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Achievements in Public Health, 1900–1999

Fluoridation of Drinking Water to Prevent Dental Caries

Fluoridation of community drinking water is a major factor responsible for the decline in dental caries (tooth decay) during the second half of the 20th century. The history of water fluoridation is a classic example of clinical observation leading to epidemiologic investigation and community-based public health intervention. Although other fluoride-containing products are available, water fluoridation remains the most equitable and cost-effective method of delivering fluoride to all members of most communities, regardless of age, educational attainment, or income level.

Dental Caries

Dental caries is an infectious, communicable, multifactorial disease in which bacteria dissolve the enamel surface of a tooth (*1*). Unchecked, the bacteria then may penetrate the underlying dentin and progress into the soft pulp tissue. Dental caries can result in loss of tooth structure and discomfort. Untreated caries can lead to incapacitating pain, a bacterial infection that leads to pulpal necrosis, tooth extraction and loss of dental function, and may progress to an acute systemic infection. The major etiologic factors for this disease are specific bacteria in dental plaque (particularly *Streptococcus mutans* and lactobacilli) on susceptible tooth surfaces and the availability of fermentable carbohydrates.

At the beginning of the 20th century, extensive dental caries was common in the United States and in most developed countries (*2*). No effective measures existed for preventing this disease, and the most frequent treatment was tooth extraction. Failure to meet the minimum standard of having six opposing teeth was a leading cause of rejection from military service in both world wars (*3,4*). Pioneering oral epidemiologists developed an index to measure the prevalence of dental caries using the number of decayed, missing, or filled teeth (DMFT) or decayed, missing, or filled tooth surfaces (DMFS) (*5*) rather than merely presence of dental caries, in part because nearly all persons in most age groups in the United States had evidence of the disease. Application of the DMFT index in epidemiologic surveys throughout the United States in the 1930s and 1940s allowed quantitative distinctions in dental caries experience among communities—an innovation that proved critical in identifying a preventive agent and evaluating its effects.

Fluoridation — Continued

History of Water Fluoridation

Soon after establishing his dental practice in Colorado Springs, Colorado, in 1901, Dr. Frederick S. McKay noted an unusual permanent stain or "mottled enamel" (termed "Colorado brown stain" by area residents) on the teeth of many of his patients (*6*). After years of personal field investigations, McKay concluded that an agent in the public water supply probably was responsible for mottled enamel. McKay also observed that teeth affected by this condition seemed less susceptible to dental caries (*7*).

Dr. F. L. Robertson, a dentist in Bauxite, Arkansas, noted the presence of mottled enamel among children after a deep well was dug in 1909 to provide a local water supply. A hypothesis that something in the water was responsible for mottled enamel led local officials to abandon the well in 1927. In 1930, H. V. Churchill, a chemist with Aluminum Company of America, an aluminum manufacturing company that had bauxite mines in the town, used a newly available method of spectrographic analysis that identified high concentrations of fluoride (13.7 parts per million [ppm]) in the water of the abandoned well (*8*). Fluoride, the ion of the element fluorine, almost universally is found in soil and water but generally in very low concentrations (<1.0 ppm). On hearing of the new analytic method, McKay sent water samples to Churchill from areas where mottled enamel was endemic; these samples contained high levels of fluoride (2.0–12.0 ppm).

The identification of a possible etiologic agent for mottled enamel led to the establishment in 1931 of the Dental Hygiene Unit at the National Institute of Health headed by Dr. H. Trendley Dean. Dean's primary responsibility was to investigate the association between fluoride and mottled enamel (see box). Adopting the term "fluorosis" to replace "mottled enamel," Dean conducted extensive observational epidemiologic surveys and by 1942 had documented the prevalence of dental fluorosis for much of the United States (*9*). Dean developed the ordinally scaled Fluorosis Index to classify this condition. Very mild fluorosis was characterized by small, opaque "paper white" areas affecting ≤25% of the tooth surface; in mild fluorosis, 26%–50% of the tooth surface was affected. In moderate dental fluorosis, all enamel surfaces were involved and susceptible to frequent brown staining. Severe fluorosis was characterized by pitting of the enamel, widespread brown stains, and a "corroded" appearance (*9*).

Dean compared the prevalence of fluorosis with data collected by others on dental caries prevalence among children in 26 states (as measured by DMFT) and noted a strong inverse relation (*10*). This cross-sectional relation was confirmed in a study of 21 cities in Colorado, Illinois, Indiana, and Ohio (*11*). Caries among children was lower in cities with more fluoride in their community water supplies; at concentrations >1.0 ppm, this association began to level off. At 1.0 ppm, the prevalence of dental fluorosis was low and mostly very mild.

The hypothesis that dental caries could be prevented by adjusting the fluoride level of community water supplies from negligible levels to 1.0–1.2 ppm was tested in a prospective field study conducted in four pairs of cities (intervention and control) starting in 1945: Grand Rapids and Muskegon, Michigan; Newburgh and Kingston, New York; Evanston and Oak Park, Illinois; and Brantford and Sarnia, Ontario, Canada. After conducting sequential cross-sectional surveys in these communities over 13–15 years, caries was reduced 50%–70% among children in the communities with fluoridated water (*12*). The prevalence of dental fluorosis in the intervention

Fluoridation — Continued

H. Trendley Dean, D.D.S.

In 1931, dental surgeon and epidemiologist H. Trendley Dean (August 25, 1893–May 13, 1962) set out to study the harm that too much fluoride could do; however, his work demonstrated the good that a little fluoride could do.

Henry Trendley Dean grew up in East St. Louis, and received his D.D.S. from the St. Louis University School of Dentistry in 1916. After 1 year in private practice, Dean joined the Army, serving in a number of military camps stateside before going to France. In 1919, Captain Dean returned to private practice, but 2 years later joined the Public Health Service as acting assistant dental surgeon. During the next 10 years he served in Marine hospitals around the country, studied for a year at Boston University, and developed a reputation as both a skilled dental surgeon and researcher. In 1931, Dean became the first dental scientist at the National Institute of Health, advancing to director of the dental research section in 1945. After World War II, he directed epidemiologic studies for the Army in Germany. When Congress established the National Institute of Dental Research (NIDR) in 1948, Dean was appointed its director, a position he held until retiring in 1953.

The National Institute of Health (NIH) had hired Dean in 1931 to conduct a major study of mottled enamel. The team that Dean assembled reflected an interdisciplinary approach. The study required accurate assays of fluoride in water, so he enlisted Dr. Elias Elvove, senior chemist at NIH, who developed a technique for measuring the presence of fluoride in water to an accuracy of 0.1 ppm. He also hired experts in animal dentistry, dental pathology, and water chemistry. As accurate data on the incidence of fluorosis emerged, the apparent correlation between mottled teeth and lower caries rates grew more compelling. As early as 1932, Dean observed that individuals in an area where mottled teeth was endemic demonstrated "a lower incidence of caries than individuals in some nearby non-endemic area." By 1938, determining the prophylactic properties of fluoride became the study's primary focus.

Dean's legacy comes almost entirely from his association with the introduction of fluoridation, yet fluoride constituted only a small part of his professional activities. He also studied the effects of radium poisoning on alveolar bone; developed a program to study the prevention and cure of Vincent's angