	0.00	0.61	1.19	1.48
	2011	26	0.91	0.72	1.13	0.00	0.00	0.6	1.36	1.91
	2010	26	0.71	0.55	0.90	0.00	0.18	0.74	1.28	2.23
HPRO[2]	2011	74	0.84	0.67	1.03	0.00	0.45	0.68	1.13	1.92
	2010*	66	0.51	0.32	0.75	0.00	0.00	0.16	0.74	1.66
CARD[2]	2011*	25	0.40	0.11	1.02	0.73	0.73	0.73	0.73	0.73
COLO[1]	2012	88	0.93	0.81	1.08	0.00	0.00	0.00	0.93	1.71
HYST[1]	2012	88	0.88	0.67	1.13	0.00	0.00	0.00	0.89	3.57

More details on Tennessee's reporting requirements can be found at: https://health.state.tn.us/Ceds/HAI/PDFs/SSI_Factsheet_TN.pdf, and the complete NHSN protocol for SSI reporting can be found at: http://www.cdc.gov/nhsn/pdfs/pscmanual/9pscssicurrent.pdf

Tennessee's Healthcare-Associated Infections (HAI) reporting requirements are guided by the TN Multi-Disciplinary Advisory Group (MDAG) on HAI. Currently, TN requirements align closely with federal mandates set forth by the Centers for Medicare & Medicaid Services (CMS).

Incidence

The standardized infection ratio (SIR) is used as a summary measure to compare SSI data for surgical procedures performed in Tennessee to published national (NHSN) data for 2006-8. The SIR – identical in concept to a standardized mortality ratio – is an indirect standardization method for summarizing the HAI experience across any number of stratified groups of data, and is a ratio of the number of infections observed divided by the number predicted.

Program Activities

Tennessee's Report on Healthcare-Associated Infections (https://health.state.tn.us/Ceds/HAI/) is published publicly two times per year, and includes facility-specific and state aggregate data on NHSN-reportable HAIs.

TDH provides NHSN reporting assistance to the 96 acute care hospitals involved in the TN Center for Patient Safety (TCPS) SSI prevention collaborative. In addition, the HAI program works closely with collaborative partners, such as the Tennessee Hospital Association and QSource, Tennessee Quality Improvement Organization (QIO) to align prevention activities and coordinate data feedback to reporting facilities.

Preventive Measures

Guideline for the Prevention of Surgical Site Infections was published by the Healthcare Infection Control Practices

Advisory Committee (HICPAC) in 1999 and can be found at: http://www.cdc.gov/hicpac/pdf/guidelines/SSI_1999.pdf .

Invasive Vancomycin-Resistant *Enterococcus* (VRE)

Background

Enterococci are bacteria that live in the digestive and genital tracts (colonization). They normally do not cause infection in healthy people. Vancomycin is an antibiotic that is often used to treat infections caused by *enterococci*. In some cases, *enterococci* have become resistant to vancomycin and are called vancomycin-resistant enterococci or VRE. VRE infection can occur throughout the body, with the most common body sites being the urinary tract, surgical wounds, and/or bloodstream. *Enterococcus faecalis* and *Enterococcus faecium* are the most commonly isolated enterococcus species causing human infection. Resistance is caused by plasmids (e.g., Van A, Van B). These plasmids can be transferred to other organisms such as *Staphylococcus aureus*, resulting in vancomycin-resistant *Staphylococcus aureus* (VRSA). Control of VRE is critical to reduce the chances of emerging VRSA.

Persons at higher risk of becoming infected with VRE include those who have previously been treated with vancomycin, persons hospitalized for longer periods, persons with weakened immunity, persons who have undergone surgery and those with medical devices that stay in for some time such as urinary catheters or central intravenous devices. Mainly older adults who are over the age of 60 years are more likely to have risk factors that put them at higher risk of contracting VRE and hence we observe higher incidence rates among older adult populations as shown in **Figure 2**.

Figure 1. Invasive VRE cases and rate per 100,000 population by year, 2007-2012.

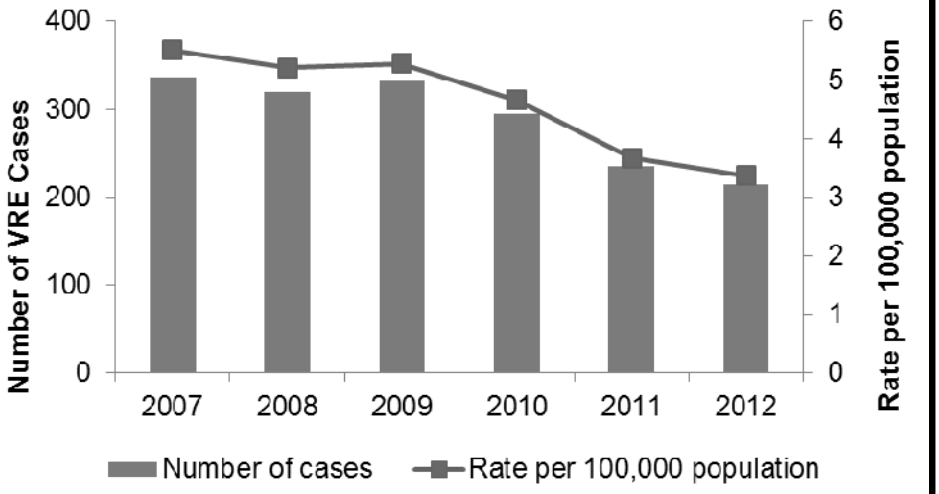
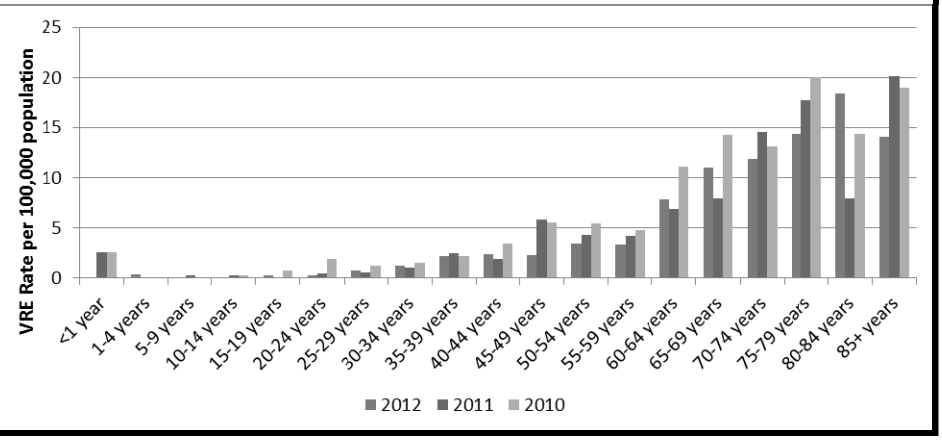


Figure 2. Incidence Rates of VRE per 100,000 populations, by Age Group, Tennessee, 2010-2012.



Incidence

The number of reported VRE cases in Tennessee remained relatively stable between 2007 and 2009, with over 300 cases reported each year and a rate of over 5 cases per 100,000 population. Since 2009, when there were 333 reported cases, the number of cases has been decreasing (295 cases in 2010; 235 cases in 2011; 214 cases 2012). By 2012, the incidence had dropped to 3.4 cases per 100,000 population (**Figure 1**). The incidence of invasive VRE increases with increasing age (**Figure 2**).

Trends

There has been a steady drop in the incidence of invasive VRE in Tennessee since 2009 (see **Figure 1**).

Program Activities

The Tennessee Department of Health monitors the incidence of invasive VRE as a measure of effectiveness of infection prevention and antimicrobial stewardship. Control of VRE is important to prevent emergence of VRSA.

Preventive Measures

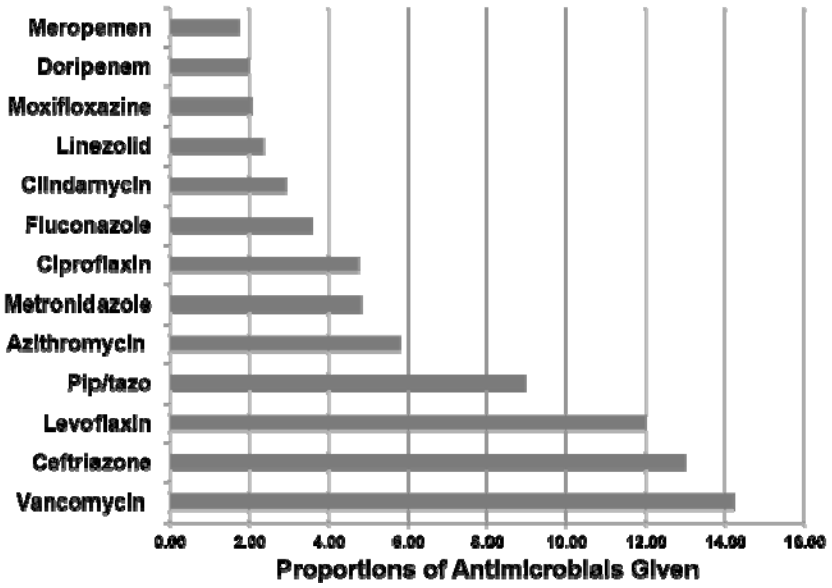
Antimicrobial stewardship and infection control measures are important in the control of VRE. Additional details can be found at: http://www.cdc.gov/hicpac/mdro/mdro_0.html.

- If a patient or someone in their household has VRE, the following are some things they can do to prevent the spread of VRE:
- Keep their hands clean. Always wash their hands thoroughly after using the bathroom and before preparing food. Clean their hands after contact with persons who have VRE. Wash with soap and water (particularly when visibly soiled) or use alcohol-based hand rubs.
- Frequently clean areas of the home, such as bathrooms, that may become contaminated with VRE.
- Wear gloves if hands may come in contact with body fluids that may contain VRE, such as stool or bandages from infected wounds. Always wash their hands after removing gloves.
- If someone has VRE, be sure to tell healthcare providers so that they are aware of the infection. Healthcare facilities use special precautions to help prevent the spread of VRE to others.

Healthcare-Associated Infections and Antimicrobial Resistance Program Special Projects

Programmatic Overview

The Tennessee Department of Health (TDH) Healthcare-Associated Infections (HAI) and Antimicrobial Resistance Program participate in a number of projects through the Emerging Infections Program Healthcare Associated Infections and Community Interface (HAIC) component. The aim of this component is to engage state health departments and their academic medical center partners to help answer critical questions about emerging HAI threats, advanced infection tracking methods, and antibiotic resistance in the United States. Information gathered through these projects plays a key role in shaping policy and recommendations for HAI surveillance and prevention.



Sample of TN results from Phase 3 of HAI and Antimicrobial Use Prevalance Survey.

Source: TDH. 2011.

Activities

Healthcare-Associated Infections and Antimicrobial Use Prevalence Survey

The Healthcare-Associated Infections and Antimicrobial Use Prevalence Survey was conducted by the Centers for Disease Control and Prevention (CDC) and the Emerging Infections Program (EIP) as a point prevalence survey for HAIs and antimicrobial use in a sample of U.S. acute care general and general children's hospitals. The objectives of the survey were: 1) to estimate the prevalence of HAIs and the distribution of HAIs by pathogen and major infection site, and 2) to estimate the prevalence and rationale for antimicrobial use among inpatients in acute healthcare facilities. The Tennessee Department of Health (TDH) participated in developing and conducting both Phase 2 (limited roll-out) and Phase 3 (full-scale survey).

In 2010, TDH completed data collection and entry for Phase 2. During this phase, 149 charts were reviewed at 3 hospitals. Over 63% of all surveyed patients were found to be on antibiotics within these facilities, with prevalence rate at each hospital ranging from 47% to 69%. Checklists were designed for each major HAI event and were used to determine whether each potential HAI met the appropriate National Healthcare Safety Net-

work (NHSN) case definition. After completing Phase 2, TDH worked with CDC and other EIP sites to develop the protocol for Phase 3.

TDH completed Phase 3 of the survey in 2011. A stratified random sample of hospitals within each of 3 bed size strata (small, medium, and large) were selected to participate. During this phase, 1486 charts were reviewed at 25 hospitals. Over 56% of all surveyed patients were found to be on antibiotics. TDH worked with CDC and other EIP states to analyze the survey data and help prepare a manuscript presenting the results.

Surveillance of Bloodstream Infections in Dialysis (SuBSID) Study

Tennessee worked with CDC through the Emerging Infections Program between 2010 and 2012 to develop and carry out a study evaluating the use of electronic data capture for surveillance of bloodstream infections (BSI) in a large dialysis organization (LDO) in the Nashville and Chattanooga areas. The primary objectives of this study were: 1) to demonstrate feasibility of creating a uniform surveillance dataset from existing electronic medical record data provided by an LDO; 2) to implement an enhanced measure of BSI incidence for patients at participating hemodialysis centers (HDCs) by identifying BSIs diagnosed within and outside the HDC; 3) to validate the quality of outpatient hemodialysis patient-day denominator data recorded in LDO electronic medical record systems; and 4) to evaluate the performance characteristics of several proxy BSI and denominator metrics captured electronically through existing data provided by the LDO. Publication of final results is expected in late 2013.

Chlorhexidine Bathing to Reduce Multi-Drug Resistant Organism Colonization Among Patients in Long-Term Care Facilities

TDH collaborated with CDC to conduct a research study evaluating the benefits of bathing with chlorhexidine gluconate (CHG) in order to reduce the colonization of multidrug-resistant organisms (MDRO) among residents of LTCFs. The specific MDROs studied included methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococcus (VRE), extended-spectrum beta-lactamase producing gram-negative bacteria (ESBL), and carbapenem-resistant enterobacteriaceae (CRE). Two LTCFs in Blount County participated in this study in 2012; final results are currently pending.

Central Office epidemiologist Ashley Moore demonstrated proper hang hygiene for chlorhexidine study field staff in training video developed by TDH.

Source: TDH, 2011

PISToL Project

In 2012, the TDH HAI Program participated in the Piloting Infection Surveillance Tools in Long-Term Care (PISToL) project, an EIP project designed to inform CDC's development of a long-term care component for NHSN. The goals of the project were to obtain structured feedback from long-term care facilities (LTCFs) regarding 1) comprehensibility and usability of HAI surveillance tools, 2) clarity and usefulness of HAI surveillance instructions and training materials, 3) burden of data collection, and 4) feasibility of conducting HAI surveillance using the provided tools. Three LTCFs in Tennessee provided TDH and CDC with feedback and data related to *Clostridium difficile* infection surveillance and/or urinary tract infection surveillance. PISToL gave TDH the opportunity to establish relationships with these LTCFs and to introduce these settings to HAI surveillance through NHSN.

Impact

HAI and Antimicrobial Use Prevalence Survey

The results from the HAI and Antimicrobial Use Prevalence Survey provided important information regarding the burden and types of HAIs in acute care facilities, in addition to antimicro-

bial drug use in Tennessee and other EIP states. Based on findings of higher-than-expected antimicrobial use in Tennessee, TDH has initiated an antimicrobial stewardship collaborative to improve the judicious use of antimicrobials across the healthcare spectrum. The prevalence survey will be repeated at regular intervals to assess HAI and antimicrobial use trends, with the next phase (Phase 4) planned in 2014.

Surveillance of Bloodstream Infections in Dialysis (SuBSID) Study

Results of this study will inform improvement in data capture and collection methods for surveillance of HAIs in dialysis facilities. TDH mandated reporting of NHSN-defined Dialysis Events beginning in 2012, and the results of this study will be critical for future validation of surveillance data collected through this mechanism.

Chlorhexidine Bathing Study

The results of this study may be important for informing standard of care in LTCFs, a setting which often faces a high prevalence of MDROs. Additionally, TDH staff gained experience working in the long-term care setting, which is a growing area of interest in HAI prevention.

PISToL Project

In addition to providing CDC with valuable feedback on its new LTCF module, the PISToL study gave TDH the opportunity to establish relationships with participating LTCFs and to introduce these settings to HAI surveillance through NHSN.

H. Sexually Transmitted Diseases

Chlamydia

Background

Chlamydia is a common sexually transmitted disease (STD) caused by the bacterium, Chlamydia trachomatis, which can damage a woman's reproductive organs. It is the most frequently reported bacterial sexually transmitted disease in the United States. Chlamydia affects both males and females, although it is most prevalent among young women.

Chlamydia can be transmitted during vaginal, anal, or oral sex. It can also be passed from an infected mother to her baby during vaginal childbirth. The majority of people infected with chlamydia have no symptoms. If symptoms do occur, they usually appear with 1-3 weeks after exposure. Women who have symptoms of chlamydia might have an abnormal vaginal discharge or a burning sensation when urinating. Men with symptoms may also have a burning sensation when urinating or a discharge from the penis, as well as burning or itching around the opening of the penis. Fortunately, chlamydia can be easily treated and cured with antibiotics. If untreated, it can progress to serious reproductive and other health problems, such as pelvic inflammatory disease in women and epididymis in men.

Figure 1. Reported Cases of Chlamydia, Tennessee, 2010-2012.

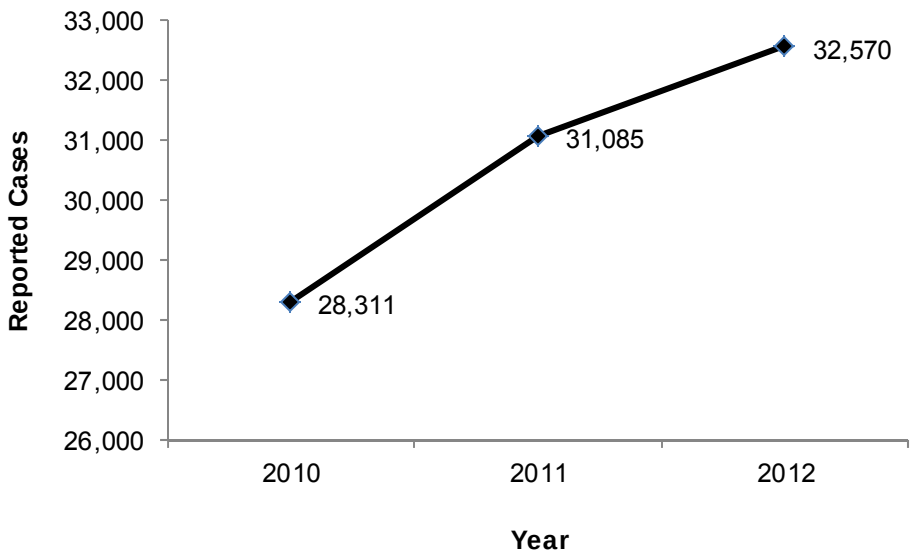
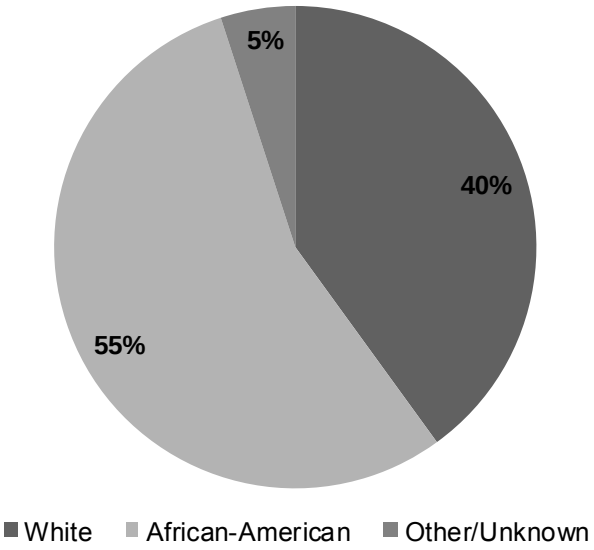


Figure 2. Reported Cases of Chlamydia, by Race, 2012.



Incidence

In 2012, there were 32,569 cases of Chlamydial infection reported to the Tennessee Department of Health. Of these cases, 22,763 (70%) were identified among women, and among 15-24 year olds (73%), which is a direct result of focused STD testing efforts among women being seen within Family Planning and Maternal Child Health clinics.

Among female cases, 12,244 (55%) were identified among Black/African-Americans and 9,563 (41%) were identified among Whites (**Figure 1**) Among the 9,767 male cases reported in 2012, 5,749 (59%) were identified among Black/African-Americans and 3,595 (37%) were identified among Whites. Among both females and males, cases from Asian, Hawaiian/ Pacific Islanders, Native Americans, and Multi-race persons composed only 3 percent of the overall morbidity for 2012.

Trends

From 2010-2012, reported Chlamydia cases have increased 15% in volume. (**Figure 2**) While cases among Blacks have increased a modest 5.6% over this 3-year period, cases among Whites have increased 30%. These increases have been attributed to aggressive testing efforts aimed at identifying new

cases throughout Tennessee. Additionally, there have been no appreciable changes by age category during this period as the majority of our program's funded testing efforts are among 15-24 year olds in Family Planning and Maternal Child Health clinics.

Program Activities
Within our state health department system, all clients who test positive for a sexually transmitted disease are offered a variety of services to reduce their risks of acquiring sexually transmitted diseases in the future. These services include: confidential counseling, testing, and treatment of those persons who are infected or who have been exposed to a sexually transmitted disease, verification of diagnosis and treatment of all reportable STDs from public and private providers, partner referral services which provides notification, screening and treatment to sexual partners, and educational and counseling services to those at risk for sexually transmitted diseases as well as the community in general.

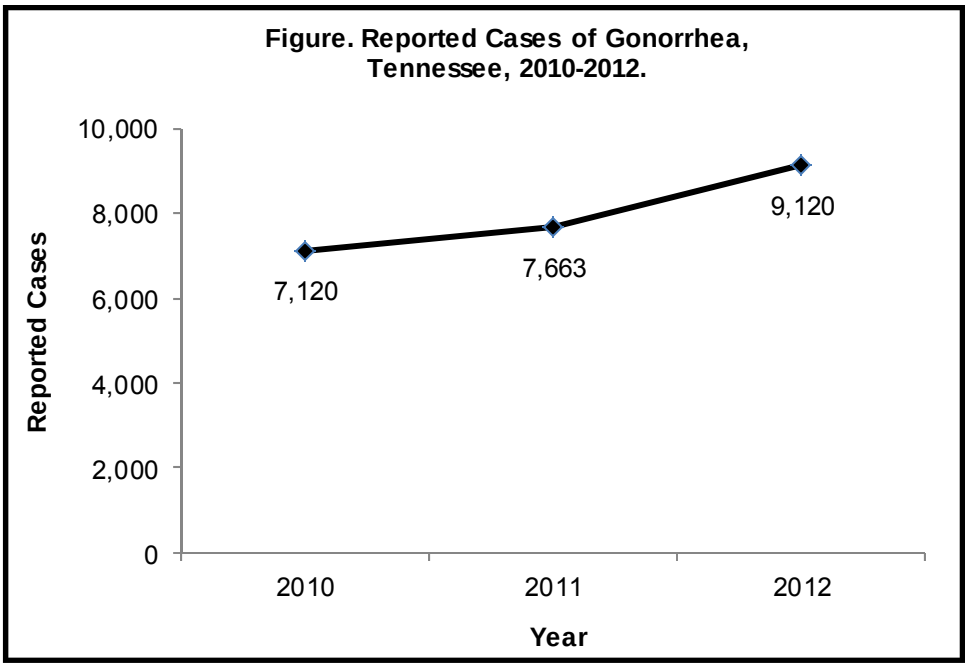
Preventive Measures
Abstaining from sexual intercourse is the best protection against Chlamydia and other STDs; however, the use of latex condoms during sexual intercourse when always and correctly used can reduce the risk of transmission of Chlamydia. Because Chlamydia is highly contagious and yet may cause no symptoms, all men and women who have sexual contact with more than one partner should be tested regularly for the disease. Constant awareness and protection are necessary because a person who has once contracted the disease does not become immune, and many people acquire Chlamydia more than once.

If a person has been diagnosed and treated for gonorrhea, he or she should notify all recent sex partners so they can see a health care provider and be treated. This will reduce the risk that the sex partner will develop serious complications from gonorrhea and will also reduce the person's risk of becoming re-infected.

Gonorrhea

Background
Gonorrhea is caused by the bacterium Neisseria gonorrhoeae. It is a very common infectious disease and is spread through contact with the penis, vagina, mouth, or anus. It can also be spread from mother to baby during delivery. Most men and women with gonorrhea have no symptoms at all. When men have signs or symptoms, they may appear one to fourteen days after infection, and could include a burning sensation when urinating, or a white, yellow, or green discharge from the penis. When a woman has symptoms they are often mild, and may include a painful or burning sensation when urinating, increased vaginal discharge, or vaginal bleeding between periods. Antibiotics can successfully cure gonorrhea in adolescents and adults. As with chlamydia, untreated gonorrhea can cause serious and permanent health problems in both men and women, such as pelvic inflammatory disease and epididymis.

Figure. Reported Cases of Gonorrhea, Tennessee, 2010-2012.



Incidence
In 2012, there were 9,120 cases of Gonorrhea reported to the Tennessee Department of Health. Similar proportions of cases were identified among men and women (48% and 51%, respectively). In terms of race, the majority of cases were reported among Black/African-Americans (6,917, or 75% of total cases reported). White cases represented 20% of the total cases reported, and other races, such as Native Americans, Asians, and Hawaiian/Pacific Islanders comprised the remaining 5%.

Trends
Following declines in overall morbidi-

ty from 2008-2009, the past three years have seen reported cases of Gonorrhea increase 28% (**Figure**)

In 2012, reported cases of Gonorrhea were highest within our largest metropolitan areas, including Memphis, Nashville, Hamilton, and Knox counties. This historical trend holds true for all sexually transmitted disease cases in Tennessee, including HIV disease.

Program Activities
Within our state health department system, all clients who test positive for a sexually transmitted disease are offered a variety of services to reduce their risks of acquiring sexually transmitted diseases in the future. These services include: confidential counseling, testing, and treatment of those persons who are infected or who have been exposed to a sexually transmitted disease, verification of diagnosis and treatment of all reportable STDs from public and private providers, partner referral services which provides notification, screening and treatment to sexual partners, and educational and counseling services to those at risk for sexually transmitted diseases as well as the community in general.

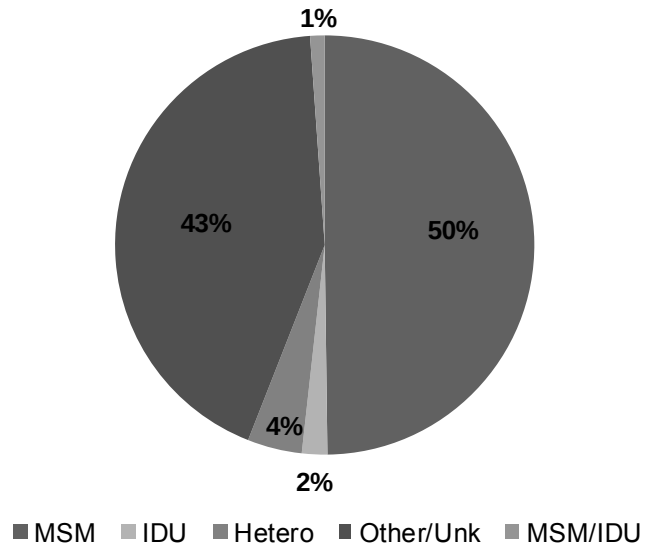
Preventive Measures
Abstaining from sexual intercourse is the best protection against Gonorrhea and other STDs; however, the use of latex condoms during sexual intercourse when always and correctly used can reduce the risk of transmission of Gonorrhea. Because Gonorrhea is highly contagious and yet may cause no symptoms, all men and women who have sexual contact with more than one partner should be tested regularly for the disease. Constant awareness and protection are necessary because a person who has once contracted the disease does not become immune, and many people acquire Gonorrhea more than once.

Human Immunodeficiency Virus (HIV) Disease

Background
HIV Disease is a collective term for the total population of persons infected with the Human Immunodeficiency Virus. It is comprised of persons who are infected with HIV, but have not been diagnosed with AIDS (Acquired Immune Deficiency Syndrome), as well as persons who have been diagnosed sometime in the past with AIDS.

To date, 25,658 Tennesseans have been diagnosed with HIV Disease since 1980, and of these persons, 8,280 (32%) have died. As of 1/1/13, there are 19,083 persons living with HIV in Tennessee.

Figure 1. HIV Exposure among Males, Tennessee 2012.

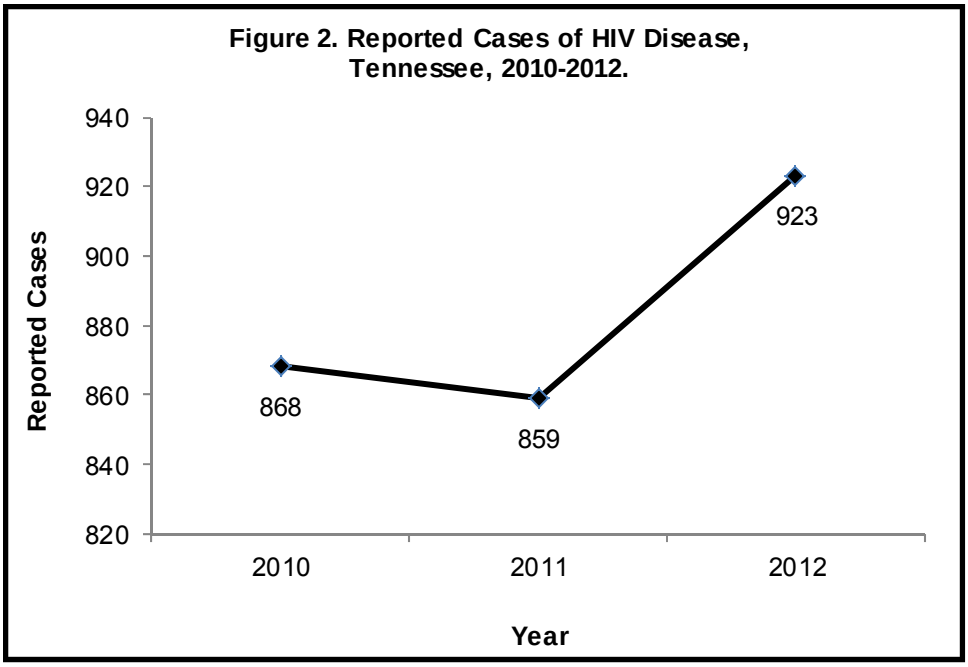


Incidence
In 2012, there were 923 newly diagnosed HIV infections (with or without AIDS) among Tennessee residents. The majority (77%) of persons newly diagnosed with HIV infection was male, was African-American (62%), and was between 15-34 years of age at time of diagnosis (54%). As of 12/31/12, there were 19,083 persons living with HIV Disease in Tennessee, regardless of where they were initially diagnosed with the disease.

Among the 713 males reported with an initial HIV diagnosis in 2012, 355 (50%) acquired their infection through sexual contact with other males (MSM), 4.2% through heterosexual contact with infected female partners, and 14 (2%) through injection drug use (IDU) (**Figure 1**).

Trends
After gradual declines in HIV morbidity from 2008-2011, reported HIV cases increased 7.4% from 2011-2012 (**Figure 2**), which was the result of a 10.1% increase in reported cases among males, combined with a slight decrease in cases among females.

Program Activities
Our current CDC grant supports a



range of activities that include: HIV counseling, testing and referral (CTR), HIV partner counseling and referral services (PS), HIV health education and risk reduction programs (HERR), HIV prevention for positive individuals (HIV-IP), public information programs (PIP), a toll-free HIV/STD hotline, capacity building programs, and a quality assurance and evaluation component.

Preventive Measures

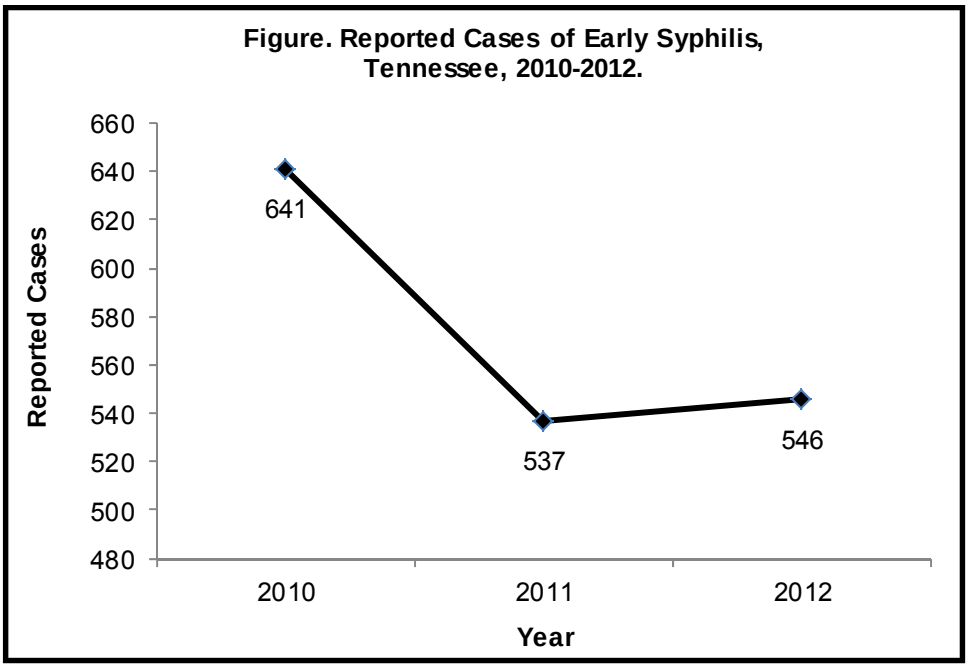
To avoid infection through sex, a person should not have anal, vaginal or oral sexual intercourse. An individual should only have sex with someone who is not infected and who has sex only with that individual. A person should use latex condoms always and correctly each time s/he has vaginal, anal or oral sex to greatly lower the risk of infection. An individual should never share needles or injection equipment to inject drugs or steroids, as the HIV in blood from an infected person can be transferred directly into the bloodstream of the next user.

Syphilis

Background

Syphilis is caused by the bacterium *Treponema pallidum*, and is spread through direct contact with a syphilis sore. These sores occur mainly on the external genitals, vagina, anus, or in the rectum. However, they can also occur in the lips and in the mouth. Syphilis is transmitted during vaginal, anal, or oral sex, and pregnant women with syphilis can pass it on to the babies they are carrying. The course of syphilis is divided into different stages (Primary, Secondary, Latent,) each with their own signs and symptoms.

A single intramuscular injection of penicillin, an antibiotic, will cure a person who has had syphilis for less than a year. Additional doses (up to three doses, given over a three week period) are needed for someone who has had Syphilis for longer than a year.



Incidence

In 2012, there were 546 cases of Early Syphilis (< 1 year duration) reported in Tennessee. Black/African Americans represented the majority of cases (377, or 69% of total cases reported). There were 158 (29%) of cases among Whites, while the remaining 11 cases were comprised by other races.

Trends

Cases reported in 2012 represented a 9.7% decrease from cases reported in 2010 (**Figure**) This can be attributed primarily to the 12.6% decrease in cases among Black/African Americans

from 2010 to 2012, which represent the majority of early syphilis cases in Tennessee.

Program Activities

The epidemiology of syphilis represents a dynamic interaction between behavior, biology, and the effectiveness of public health interventions. Syphilis elimination is possible because the disease is easy to cure once diagnosed, and because the syphilis epidemic is concentrated in a small number of geographic areas.

Key strategies in place throughout Tennessee for the successful prevention and elimination of syphilis include: expanded surveillance and outbreak response activities, rapid screening and treatment in and out of medical settings, expanded laboratory services, strengthened community involvement and agency partnerships, and enhanced health promotion.

Syphilis prevention and control activities predominantly take place within the context of health services that include STD, Infectious Disease, HIV Outreach and other services.

Preventive Measures

Abstaining from sexual intercourse is the best protection against Syphilis and other STDs.

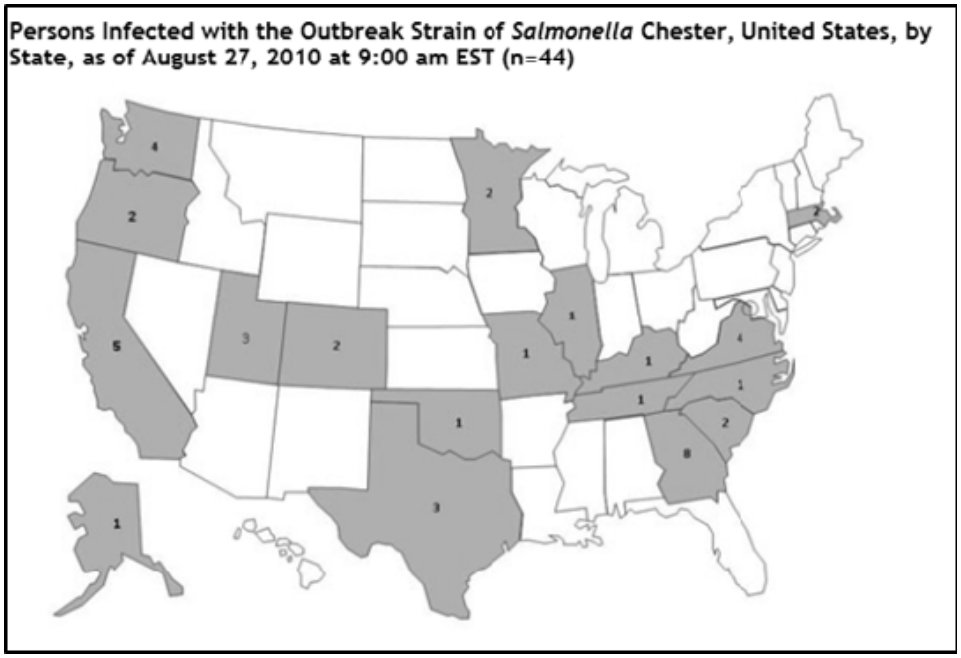
The open sores associated with syphilis may be visible and are infectious during the active stages of the disease. Any contact with these contagious sores must be avoided to prevent the spread of the disease. Latex condoms, when always and correctly used, can reduce the risk of syphilis and other STDs but only when the infected areas are covered or protected by the condom. (The open sores may occur in genital areas that can be covered or protected by a condom, but they also may occur in areas that cannot be covered or protected by a condom.)

Testing and treatment early in pregnancy is the best way to prevent syphilis in infants and should be a routine part of prenatal care. All women receiving prenatal care should be tested for syphilis during their first prenatal exam and during their last three months of pregnancy.

Section IV. Investigations and Outbreaks

Multistate Outbreak of Human *Salmonella* Chester Infections

CDC collaborated with public health officials in many states, the U.S. Department of Agriculture's Food Safety and Inspection Service (USDA/FSIS), and the U.S. Food and Drug Administration (FDA) to investigate a multistate outbreak of *Salmonella* serotype Chester infections. Investigators used DNA analysis of *Salmonella* bacteria obtained through diagnostic testing to identify cases of illness that were part of this outbreak.



A total of 44 individuals infected with a matching strain of *Salmonella* Chester were reported from 18 states since April 11, 2010 (**Figure**). Among those for whom information is available about when symptoms started, illnesses began between April 4, 2010 and June 16, 2010. Case-patients ranged in age from <1 to 88 years old, and the median age was 36 years. Fifty-four percent of patients were female. Among the 43 patients with available hospitalization information, 16 (37%) were hospitalized. No deaths were reported. Tennessee reported one case in this multi-state outbreak. This case was female, between the ages of 20-49 and visited the emergency room.

Collaborative investigative efforts of officials in many local, state, and federal public health, agriculture, and regulatory agencies linked this outbreak to Marie Callender's Cheesy Chicken & Rice single-serve frozen entrées. During June 14-18, 2010, CDC and public health officials in multiple states conducted an epidemiologic study by comparing foods eaten by 19 ill and 22 well persons. Analysis of this study suggested that eating a Marie Callender's frozen meal was a source of illness. Ill persons (89%) were significantly more likely than well persons (14%) to report eating a frozen meal. All ill persons (100%) who ate frozen meals reported eating a Marie Callender's frozen meal. None of the well persons who ate a frozen meal reported eating a Marie Callender's frozen meal. There was insufficient data from this study to implicate a specific frozen meal type. However, many of the ill persons reported eating a Marie Callender's Cheesy Chicken & Rice frozen entrée in the week before becoming ill. Additionally, two unopened packages of Marie Callender's Cheesy Chicken & Rice single-serve frozen entrées collected from two patients' homes (one collected in Minnesota on June 18, and one in Tennessee on July 19) yielded *Salmonella* Chester isolates with a genetic fingerprint indistinguishable from the outbreak pattern.

Outbreak of an Unidentified GI Illness at a Lodge, June 2010

Background

On Monday, June 21, 2010, the East Tennessee Regional Office of the Tennessee Department of Health (ETRO) received a report of multiple complaints of gastrointestinal symptoms among visitors to a Lodge in the Great Smoky Mountains National Park (Lodge A). Initial consultation with the National Park Service and Lodge A's Concessioner indicated that approximately 7 visitors had become ill in the early hours of Monday morning. No administrative staff or food service workers were reported to be ill. Lodge A, which is accessible only on foot, serves two meals a day and visitors to the Lodge generally spend a single night at the site after completing the 5+ mile hike to the Lodge on one of four trails. Set meals are served at 6 pm and 8 am; each consists of multiple canned/packaged items that are prepared daily. Following the morning meal, most visitors to the Lodge begin the return hike, although a limited number of visitors stay for two

nights. The Lodge is a popular vacation destination; cabins remain booked throughout the season and reservations are made as far as a year in advance. Due to the inaccessibility of the site, provisions for the entire season are ordered in advance and dropped by helicopter one time in the spring. Given the difficulties that would result if alteration to the menu were made, careful investigation was required to determine whether existing inventory items were safe and ensure that no foods were discarded unnecessarily.

Table 1. Total Interviews and Attack Rates by Date of Overnight Visit (N=82).

Date	Total interviewed	Well	Ill	Attack Rate
June 18	4	4	0	0%
June 19	38	12	26	68%
June 20	36	8	28	78%
June 21	27 (23 stayed 06/20 as well; 4 stayed only 06/21)	27	0	0%

A food- or water-borne pathogen was suspected as a probable cause based on the symptoms initially reported. Accordingly, the interview tool included questions regarding food history, recreational water exposure, and animal contact. Two ETRO staff members and one Sevier County staff member were dispatched to the National Park on Tuesday, June 22, to interview and collect specimens from ill visitors, who had been requested to present at the Park Headquarters following their descent from the Lodge.

Staff at Lodge A were also able to provide contact information for individuals who made a reservation at the lodge from June 18 through June 21. Staff from ETRO and the Tennessee Department of Health in Nashville contacted these individuals and interviewed them with the outbreak questionnaire to assess illness, exposures and to receive contact information for others who visited Lodge A.

Results

Initial interviews revealed a consistent set of symptoms with a tight onset period, consistent with a pre-formed bacterial toxin ingested as a point-source item. The rapid onset of illness appeared to rule out person-to-person transmission or a traditional food-borne enteric illness such as *Campylobacter*. Anecdotal reports from visitors suggested that no vegetarians had become ill and appeared to implicate a canned beef product served as the main entree. None of the visitors interviewed on-site were currently symptomatic and stool specimens could not be collected.

A total of 115 cabin spaces were reserved for the nights of June 19 and 20. Reservations are made in the name of the head of party and these individuals were contacted to provide a complete list of visitors in each cabin. The precise number of individuals lodged on-site each night could not be conclusively determined since spaces in rented cabins may go unused and not all heads of party could be reached. There were a total of 94 individuals identified who stayed at the Lodge at least one of the two nights in question: 48 on June 19 and 46 on June 20.

Interviews with visitors to the site on June 18 and June 21 revealed no illness, so the event period has been restricted to visitors lodging the nights of June 19 and June 20. A total of 74 interviews were completed with visitors to the site during the event period and this analysis is limited to these individuals. Among the visitors interviewed, 53 individuals reported becoming ill during their trip to Lodge A and one additional individual reported becoming ill the day before arrival at the Lodge (**Table 1**).

Reports of illness yielded unanimous lower gastrointestinal symptoms, although most of the cases interviewed also reported multiple other symptoms such as cramps, nausea, and headache. Onset times ranged from 3 - 91 hours after the evening meal served both nights (range excludes the ill visitor whose symptoms began before arrival). An epidemic curve generated from the interviews indicates that the largest proportion developed symptoms early in the morning hours of June 20 and June 21. This is consistent with the working hypothesis that a food item (or items) was the source of intoxication.

The mean incubation period among ill visitors was13.6 hours; this varied significantly when stratified by date of lodging (17.1 vs. 10.4 hours on June 19 and June 20, respectively). The decrease in mean incubation period may signify that visitors to the Lodge on the second night of the event period received a greater dose of the causative agent. This is also consistent with the increased attack rate noted among visitors on June 20.

A food history was collected from all interviewed visitors utilizing the dining hall menu provided by Lodge A. Visitors were also questioned regarding exposure to creek water and contact with animals. No visitors reported having contact with animals while en route to or at the Lodge. Consumption of food items was consistent between both ill and well visitors. Odds ratios were calculated by day of exposure for those food items with the highest attack rates.

Only two items had significantly high odds ratios for both days in which illness occurred: beef in gravy and mashed potatoes. Because these items were almost universally consumed together and quantity of each food item consumed was not collected, it is difficult to tease apart their individual contributions. However, when odds ratios were calculated for absolute consumption of food items (that is, combining both days and assessing consumption), the beef was clearly implicated, producing an odds ratio of 17.667 (95% CI: 1.914, 163.027).

ETRO/Sevier County staff worked closely with the TDOH Central Office to respond quickly and arrive at the National Park before visitors returned to their locations of origin. Most of the ill visitors' symptoms had already resolved at the time of interview and no stool specimens were collected at the time of ETRO staff's visit to the Park. The Central Office coordinated with both the National Park Service and with other states' departments of health to achieve collection of stool specimens from visitors that reported ongoing illness. A single stool specimen was collected and submitted for culture; results revealed a quick-growing *Staphylococcus aureus* and a more slow-growing *Clostridium perfringens*. The latter pathogen has been identified as a more likely causative agent since the symptoms and incubation periods experienced by ill visitors were consistent with *C. perfringens* intoxication. Additionally, the anaerobic bacterium *C. perfringens* is often associated with canned products and meat products, which were among foods consumed that had the highest odds ratios on both a per-day and absolute exposure basis.

Discussion

As described above, despite an implicated food item, a lab-confirmed food source could not be determined. Lodge policy and practice require that leftover food be immediately disposed of and all food containers well washed to minimize the attraction of bears and smaller nuisance animals to the Lodge. Given these practices, food samples could not be collected. However, the Concessioner also described occasional storage of unprepared leftover foods; upon interview, food service workers were able to confirm that approximately half a can of additional beef was used on June 19, the remainder of which was stored in a sealed, refrigerated container and added to the cans of beef prepared on June 20. The storage of the unused beef (although apparently properly handled), subsequent increase in attack rate and decrease in incubation period provide multiple points of evidence that further increase the index of suspicion with regard to the beef.

The individual that provided the stool specimen was notified of the results by phone. The Lodge Concessioner was notified that *S. aureus* and *C. perfringens* had been isolated from a specimen and he was encouraged to contact the Sevier County Health Department or ETRO if he had any further questions regarding outbreak prevention or facility disinfection.

Although the causative agent does not appear to have been transmitted person-to-person in this instance, because of the potential for spread and the difficulties that would be faced if a different pathogen were to establish itself at the site, ETRO staff discussed with the Concessioner disinfection procedures that should be implemented and also provided Lodge A's staff with Parapaks and instructions regarding collection of stool if a future outbreak should occur.

Recommendations

To reduce the potential for additional outbreaks at Lodge A, ETRO staff also made the following recommendations for the Concessioner and Lodge staff, especially food services workers:

⇒ Frequently review and ensure adherence to food handling practices that minimize the likelihood of both food and surface contamination

⇒ Frequently review and ensure adherence to routine disinfection practices with cleaning products effective against persistent pathogens in order to minimize the likelihood of surface contamination

⇒ Enforce exclusion policies for ill staff, especially food handlers

⇒ Ensure that handwashing facilities are properly supplied and alcohol-based hand sanitizers are readily available in areas where handwashing facilities do not exist

⇒ Monitor visitor health and collect stool specimens if more than 3 visitors become ill with diarrheal illness in a 24 hour period

Although no visitors to Lodge A presented to a hospital for their illness, the large numbers of out-of-state visi-

tors to the National Park and the closely associated tourist attractions in Pigeon Forge/Gatlinburg each year signify a local area of increased risk for initiation of a multi-state outbreak that is unique to the East Tennessee Region. In light of this and following an earlier outbreak in 2010 associated with another Great Smoky Mountains National Park facility, ETRO has increased surveillance for enteric illness originating in Blount and Sevier Counties, especially associated with out-of-state patients presenting to local hospitals.

Fungal Infections Associated with Contaminated Methylprednisolone Acetate Injections in Tennessee, Fall 2012-2013

Background

Starting in September 2012, the Tennessee Department of Health (TDH) investigated an outbreak of fungal infections among recipients of epidural glucocorticoid injections at three outpatient clinics in Tennessee, which was part of a larger national outbreak involving 20 states. Contaminated preservative free methylprednisolone acetate (MPA) from one compounding pharmacy was implicated as the source of fungal exposure. Cases were identified as individuals that had received a potentially-contaminated MPA injection with subsequent development of meningitis, spinal or paraspinal abscess, peripheral joint infection, or posterior circulation stroke in the absence of any lumbar puncture result.

Investigation

In the early stages of the investigation in mid-September, TDH efforts were focused on identification of the causative exposure, identification of new cases, and the determination of the best course of treatment for ill patients. TDH also encouraged the affected clinics to begin notifying all potentially exposed patients. By the end of September, TDH had identified the most likely source of exposure (MPA from the New England Compounding Center [NECC]) which helped push for a recall of all potentially contaminated MPA lots. Cooperation and communication between TDH and the Tennessee clinical community through Epi-X and Tennessee Health Alert Network (THAN) messages helped to identify new potential cases; these were evaluated and started on antifungal therapy. In the first week of October, the TDH State Health Operations Center (SHOC) was activated, along with Regional Health Operation Centers (RHOCs) across the state to manage every aspect of the investigation which included, but was not limited to: identification of all exposed patients; exposed patient notification and tracking (from TDH staff) through phone calls, home visits and certified mail; finding of cases; case treatment and exposure analysis; communication to the public and key stakeholders; and coordination between TDH and CDC, FDA and other state entities. Also in October, TDH gained assistance from CDC to help in the process of case data collection and analysis in the form of an EPI-AID (on-site assistance from CDC's Epidemic Intelligence Service officers). This effort was further assisted when 14 hospitals were able to provide TDH with remote access to their electronic medical record (EMR) system. A second Epi-AIDepi-aid would be called for in November to help assist with data collection in response to an increase of patients presenting with infections at the location where injections were administered (e.g. spinal and paraspinal abscesses).

TDH partnered with the Poison Control Center to help handle the call volume from the public and concerned patients regarding the fungal infection outbreak. TDH was able to contact and track all exposed patients (thought to be over 1,100 at the time) for any new disease through the end of November. The extensive amount of information from these efforts was coordinated through the use of the Tennessee Countermeasure Response Network (TNCRN).

Due to the large amount of clinical and procedure information that was being provided to TDH as well, an information management system was established to track patient follow-up, clinical, and procedure information and to coordinate with the TNCRN system on a daily basis. Information collected was used so that all exposed patients were referred to the healthcare system and received appropriate follow-up and treatment based on CDC's guidelines. The information collected in Tennessee was also used to help inform national diagnostic and treatment guidelines.

Procedure and exposure data were analyzed on a daily basis to help better describe the risk factors for disease to help prioritize communication and outreach. Analysis was also completed on available clinical and treatment data to help better understand the

course of illness and the most effective treatment strategies for all patients. Results are described in the following two paragraphs.

Of the 153 case patients, 22 had meningitis alone (14.4%), 69 had spinal or paraspinal infection alone (45.1%), 57 had meningitis and spinal or paraspinal infection (37.3%), 3 had posterior circulation stroke without LP (2.0%), and 2 had peripheral joint infection (1.3%). The median age was 68 years (range, 23 to 91). The median time from the last epidural glucocorticoid injection to symptom onset was 36 days (range, 0 to 198). Symptoms and signs included headache (in 60% of the patients), new or worsening back, neck or leg pain (in 71%), neurologic symptoms (in 47%), nausea or vomiting (in 35%), and stiff neck (in 24%). The median cerebrospinal fluid white-cell count on the first lumbar puncture among patients who presented with meningitis, with or without stroke or focal infection, was 460 per cubic millimeter (range, 6 to 12,745), with 72% granulocytes (range, 0 to 94); the median protein level was 121.5 mg per deciliter (range, 29 to 893); and the glucose concentration was 46 mg per deciliter (range, 12 to 194). A total of 31 patients had laboratory confirmation of Exserohilum rostratum infection (30 patients) or Aspergillus fumigatus infection (1 patient). Fifteen patients died (9.8%).

In Tennessee, 1021 patients received MPA injections. As of April 30, 2013, 152 patients (14.9%) met the case definition; 126 had localized infection, 79 had meningitis, 3 had stroke (with no lumbar puncture), and 2 had joint infection. Univariate risk factors for fungal infection included: age >60 years, female sex, injection received at Clinic B, exposure to multiple procedures, exposure to MPA lot 06292012@26, and exposure only to vials >50 days old (compared to exposure to newer vials only). In multivariate analysis, risk factors for infection included age >60 years (adjusted odds ratio (aOR): 3.15; 95% CI: 1.99, 4.99); undergoing ≥1 translaminar procedure (aOR: 1.81; 95% CI: 1.15, 2.83); and cumulative dose of lot 06292012@26 injected 46-60 days and >60 days after production, in 40-mg increments (aOR: 1.40; 95% CI: 1.18, 1.65; aOR: 1.85; 95% CI: 1.55, 2.21, respectively). Risk factors for meningitis or localized infection were similar to the results for all cases, though receiving an injection at Clinic A was a risk factor for meningitis (aOR: 3.02; 95% CI: 1.29, 7.04).

Summary

The relationship between the state health department and Tennessee's clinical community were essential to timely identification of the first cases linked to epidural steroid injections. Existing emergency preparedness infrastructure was key to patient notification and follow-up. Ease of communication between clinicians and TDH staff (including remote EMR access) helped to identify the causative exposure and describe the spectrum of illness among the exposed. Real time review of case medical records was instrumental in the development of interim treatment guidelines throughout the course of the outbreak. Investments in public health infrastructure from the state and federal levels were critical for an effective response.

SECTION V.
ENVIRONMENTAL HEALTH

Partnership to Promote Localized Efforts to Reduce Environmental Exposure

Programmatic Overview

Tennessee Department of Health (TDH) Environmental Epidemiology Program (EEP) is an active participant in Agency for Toxic Substances and Disease Registry (ATSDR's) Partnership to Promote Localized Efforts to Reduce Environmental Exposure (APPLETREE) Program. Based on environmental data, EEP performs public health assessments, health consultations, exposure investigations, community involvement activities, and technical assistance. These reports present conclusions, make recommendations, and plan corrective actions.

Activities

Site-Specific Investigations and Response

As a partner in ATSDR's Cooperative Agreement Program, EEP prepares Public Health Assessments (PHAs), Health Consultations (HCs), and Technical Assists (TAs). PHAs, HCs, and TAs provide a response to an environmental public health question. These reports provide a viewpoint on a public health issue related to human exposure to a hazardous substance. If a health hazard is identified, EEP makes specific recommendations to eliminate the hazard. Examples of public health actions may be providing emergency water supply, restricting site access, or taking other necessary measures to stop the exposure. Together, EEP and ATSDR use the best science, take responsive public health actions, and provide trusted health information to prevent exposure and disease related to toxic substances.

ATSDR provides funding and technical assistance 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 2010 to 2012, TDH EEP released 23 reports **(Table)**. Our public health assessments, consultations, fact sheets, and other reports are available on the TDH Website at http://health.tn.gov/environmental.

Tennessee is consistently listed as one of the top users and generators of hazardous materials in the United States. In 2012, Tennessee had 16 active sites on the federal National Priorities List (NPL) of Superfund sites. The NPL consists of the hazardous waste sites in most need of cleanup. When a site is proposed for the NPL, federal rules

Table. Completed Environmental Public Health Reports, Tennessee, 2010-2012.

Name of Site	City and County of Site	Name of Site	City and County of Site
Former 36th Street Landfill	Chattanooga, Hamilton	Tiger Cleaners	Memphis, Shelby
Davis Mill Creek Ponds, Copper Basin	Copperhill, Polk	Lawson's Cleaners	Memphis, Shelby
TVA Kingston Fossil Plant Coal Ash Spill	Harriman, Roane	Kraus Model Cleaners	Memphis, Shelby
ISS Oxford Site	Memphis, Shelby	Pyramid Site	Memphis, Shelby
Restaurant Vapor Intrusion Investigation	Memphis, Shelby	Rental Uniform Company	Kingsport, Sullivan
Egyptian Lacquer Manufacturing Company Vapor Intrusion Investigation	Franklin, Williamson	Park Place Cleaners	Memphis, Shelby
Security Signals	Oakland, Fayette	Bruce Spring	Dickson, Dickson
IGI Adhesives Vapor Intrusion Investigation	Nashville, Davidson	Tokheim Update	Jasper, Marion
Quad Industries	Bradford, Gibson	Wright Medical Technology	Arlington, Shelby
Johnson Controls Vapor Intrusion Investigation	Lexington, Henderson	9053 Middlebrook Pike	Knoxville, Knox
Smokey Mountain Smelters	Knoxville, Knox	Goodrich Landing Gear	Tullahoma, Coffee
Tokheim Site	Jasper, Marion		

mandate an assessment of health.

New National Priorities List Superfund Sites

On September 22, 2010, the Smokey Mountain Smelters Site in Knox County was added to the federal NPL of Superfund sites. Smelting operations took place from 1922 until 1944. The site had a history of uncontrolled hazardous waste management. Soil, groundwater, and surface water were impacted by contamination including metal slag, aluminum dross, and ammonia. Additional construction, demolition, trash, and potentially hazardous materials were dug up during site operations. The U.S. Environmental Protection Agency (EPA) did a full-scale cleanup of the site.

The Alamo Contaminated Groundwater Site became an NPL site in September 2011. In 1988, volatile organic compounds (VOCs) were discovered in the groundwater used for the Town of Alamo's public water supply in Crockett County. An air stripping system has been used to purify the drinking water for consumer use. So far the air stripper has been able to remove the VOCs. The site consists of a VOC-contaminated groundwater plume that extends approximately ⅓-mile northeast to southwest in the area of the Alamo municipal well field. The Alamo water department estimates 300,000 gallons of water is pumped from their four municipal groundwater wells per day. Various studies have found multiple possible sources of VOCs in the vicinity of the plume. Due to the likelihood that the pollution is the result of multiple releases, the groundwater contamination cannot be attributed to any particular source. During our investigation, EEP met with local government officials. EEP anticipates the completed PHA will be published in 2013.

The U.S. EPA proposed the Clinch River Corporation (CRC) Site on September 14, 2012. From 1929 to 2002, a pulp and paper mill operated on the CRC Site in Roane County. By-products of the pulp and paper mill manufacturing process included black liquor (spent processing waste) and coal tar constituents. Black liquor can be composed of phenols, sodium hydroxide, sodium oxide, and sulfur as well as metals, such as calcium and magnesium. Coal tar consists of polynuclear aromatic hydrocarbons, phenols, and heterocyclic oxygen, sulfur, and nitrogen compounds. Surface water, groundwater, soil, sediment, and fish have been impacted by contamination from this site. When this Annual Report was written, our environmental public health investigation of the CRC Site was just beginning.

In addition to these new NPL sites, EEP worked on older, active NPL sites investigating carbon tetrachloride at the Hardeman County Landfill and mining wastes at Copper Basin.

In December 2008, over a billion gallons of coal ash spilled at the TVA Kingston Fossil Plant in Roane County. Our previous Annual Report detailed the spill and the resultant public health response. In 2010, following a public comment period, EEP and ATSDR published the final PHA *Tennessee Valley Authority (TVA) Kingston Fossil Plant Coal Ash Release*. The final report has been of great interest as the safety of other coal ash impoundments and the hazard disposal classification of coal ash were both under review by the U.S. EPA.

A polluted leachate pond with leftover salt cake and barrels stain the Smokey Mountain Smelters Site in Knoxville, Knox County.

There are hundreds of other hazardous waste sites in Tennessee. Most sites are cleaned up and overseen by Tennessee Department of Environment and Conservation (TDEC) Division of Remediation or Division (DoR) or the Division of Solid and Hazardous Waste Management (DSWM).

There were several important advancements in health risk assessment from 2010 to 2012. Vapor intrusion continues to be discussed and researched. Vapor intrusion is the migration of volatile chemicals from contaminated groundwater or soil into an overlying building. At the IGI Adhesives Site in Nashville, Davidson County, chemicals from a former manufacturing plant leaked into the ground. TDEC wanted to know if homes or businesses in the area were affected by vapor intrusion. EEP and TDEC measured levels of chemicals in the indoor air in 3 homes and 2 businesses. Levels of site-related chemicals in the indoor air at all locations were within accepted health risk limits. EEP informed the residents and business owners of the results. EEP and TDEC also sampled indoor air in homes near the ELMCO Site in Franklin, Williamson County. The chemicals, benzene, acetone, and toluene, were found seeping into a nearby creek. Several homes were situated between the creek and the ELMCO plant. Indoor air was sampled in 3 homes. Results of the sampling showed levels of these chemicals in indoor air were within accepted health risk limits.

New research suggested the heavy metal lead could have harmful effects on a developing child at levels lower than previously thought. The CDC lowered their childhood blood lead screening guidance from 10 µg/dL to 5 µg/dL. In a south Chattanooga neighborhood, high levels of lead contamination were discovered in residential soils. Although the source of the lead was unknown, TDEC speculated it may have come from foundry sand or bag house dust from Chattanooga's industrial past. TDEC screened many yards to determine the extent of the lead contamination. The EPA removed contaminated soil from 68 residential yards. EEP assisted with data evaluation and health education in the neighborhood. The joint efforts of EEP, TDEC, and EPA improved the health of the community through education and remediation of the lead hazard in the soils of their neighborhood.

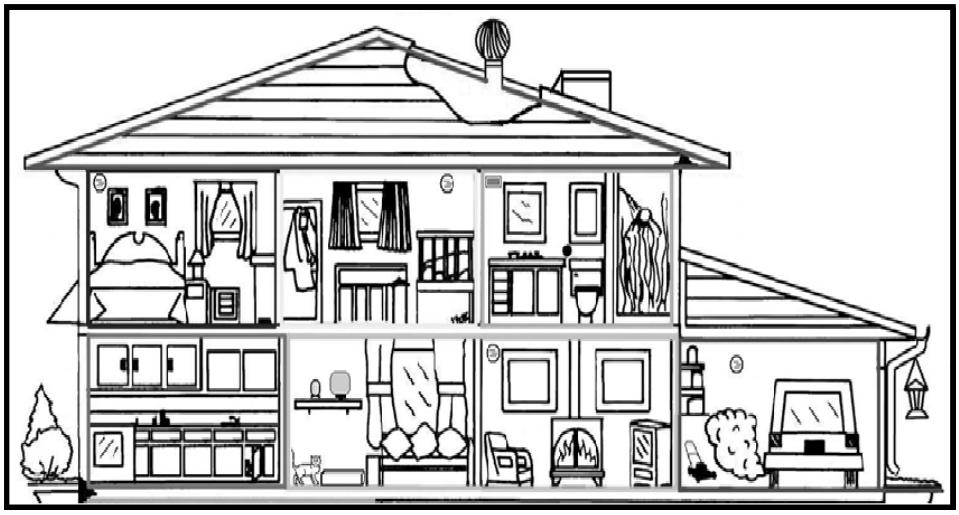
A pit full of dirty water creates a physical hazard at the Clinch River Corporation Site in Harriman, Roane County.

Impact

From 2010 to 2012, the EEP worked on 35 environmental sites as part of its APPLETREE Cooperative Agreement. As a result, many HCs, TAs, and a PHA were prepared that evaluated the potential for exposure to site-related chemicals in the soil, groundwater, surface water, or air. Much of our site-specific work involved evaluating future exposure to those that would occupy commercial buildings that were to be re-purposed as new businesses. EEP evaluated potential exposures in single family homes near manufacturing plants that had some type of historic chemical release to the soil, groundwater, or air. Further work included evaluation of chemical releases in the vicinity of daycare facilities. EEP communicated the results of our evaluations to individual homeowners and daycare operators through individual meetings and correspondence. Community meetings were held in Chattanooga to report results for three separate sites relating to redevelopment of two former school sites, closure and remediation of a former chemical company site, and for a neighborhood having elevated lead in lawn soils. The meetings informed the communities of findings and provided a forum for citizen's questions to be answered. EEP educates individuals and community members on chemical exposure and environmental impacts through these interactions.

Healthy Places

Programmatic Overview
Environmental Epidemiology Program (EEP) promotes Healthy Homes. A healthy home reassures health and wellness by preventing illness and injury. Through our Healthy Homes Website, EEP addresses issues like mold, radon, lead, carbon monoxide, mercury, pesticides, and unintentional injuries.



Activities

Healthy Homes
Environmental hazards in the home harm millions of people each year. A healthy home can prevent illness and injuries. A healthy home is designed, built, and maintained to support health. Centers for Disease Control and Prevention (CDC's) Healthy Homes Program is a coordinated, comprehensive, and holistic approach to preventing diseases and injuries that result from housing-related hazards and deficiencies. Following these seven Healthy Homes principles will promote good health and wellness.

Keep your home:

Dry: Damp houses provide a good environment for mites, roaches, rodents, and molds.

Clean: Clean homes help reduce pest infestations and exposure to contaminants.

Pest-Free: Studies have shown exposure to mice and cockroaches can increase asthma attacks in children. Improper pesticide treatments for pest infestations can worsen health problems, since pesticide residues in homes can pose health risks.

Safe: The majority of children's injuries occur in the home. Falls are the most frequent cause of residential injuries to children, followed by injuries from objects in the home, burns and poisonings.

Contaminant-Free: Chemical exposures include lead, radon, carbon monoxide, pesticides, asbestos and environmental tobacco smoke. Exposures are often higher indoors than outdoors.

Ventilated: Studies have shown that increasing the fresh air in a home improves respiratory health.

Maintained: Poorly-maintained homes are at risk for moisture and pest problems. Deteriorated lead-based paint in homes built before 1978 is the primary cause of lead poisoning in children.

Flooding
Many parts of Tennessee experienced flooding. In May 2010, flash flooding displaced thousands of residents. In some counties, flooding reached a 1,000-year flood event as recorded by the National Weather Service. In West Tennessee, a levee on the Wolf River broke flooding Millington. In Middle Tennessee, the Cumberland River overflowed its banks spilling into Nashville. Then in February 2011 in East Tennessee, flash flood overwhelmed parts of Knoxville. The rains of April and May 2011 along the Mississippi River were among the largest and most damaging recorded in the past century. Officials ordered over 1,300 homes to be evacuated near Memphis. Heavy rainfall and flooding can ruin a home, increase the risk of waterborne disease, lead to groundwater contamination, cause a septic system to fail, create massive trash piles, wreck farms and livestock, result in hazardous materials release, or destroy infrastructure.For residents and businesses, quickly cleaning up and drying out after a flood is important to maintain good health. Tennessee Department of Health (TDH) distributed factsheets about *Reentering Your Flooded Home*, *Make Water Safe*, *Protect Yourself from Mold*, and *Drink Safe Water* to help residents get back into their homes safely. Some county health departments had to close due to infrastructure damage. Boil water advisries were announced for many communities.

Our Environmental Health Specialists Network (EHS-Net) and CDC's National Center for Environmental

Health (NCEH) compared contaminants in flood water to contaminants in river water and domestic well water. All ten surface water samples collected after the flood were positive for fecal coliforms, *E. coli*, enterococcus, and *Salmonella*. Some of the samples were positive for *Cryptosporidium*, *Campylobacter*, and adenovirus. In general, water sampling done a month later at the same locations showed much less or no contamination. After the heavy rainfall, some groundwater wells tested positive for fecal coliforms, *Salmonella*, and *Campylobacter*. Residents were advised to stop using their well or to shock-disinfect their well.

Ellen Yard, PhD, tests for contaminants in flood water near downtown Nashville, Davidson County.

As residents and businesses cleaned up, tons of trash was produced. It was difficult for maintenance crews to keep up with the garbage, water-logged debris, white goods, and household hazardous materials being discarded. A dead animal disposal advisory was shared with farmers. The U.S. Environmental Protection Agency (EPA) assessed oil and hazardous material releases. EPA performed recon and pickup of flood-related hazmat materials. While we cannot control the weather, Environmental Public Health has a vital role in ensuring health and safety is reestablished after severe weather.

National Toxic Substance Incidents Program (NTSIP)

Programmatic Overview

Tennessee Department of Health (TDH) Environmental Epidemiology Program (EEP) performs acute chemical exposure surveillance through the National Toxic Substance Incidents Program (NTSIP). Tennessee was one of only seven states to be awarded a cooperative agreement with Agency for Toxic Substances and Disease Registry (ATSDR) for NTSIP. Program staff collect information on harmful materials also known as toxic substances. These materials include chemicals, radiation, and naturally-occurring matter that could cause harm to people or the environment. The information is uploaded into the NTSIP database within 48 hours of an incident. NTSIP staff create educational materials about hazards commonly recorded in their database.

EEP is planning to correlate environmental exposures to hazardous substances with adverse health effects in populations as a part of Centers For Disease Control and Prevention (CDC's) Environmental Public Health Tracking (EPHT) Network. Ultimately, Environmental Public Health Tracking will be able to provide current, relevant, and accurate information about environmental exposures and health outcomes.

Activities

National Toxic Substance Incidents Program

Approximately 2,400 out of 15,000 annual toxic substance incidents in the United States result in death, illness, or injury. Acute toxic incidents may range from illicit methamphetamine lab explosions in homes to chemical suicides in automobiles and from industrial chemical releases to transportation accidents. Such events frequently require public health protective actions such as evacuations, in-place sheltering, or decontaminations.

Tennessee was one of only seven states to be awarded a grant from ATSDR for the National Toxic Substance Incidents Program. NTSIP collects and combines information from many resources to protect people from harm caused by spills and leaks of toxic substances. Data is gathered through our partnerships with the National Response Center (NRC), Tennessee Emergency Management Agency (TEMA), and Department of Transportation (DOT) as well as from news media reports. NTSIP surveillance data is used to prepare prevention

messages to protect the general public from chemical exposure.

From 2010 to 2012, NTSIP reported 1,095 acute toxic substance incidents eligible for surveillance with 281 victims and 29 fatalities. NTSIP tracks methamphetamine incidents that result in acute chemical exposure to anyone or in injury to a first responder. NTSIP has prepared web-based fact sheets on chemicals commonly showing up in surveillance data. Information about carbon monoxide, pesticides, ammonia, sodium hydroxide, and natural gas safety are available at http://health.state.tn.us/environmental/NTSIP.htm.

Impact

TDH NTSIP has developed excellent working relationships with TEMA, NRC, TN Meth Task Force, and local health agencies. Program staff investigated incidents and alerted others about the incidents on a regular basis. Based on surveillance data, success stories and fact sheets were prepared. A Community Assessment for Public Health Emergency Response (CASPER) questionnaire was also developed. It included specific survey questions about carbon monoxide awareness and preparedness. The CASPER questionnaire was used during a training exercise as staff went door-to-door asking questions and sharing a carbon monoxide factsheet. NTSIP staff directly engaged the general public by answering their carbon monoxide poisoning questions.

A tanker leaking nitrogen creates a potentially hazardous situation in Johnson City, Washington County.

The U.S. Environmental Protection Agency cleaned up 68 yards contaminated with lead in Chattanooga, Hamilton County.

Environmental Health Specialist Network (EHS Net): Food Safety

Programmatic Overview

Tennessee's EHS-Net staff works in collaboration with federal, state, and local agencies to develop a better understanding of the environmental causes to foodborne illness. Our goal is to help reduce the incidence of foodborne illness through our participation in local and national research,

focused in key areas of food safety and outbreak prevention. Outcomes of our work provide generalizable knowledge that facilitates a better understanding of foodborne diseases, their causes and exposure routes, and illness prevention through education. In addition, our research provides supportive data for longstanding, effective policy development and/or change in public and private communities of food safety.

Activities

Tennessee Projects:

- Grocery Store Survey (Risk Analysis)
- Outbreak Investigation Training
- Evaluation of Self-Analysis for Food Excellence (SAFE) program
- Foodborne Illness Compliant Form
- Analysis of Statewide Restaurant Data

Multisite Projects:

- Leafy Green Handling Study
- Ill Food Handler Study
- Cooling Study

Impact

The following are examples of project accomplishments and impacts that have been made:

- In June 2010, data was collected for the Grocery Store Survey in the Nashville area. The goal was to create a grocery store database to describe the retail grocery and market sector in Nashville with the purpose of facilitating informed discussion locally and among EHS-Net partners regarding future studies and interventions within grocery store environments. The objectives were to assess and categorize risk by establishing a risk assessment protocol for grocery stores and markets. EHS-Net in collaboration with the Public Health Service organized a risk assessment exercise targeting grocery stores within Nashville/ Davidson County, Tennessee. In 2012, additional steps were taken to conduct analysis between store characteristics and risk to find any association. A final report of the initial work was produced, and a manuscript that includes all work is in progress.
- Environmental specialists in Tennessee gained valuable experience by participating in the EHS-Net Outbreak Study and Epi-Ready Training. An EHS-Net specialist, the state's foodborne outbreak coordinator, and the assistant director of Tennessee's State Public Health Laboratory participated in an Epi-Ready Train-the-Trainer course. This environmentalist-epidemiologist team planned and facilitated 4 regional outbreak training exercises throughout the state in 2010. More than 215 Environmental and Epi staff were trained. Additional outbreak training was conducted in 2011, which emphasized the evaluation of food flow and contributing factors to promote use of the EHS-Net Outbreak Study investigation tool by environmentalists statewide.
- The EHS-Net specialist working in the Davidson County catchment area has been involved since 2003 in developing and administering a remedial food safety training program for poorly performing restaurants (that score <70 on inspections), their management, and staff. During this time 388 restaurants and 686 foodworkers have participated in Self-Analysis for Food Excellence training, which includes classroom review and onsite evaluation of each restaurant's facilities. During 2010, it included 46 establishments and 77 individuals. Training was conducted in the field at these poor-performing restaurants; the focus was on critical violations, risk factor violations (3, 12, and 20), and monitoring logs and procedures (no score was given). The EHS-Net specialist also held classroom training on basic food safety with emphasis on temperature control,

Danny Ripley, Environmental Health Specialist, Metro Public Health Department, Nashville, Tennessee, teaching a basic food handlers class.

hygienic practices, cleaning and sanitizing, and monitoring procedures. While participating restaurants consistently demonstrated marked improvement in the regularly scheduled follow-up inspection, evaluation of long-term performance is lacking. Violations associated with risk factors for foodborne illness reduced 62%, critical violations reduced 85%, and a total of 694 establishments have been trained thru 2003-2010. Such analysis will help us describe the importance of EHS-Net and the effectiveness of government food safety programs.

- An EHS-Net multi-state project resulted in the development of a Foodborne Illness Complaint Form available for use by public health agencies that receive complaints from residents/consumers regarding possible foodborne illnesses. This complaint form will be used to evaluate trends of different complaints, achieve evaluation and follow-up, and transfer of information between environmental and epidemiologist staff. Tennessee is installing a new information system to be used by environmentalists statewide. Tennessee was selected as an awardee for a 2010-2015 EHS-Net Food practice grant. Interventions based on best-practices, CIFOR guidelines, and past EHS-Net projects are being implemented. The form may be viewed at the CDC website: http://www.cdc.gov/nceh/ehs/EHSNet/resources/index.htm.
- Tennessee EHS-Net staff has contributed substantially to the design of three multistate and five local studies, have contributed participant interviews in all EHS-Net multistate studies, frequently exceeding the required sample size by 100%, and have led results through ≥20 publications and ≥13 scientific presentations by EHS-Net staff. This EHS-Net teamwork has contributed to the effectiveness and stability of EHS-Net as a meaningful national project and has encouraged discussion and awareness of EHS-Net in the public health community.
- Leadership was provided by Tennessee to the data analysis workgroup in the Leafy Green Handling study and Ill Food Handler study. An abstract of the Ill Food Handler study submitted by Tennessee was presented at the 2010 USDA Food Safety Education Conference. The finding of this study would encourage workers to stay at home when ill and could help public health agencies create more focused intervention strategies.
- EHS-Net staff designed the survey, pilot tested, and data is currently being collected in 50 establishments for the Cooling study, which is aimed to better understand potentially hazardous food cooling procedures among restaurants within the EHS-Net capture areas.
- In October 2011, Tennessee's EHS-Net staff collaborated with CDC, FDA, and eight other local health departments in an effort to better understand the contributing factors that lead to foodborne illness, by examining the relationship between kitchen managers' knowledge and attitudes, and their food safety practices through the "Kitchen Managers Certification Study". Within our catchment areas, 50 restaurants were visited for the study to compare food safety knowledge levels and attitudes of certified kitchen manager/person in charge (KM/PIC) and non-certified KM/PIC, and foodborne illness outbreak risk factors. Data has suggested that food safety certification is related to food safety knowledge, and receiving certification from an accredited organization is important. Additional analysis is ongoing for this study.

Environmental Health Specialist Network (EHS Net): Water

Programmatic Overview

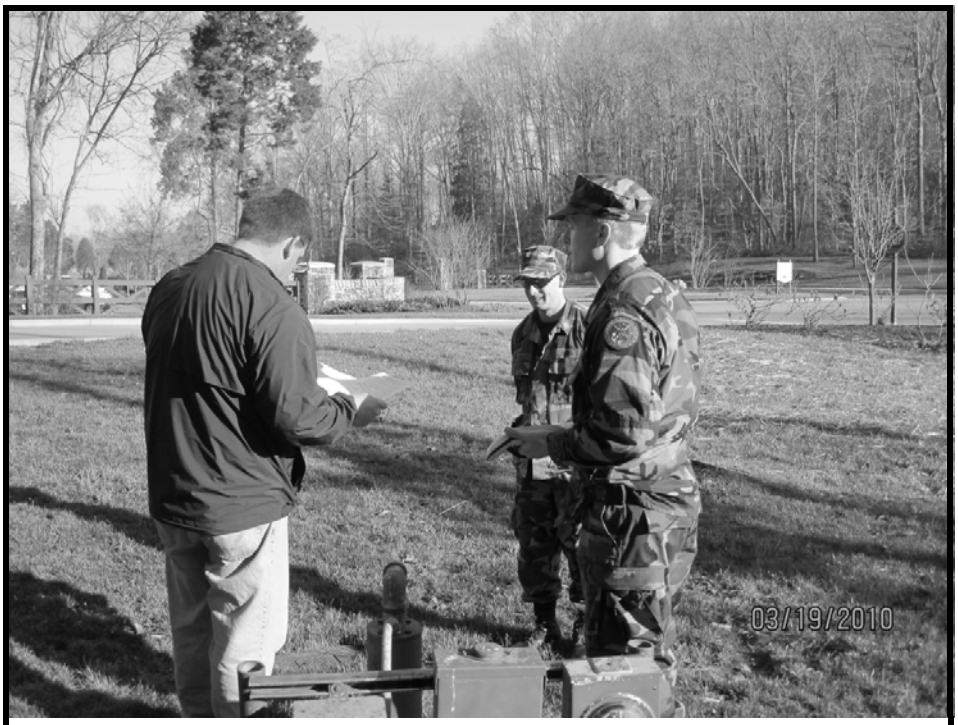
The Tennessee Department of Health (TDH) has been a participant in the Environmental Health Specialist Network (EHS-Net) Water since its inception in 2005. Our involvement in EHS-Net Water has increased our capacity to conduct waterborne outbreak response, increased our understanding of antecedents to water related illnesses, and improved communication within the state and regional health departments and among other agencies such as the Tennessee Department of Environment and Conservation (TDEC) and the Tennessee Department of Agriculture. Additionally, we are concerned with preventing waterborne outbreaks by promoting healthy swimming and swimming pool maintenance practices, by working with water regulatory agencies to promote safe drinking water supplies, by fully investigating potential waterborne illnesses and outbreaks, and by working on local and national levels to understand how environmental factors allow these outbreaks to occur.

Activities

Tennessee Projects:

- Purchased field and laboratory equipment for water sampling and analysis
- Conducted waterborne disease

outbreak training at 5 sites
- Evaluated public water system complaint logs under the Public Health Surveillance System Framework
- Hosted 2 U.S. Public Health Service Applied Public Health Team (APHT) Training events in 3 counties
- Conducted a computer assisted telephone drinking water survey
- Completing a multiyear study to understand the geographic disproportionality of cryptosporidiosis in Northeast Tennessee
- Building a Geographic Information System (GIS) of public water distribution systems and private water well locations



U.S. Public Health Service, Applied Public Health Team interviewing a water well owner.

Multisite Projects:
- Conducted a review of 35 years of waterborne outbreak reporting
- Created an integrated food and waterborne illness complaint form

Impact
- Prior to our involvement with EHS-Net Water, species of *Cryptosporidium* causing illness were not being identified. With the equipment made possible through EHS-Net, TDH Laboratory Services now has capacity to identify *Cryptosporidium* from stool and environmental samples and conduct polymerase chain reaction (PCR) analysis to determine species. In addition, with EHS-Net funds, we have purchased equipment to collect, filter, and analyze water samples. In 2011, we purchased a hand held water quality meter, peristaltic pump, photoionization detector and other supplies to collect water samples in the field. For the Nashville laboratory, a new liquid scintillation counter was purchased to detect radiologic contaminants from water samples. The scintillation counter is being used to evaluate radon levels from groundwater samples provided by public water systems in support of a study the TDEC Division of Water Resources is currently conducting and may be useful for private well samples in the future.
- During 2011, waterborne outbreak training was conducted in 5 sites and included state and regional environmental staff from the TDH and TDEC, and epidemiologic and laboratory staff from TDH. The purpose of these workshops was to elaborate on ways that the TDEC and TDH could collaborate during waterborne outbreaks. Having local and regional staff at the workshops, and hosting them at local venues, gave everyone involved the opportunity to meet and better understand their roles.
- During 2010, public water system complaint logs from 32 public water systems in middle Tennessee were reviewed as a public health surveillance tool for the early detection of waterborne illness and drinking water contamination under the guidelines of the Public Health Surveillance System Framework. The results of this evaluation reveal that the complaint log system does not allow use of this information as a standalone surveillance tool. However, with adjustment, the complaints could be useful as an early indicator of factors leading to possible waterborne disease. A written summary of the project was completed and shared with the TDEC including recommendations to improve complaint log usefulness in this regard.
- During 2010 and 2011, APHTs conducted over 1,200 door to door surveys to help delineate the sources of drinking water used by households. Geolocated were 400+ wells and maps of public water distribution systems.
- During 2010, a computer assisted telephone drinking water survey entitled *Knowledge, Attitudes, and*

Sampling water from Bee Spring for *Cryptosporidium*.

Behaviors Regarding the Water We Consume was administered to 2,000 Tennessee residents. Questions covered 4 broad categories: 1) drinking water sources; 2) home water treatment; 3) water safety concerns; and 4) demographics. Results from this survey demonstrate that the majority of Tennessee residents (90%) consume water from public water systems without further treatment, dispelling the thought that bottled water is the most popular drinking water of choice. Additionally, these survey results indicate that individuals using private well or spring water are unlikely to treat their water prior to drinking and believe it safe to drink. These results may be beneficial in targeting public health messaging in the future.

- In 2010, we began a multiyear study to investigate the geographic disproportionality of cryptosporidiosis reporting in Northeast Tennessee. Supplemental case forms were developed, laboratory equipment was purchased and stool samples from case patients were collected in support of this study. A geographic information system of cases in the northeast region was created to analyze ecologic and environmental data based on proximity of case patient address to each other and to potential environmental reservoirs. Leveraging results from a FoodNet laboratory survey with the enhanced cryptosporidiosis surveillance data indicated that the reported number of cases doubled after laboratories switched to rapid card assays. Preliminary results of this investigation indicate that beef cattle density and animal contact are generally greater in the northeast region of Tennessee. Preliminary findings were disseminated during a December 2012 NORS WASH Webinar Series and will be presented at the March 2013 Tennessee Environmental Conference.
- Building a GIS of public water distribution systems and private water well locations involves combining disparate sources of drinking water data into one geographic information system. Community water systems in the middle Tennessee area have been contacted by phone and e-mail to obtain digital or paper maps of public water distribution systems. Private water well data are being obtained from the TDEC water well database and mapped in the GIS. Having these data in a central location will provide additional resources to investigate illness related to contaminated drinking water and provide a means to prioritize outreach to private well users.
- During 2010, Tennessee led the EHS-Net workgroup calls to complete an integrated food and waterborne illness complaint form. This form provides an instrument for standardizing an initial interview with a person believed to have a food or waterborne illness. The form was shared with EHS-Net sites and the TDEC during 2011.
- As a multisite project, we conducted a review of 34 years of waterborne outbreak reporting during which we identified 30 waterborne disease outbreaks, 17 of which were previously unreported to CDC. The results of this retrospective study have been compiled and are being incorporated into a manuscript by our EHS-Net Water partners in Minnesota.

Section VI.
Public Health Emergency Preparedness Program

Emergency Preparedness (EP)

Programmatic Overview

The mission of EP is "*to prepare for, respond to and recover from health emergencies affecting the State of Tennessee*". Our vision is "*to be the top accredited public health preparedness program in the nation.*" EP mission critical activities are supported by an annual budget of ~$18M and ~110 staff statewide who pursue core values of Innovation, Responsiveness, Excellence and Integrity.

Activities

Mission critical activities include:

- planning, exercising, and responding to all-hazard events in coordination with local, state, and federal partners;
- maintaining capacity for rapid, mass distribution of medicine and medical supplies;
- increasing hospital preparedness, response and surge capacity;
- providing emergency health information quickly and effectively to all Tennesseans;
- coordinating Medical Reserve Corps (MRC) volunteer units;
- building epidemiologic surveillance and investigation capacity;
- supporting a comprehensive exercise program to test emergency response capacity;
- developing risk communication and dissemination strategies;
- improving fiscal and administrative readiness; and

Impact

The following are examples of program accomplishments and impacts on public health readiness:

- Late in September 2012, a cluster of life-threatening infections following epidural injection of methylprednisolone acetate (MPA) from a single compounding pharmacy was identified. On October 5, the State Health Operations Center (SHOC) was activated to support active surveillance, case investigation and provide at-risk communication and monitoring for ~1,100 Tennessee residents who received contaminated MPA. The SHOC was operational for more than three months to provide state-wide coordination of approximately 170 practitioners participating in this historical public health response.
- Statewide infrastructure was strengthened and readiness improved through procurement of three Mobile Emergency Operations Centers and upgrades to Regional Health Operations Centers.
- Technical Assistance Reviews are a measure of local readiness for dispensing of medical countermeasures to the public. From 2010 through 2012 the local and state scores have continued to improve demonstrating maturity of local planning and operational readiness. Statewide averages have improved from a score of 85 in 2010 to 90 in 2012.
- Tennessee Department of Health (TDH) can monitor medical materiel levels through the use of the Tennessee Countermeasure Response Network (TNCRN). The system has an inventory management module for tracking and managing inventory of disaster resources. This includes personal protective equipment, antiviral medications, other pharmaceuticals, and medical material from a variety of sources. Full deploy-

The State Health Operations Center (SHOC) was activated to coordinate the public health response to Tennesseans at risk of life-threatening fungal infections following contaminated steroid injection. Standing at the front are Commissioner John Dreyzehner and Governor Bill Haslam.

ment of the TNCRN Inventory Management system to Knox County Health Department has occurred. It includes 21 departments and over 90 daily users.

- In 2011 and 2012, EP partnered with the U.S. Marshals Service to provide convoy Security Training for local law enforcement personnel. This unique training strengthened partnerships and increased understanding of the procedures used during a public health emergency requiring deployment of the Strategic National Stockpile.
- An EP evaluation team participated in Flulapalooza held at Vanderbilt University Medical Center in 2012. Flulapalooza was designed to test the Medical Center's emergency mass vaccination plan and was awarded the Guinness World Record for the most vaccinations given in eight hours. Free flu vaccines were given to 12,850 University and Medical Center faculty, staff, volunteers and students during the daylong event. Nurses, 44 at a time from a labor pool of 138, worked simultaneously at individual stations in the Flulapalooza tent with a separate group of volunteers maintaining patient flow and logistics.
- EP continually works to improve and expand stakeholder information sharing and rapid alerting. In 2010, the Tennessee Health Alert Network (TNHAN) was used to generate 373 alerts at the state, regional and local levels. In 2011, the number of alerts increased to 400 and in 2012 they totaled 584 alerts. This increasing trend demonstrates success towards improving communications among stakeholders. Alerts involved multi-agency and multi-regional exercises, outbreaks, natural disasters, staff assembly, and response tests.
- In 2010, EP increased its multi-state alerting capability by achieving Public Health Information Network Certification for Cascade alerting and conducted tests with both State and CDC partners. In 2012, TNHAN moved to a virtual-based platform which greatly enhanced network security and stability. During 2010–2012, EP worked with first responder agencies to improve redundant 800MHz radio communications. This successfully provided the 13 public health regions direct contact to the Tennessee Emergency Management Agency, State Emergency Operations Center in Nashville.
- In May 2010, EP hired a dedicated coordinator for the Emergency Services for the Advance Registration of Volunteer Health Professionals (ESAR-VHP). In late 2011, ESAR-VHP was integrated with MRC to support public health initiatives in health, safety, and resiliency of local communities within Tennessee. MRC had a face lift in 2012—the volunteer web page was redesigned (http://health.state.tn.us/volunteer/index.shtml), outreach materials such as posters and information cards developed and distributed, and a system upgrade initialized.
- The Rapid Assessment of Populations Impacted by Disasters (RAPID) Team was formed to improve state disaster surveillance capabilities and build a cache of disaster surveillance tools. The team conducted four full-scale exercises in Knox, Cheatham and Davidson Counties , created a RAPID Toolkit with all of the necessary maps and assessment tools ready for quick team deployment, and trained more than 200 professionals to conduct post-disaster needs assessments.
- In October 2011, EP teamed with local, state and federal partners to rapidly investigate potential Strontium overexposure among Tennessee residents who previously received Cardiogen-82 Positron Emission Tomography. Information gained helped determine that improper usage of the CardioGen-82 generator contributed to excess radiation in patients from two states, rather than a generator defect affecting patients nationwide. The investigation team accomplished the unprecedented task of rapid radiation screening on a large number of TN residents. Experience gained enhanced our ability to respond to future radiologic events.
- Training and planning are critical elements of the EP program. The TNCAT exercise series, established in 2007, is an ongoing local and state government collaborative effort of planning, exercise and training. The TNCAT2k12 Full Scale Exercise was implemented to evaluate the Middle Tennessee Region's Communications, Emergency Operations Center Management, Hospital Surge, Triage and Treatment, and Logistics Operations capabilities. The full scale exercise involved numerous and diverse agencies including seven local emergency management agencies, 11 hospitals, and five state agencies.
- EP collaborated with the University of North Carolina's CDC-sponsored Preparedness and Emergency Response Learning Center to develop the Tennessee Disaster Support Network (TDSN) (http://health.state.tn.us/Ceds/

TNDisSup/index.htm) designed to assist Tennessee communities in meeting their needs before, during, and after a disaster. While TDH is working to ensure that *all* Tennessee residents and visitors are prepared to respond to a wide range of emergencies, individuals with functional needs may be disproportionately affected by a disaster. To close this gap, the TDSN website was designed to connect populations that have unique needs with the agencies that serve them.

- During 2010–2012, EP enhanced administrative preparedness and improved efficiency by providing technical assistance to Regional Health Departments for effective management of their respective budgets, resulting in an 80% reduction of unspent regional funds and implementing electronic invoices to reduce reimbursement times and cut administrative costs in half.
- In 2012, the TNCRN patient management module was tested in collaboration with the National Disaster Medical System (NDMS) and Memphis Emergency Managers. EP demonstrated the ability to track patient status and location in real time, using common data exchange specifications and across multiple jurisdictions. Patient data was successfully transmitted throughout the continuum of care from the originating state, through patient reception areas to Memphis NDMS hospitals using four disparate information technology systems, including TNCRN.

Section VII. Surveillance Systems and Informatics Program

Surveillance Systems and Informatics Program

Programmatic Overview

The Surveillance Systems and Informatics Program (SSIP) supports integrated disease surveillance activities for both reportable and non-reportable conditions and events across programs in the Communicable and Environmental Diseases & Emergency Preparedness (CEDEP) section of the Tennessee Department of Health (TDH). SSIP was formed in 2011, and promotes interoperability by facilitating the accurate and timely receipt and transfer of public health information to surveillance systems via accepted standards and vocabulary while maintaining data security. Currently comprised of epidemiologists and an administrative assistant, SSIP works closely with information technology partners, including surveillance system and EDI (Electronic Data Interchange) administrators and the Health Systems Architect. This collaboration allows TDH to provide public health investigators with the information needed for surveillance of ongoing and emerging public health threats through investigations and public health interventions. SSIP recognizes successful interoperability in TN as involving three primary aspects of effective communication across information systems and business uses: semantic understanding (vocabulary), syntactic agreement (communication structure), and business process understanding and workflow integration.

SSIP brought in the New Year and recognized the Systematized Nomenclature of Medicine with SNOMED the Snowman.

Activities

Integrated Disease Surveillance System

SSIP is responsible for the implementation and maintenance of TN's integrated disease surveillance system for communicable disease surveillance. The integrated surveillance solution used in TN is known as the National Electronic Disease Surveillance System (NEDSS) Base System (NBS), supplied by the Centers for Disease Control and Prevention (CDC). It allows investigators to look at a patient (not a disease) across time and condition or CEDEP program area. Currently this system is used for surveillance of general communicable diseases, including but not limited to tuberculosis, FoodNet activities, arboviral diseases in support of ArboNet, carbon monoxide poisoning, as well as non-reportable conditions such as latent tuberculosis infection. SSIP provides NBS support to both CEDEP program area staff and field staff throughout TN. SSIP aids in data management, builds data extracts, builds condition-specific NBS investigation pages using information standards, and creates and maintains training materials. Other integrated disease surveillance activities include electronic case reporting, refining and further adopting electronic laboratory reporting (ELR), implementation of decision support functionality, and STD surveillance system integration. SSIP also works closely with the CDC's NBS User Group, or NUG, consisting of 19 jurisdictions which utilize the NBS for integrated disease surveillance, to document system and integration requirements, oversee application development governance, perform application testing, and discuss and support integrated disease surveillance and electronic reporting practices across the NBS jurisdictions.

Informatics Support to CEDEP

SSIP provides support to program areas for other surveillance systems, including PRISM for STD surveillance and case management, eHARS for HIV/AIDS surveillance, and works closely with other informatics intensive projects such as Immunization Registry messaging, public health lab report messaging, and syndromic surveillance messaging. SSIP staff also work with program areas to analyze and document public health business processes. The program provides HL7 education and resources to other public health staff to support CEDEP activities. SSIP team members also work with internal and external partners toward implementation of standards-based messaging, including: electronic laboratory reporting, immunization registry queries, responses and updates, case notifications to CDC for nationally notifiable diseases, and electronic data interchange and interoperability with other health department systems, including blood lead surveillance and cancer reporting. Additionally, SSIP is working on the development of syndromic surveillance messaging and laying the groundwork to receive, process, and send electronic case and morbidity reports. Program

staff members continue to work with Tennessee Department of Health Laboratory Services toward implementation of electronic exchange of information, which includes sending and receiving of test orders and results (TOR) from our patient health record system and the lab's Laboratory Information Management System, as well as electronic laboratory results reports (ELR) for reportable lab events. Future work will include additional integrated disease surveillance activities particularly in regard to STD surveillance as well as working closely with CEDEP program experts to develop and utilize decision support capabilities in our integrated disease surveillance. SSIP works with TDH's Information Technology Services Division and external partners at the TN Office of eHealth Initiatives to increase electronic data transport by adopting and offering secure transport methodologies such as DIRECT transport and SOAP/web services to the state HISP (Health Information Service Providers).

TN Department of Health is long standing and active member of the ANSI accredited standards development organization Health Level Seven International (HL7).

Meaningful Use

SSIP provides support for and coordination of the public health aspects of CMS (Centers for Medicare and Medicaid Services) Meaningful Use Incentive Program using ONC (Office of the National Coordinator for Health Information Technology) Certified Electronic Health Record (EHR) technology (CEHRT). This initiative calls for the use of certified electronic health records to exchange electronic health information in a meaningful manner in order to improve the quality of health care and promote public health. Meaningful Use is an on-going initiative staged in cycles. Currently in Stage 1, eligible healthcare providers must choose one of three Public Health objectives, which focus on sharing immunization registry data, electronic laboratory results reports (ELR), and syndromic surveillance information with public health agencies. TDH accepts immunization registry data and ELR in order for eligible providers and hospitals to meet Meaningful Use objectives. TDH's active participation in the Meaningful Use Incentive program allows public health to develop more collaborative relationships with trading partners, provides opportunity for electronic data receipt and exchange, and encourages public health to improve efficient use of limited resources. Meaningful Use is an ambitious and fast-moving incentive program working toward implementation of EHR while encouraging interoperability among information systems in order to share meaningful information to improve individual health care, reduce overall healthcare costs, and ensure the public's health.

Electronic Laboratory Reporting (ELR)

As of June 2013, TDH has worked with 21 health systems representing 57 hospital laboratories to facilitate ELR for Stage 1 of Meaningful Use following the HL7 2.5.1 Implementation Guide for ELR. To date, 42 hospitals have successfully completed Meaningful Use testing for ELR. Although no hospitals are in production sending ELR to TDH, there are 14 hospitals that are working on final details and are close to full production submission. Two national laboratories, Lab Corp and Mayo, have been sending ELR data to the Department of Health following CDC's Health Level 7 International (HL7) based 2.3.1 Implemen-

tation guide for ELR since 2005. A third national laboratory, ARUP, began sending ELR data to TDH following the same specification for ELR in June 2012. Currently TDH is testing with Quest Diagnostics Atlanta and it is anticipated that Quest be moved to production by the end of 2013. In addition, TDH continues to work with the TN State Public Health Lab to implement ELR following the HL7 2.5.1 ELR Implementation Guide and will continue testing for production implementation during 2013-2014. Currently, roughly 33% of lab reports consumed by a TDH communicable disease surveillance system are received via ELR.

Impact

The Surveillance Systems and Informatics Program works to provide public health with the information needed to conduct investigations and public health interventions, allowing for surveillance of ongoing and emerging public health threats. TDH's readiness and willingness to be a meaningful participant in electronic health information exchange improves data quality through standardization and automation. It also promotes responsible use of limited personnel and financial resources by providing opportunities for eliminating unnecessary duplicate data entry across health record systems and public health systems. Furthermore, it improves decision making capabilities for patient health with increased validity and reliability of information used for the key public health activities of case detection, surveillance, disease investigation, and public health intervention.

SECTION VIII.
EPIDEMIC INTELLIGENCE SERVICE

Epidemic Intelligence Service

A critical function of the Centers for Disease Control and Prevention (CDC) is to investigate outbreaks and train Epidemiologists to serve our nation. Since 1951, the Epidemic Intelligence Service (EIS) has trained "shoe-leather" Epidemiologists to respond to the most urgent and serious public health threats in the world. The CDC EIS program was established following the start of the Korean War as an early warning system against biological warfare and man-made epidemics. The program was primarily made up of medical doctors but has grown to encompass a more representative and diverse set of researchers and scientists who serve in the two-year EIS assignments. Additionally, the EIS program of today has expanded into a surveillance and response unit for all types of epidemics, including chronic disease and injuries.

Since the first cold war EIS classes of the 1950's, CDC has trained nearly 3000 EIS officers who 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 disease eradication, describe disease transmission during outbreaks, and implement preventive measures to stop diseases. 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 typically include persons with advanced degrees and some training or interest in public health. Officers are assigned to positions either at the CDC. Some EIS officers have extensive clinical medicine training while others have strong biostatistics backgrounds. The program offers applied Epidemiology training to round out professional experience. CDC positions in Atlanta, Fort Collins, Morgantown or Cincinnati are available, or positions may be based at state health departments like the Tennessee Department of Health. In both CDC and state-based positions, EIS officers 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. During the period covered in this report, Rendi Murphree, PhD completed her assignment, and Jane Baumblatt joined the EIS in Tennessee.

Examples of recent EIS investigations in Tennessee include:

⇒ Surveillance for Guillain-Barré Syndrome during the National Influenza A (H1N1) 2009 Vaccination Campaign: U. S. Emerging Infections Program Sites

⇒ Adverse events associated with

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	2009-2011	Rendi Murphree, PhD, MS
1988-1990	Ban Mishu, MD	2011-	Jane Baumblatt, MD

intravitreal inoculation of bevacizumab in three patients with macular degeneration

⇒ Outbreak of Tuberculin Skin Test Conversion among Employees of an Elephant Sanctuary

⇒ Surveillance for a Possible Increase of Legionnaire's Disease Following Record Flooding

⇒ NCEH Health Studies Branch Pilot Study to Assess Flood-Related Well Water Contamination via Ultra-filtration

⇒ Acute Gastroenteritis among Students of Indian Lake Elementary School - Hendersonville, TN, 2010

⇒ Cluster of Acute Hepatitis C cases Among Inmates of a Federal Prison

⇒ Acute Gastroenteritis among NACCHO Conference Attendees

⇒ *Shigella flexneri* Infection among Men Who Have Sex with Men

⇒ Outbreak of Fungal Meningitis Associated with Spinal Injections

⇒ Evaluation and Data Analysis of the Tennessee Controlled Substances Monitoring Program

⇒ Attitudes of Tennessee Residents to Organic and GM Foods

Section IX.
Awards, Honors and Publications

Awards and Honors

Dr. John Dunn:
⇒ National Association of State Public Health Veterinarians (NASPHV), Treasurer, 2012

Brenda Eggert:
⇒ Tennessee Public Health Association (TPHA) Public Health Worker of the Year, 2012

Katie Garman:
⇒ FoodNet Star Award, 2012

Carter Garner:
⇒ Lynn B. Hearn Award, 2012-2013 Environmentalist of the Year, Tennessee Environmental Health Association

Dr. Samir Hanna:
⇒ FDA Award for participation in the National Antimicrobial Resistance Monitoring System (NARMS), 10 years
⇒ FDA Award for Outstanding Efforts in Record Maintenance and Data Sharing, 2012

Erin Holt:
⇒ HL7® V2.7 Control Specialist Certification, 2012

Dr. Marion Kainer:
⇒ One of the 10 Best Physicians of the year, Medscape, 2012
⇒ Tennessean of the Year (together with Dr. April Pettit), The Tennessean, 2012
⇒ Testified in front of the US Senate Health, Education, Labor and Pensions Committee, 2012
⇒ Commissioner's Award for Outstanding Service, Tennessee Department of Health, 2012
⇒ Distinguished Leadership Award, Council of State and Territorial Epidemiologists, 2012
⇒ Tennessee and New York tied for first place for "Most Collaborative Healthcare-Associated Infections State Program", Division of Healthcare Quality and Promotion, 2011
⇒ Woman of Influence Award for Public Policy, Nashville Business Journal, 2011
⇒ HICPAC Liaison, 2010, 2011, 2012
⇒ Bull's Eye Award for Innovation and Excellence for the Tennessee Web Immunization System H1N1 Provider Pre-Registration System, Association of Immunization Managers (along with Dr. Kelly Moore), 2010
⇒ Immunization Excellence Award: Honorable Mention for Overall Season Activities, National Influenza Vaccine Summit (along with Dr. Kelly Moore), 2010

Lori LeMaster:
⇒ National Conference for Food Protection, Chairman, 2012-2013

Dr. Kelly L. Moore:
⇒ Association of Immunization Managers (AIM) Natalie J. Smith Memorial Award for Outstanding Program Management, 2012
⇒ AIM's liaison member of the Federal Advisory Committee on Immunization Practices (ACIP), 2011
⇒ TN Chapter of the American Academy of Pediatrics "Friend of Children" Award, 2010

Dr. Rendi Murphree:
⇒ CDC, H1N1 Incident Manager, Certificate and Honor Coin, 2012
⇒ Outstanding Unit Citation, 2010, 2011, 2012
⇒ Unit Commendation, 2010, 2011, 2012
⇒ Achievement Medal, 2011
⇒ CDC, National Center for Emerging and Zoonotic Infectious Diseases, Honor Award, 2010

Dr. Paul Petersen:
⇒ CDC Region IV SNS Leadership Award, 2012
⇒ Federal Computer Week Top Federal 100 Award, 2011

CDR Jay Roth:
⇒ CDC, H1N1 Incident Manager, Certificate and Honor Coin, 2012
⇒ Achievement Medal, 2010
⇒ Outstanding Unit Citation, 2010
⇒ Unit Commendation, 2010

Thom Shavor
⇒ Secretary of AIDS Coalition

Craig Shepherd:
⇒ Walter S. Mangold Award, 2011
⇒ Davis Calvin Wagner Sanitarian Award, 2011

Dr. Jon Warkentin:
⇒ National Tuberculosis Controllers Association (NTCA), President, 2012-2013

Publications, Posters, and Presentations

Active Bacterial Core Surveillance (ABCs):
Cohen AL, Taylor T, Farley MM, Schaffner W, Lesher LJ, Gershman KA, Bennett NM, Reingold A, Thomas A, Baumbach J, Harrison LH, Petit S, Beall B, Zell E, Moore M and the Active Bacterial Core Surveillance Team. An assessment of the screening method to evaluate vaccine effectiveness: The case of 7-valent pneumococcal conjugate vaccine in the United

States. 2012; PLoS ONE 7 (8):e47185.doi:10.137/journal pone.0041785.

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MacNeil JR, Cohn AC, Farley M, Mair R, Baumbach J, Bennett N, Gershman K, Harrison LH, Lynfield R, Petit S, Reingold A, Schaffner W, Thomas A, Coronado F, Zell ER, Mayer LW, Clark TA, Messonnier NE. Current epidemiology and trends in invasive *Haemophilus influenz*a disease – United States, 1989-2008. Clin Infect Dis 2011; 53:1230-1236.

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Burton DC, Flannery B, Bennett NM, Farley MM, Gershman K, Harrison LH, Lynfield R, Petit S, Reingold AL, Schaffner W, Thomas A, Plikaytis BD, Rose CE, Whitney CG, Schuchat A for the Active Bacterial Core Surveillance/Emerging Infections Program Network. Socioeconomic and racial/ethnic disparities in the incidence of bacteremic pneumonia among U.S. adults. Am J Pub Health 2010; 100:1904-1911.

Cohn AC, MacNeil JR, Harrison LH, Hatcher C, Jordan T, Schmidt M, Pondo T, Arnold KE, Baumbach J, Bennett N, Craig AS, Farley M, Gershman K, Petit S, Lynfield R, Reingold A, Schaffner W, Shutt KA, Zell ER, Mayer LW, Clark T, Stephens D, Messonnier NE. Changes in *Neisseria meningitidis* disease epidemiology in the United States, 1998-2007: implications for prevention of meningococcal disease. Clin Infect Dis 2010; 50: 184-191.

Cohen AL, Harrison LH, Farley MM, Reingold AL, Hadler J, Schaffner W, Lynfield R, Thomas AR, Campsmith M, Li J, Schuchat A, Moore MR and the Active Bacterial core surveillance team. Prevention of invasive pneumococcal disease among HIV-infected adults in the era of childhood pneumococcal immunization. AIDS 2010; 24:2253-2262.

Goins WP, Talbot TR, Schaffner W, Edwards KM, Craig AS, Schrag SJ, VanDyke MK, Griffin MR. Adherence to perinatal Group B streptococcal prevention guidelines. Obstet Gynecol 2010; 115:1217-1224.

MacFarquhar JK, Jones TF, Woron AM, Kainer MA, Whitney CG, Beall B, Schrag SJ, Schaffner W. Outbreak of late-onset Group B streptococcus in a neonatal intensive care unit. Am J Infect Cont 2010; 38:283-288.

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Poehling KA, Light LS, Rhodes M, Snively BM, Halasa NB, Mitchel E, Schaffner W, Craig AS, Griffin MR. Sickle cell trait, hemoglobin C trait, and invasive pneumococcal disease. Epidemiology 2010; 21:340-346.

Foodborne Diseases Active Surveillance Network (FoodNet):
Clogher P, Hurd S, Hoefer D, Hadler JL, Pasutti L, Cosgrove S, Segler S, Tobin-D'Angelo M, Nicholson C, Booth H, Garman K, Mody R, Gould LH. Assessment of physician knowledge and practices concerning STEC infection and enteric illness, 2009, FoodNet. Clin Inf Dis 2012; 54 (suppl 5): S446-S452 doi:10.193/cid/cis246.

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Hurd S, Patrick M, Hatch J, Clogher P, Wymore K, Cronquist AB, Segler S, Robinson T, Hanna S, Smith G, Fitzgerald C. Clinical laboratory practices for the isolation and identification of *Campylobacter* in foodborne diseases, Active Surveillance Network (FoodNet) Sites: Baseline information for understanding changes in surveillance data. Clin Infect Dis. 2012: 54 (suppl 5): S440-S445 doi:10.1093/cid/cis245.

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Jones, TF, Gerner-Smidt P. Nonculture diagnostics for acute gastroenteritis: new challenges, new opportunities. (Editorial). Emerg Infect Dis 2012:18:513-514.

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Manikonda K, Palmer A, Wymore K, McMillian M, Nicholson C, Hurd S, Hoefer D, Tobin-D'Angleo M, Cosgove S, Lyons C, Lathrop S, Hedican E, Patrick M. Validating deaths reported in the Foodborne Diseases Active Surveillance Network: are all deaths being captured: Clin Infect Dis 2012; 54 (Suppl 5): S421-S423 doi:10.1093/cid/cis266.

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The key to reducing the burden for healthcare facilities in reporting and preventing healthcare-associated infections. Council of State and Territorial Epidemiologists (CSTE) annual conference, Omaha, NE, June 3-7, 2012 (poster).

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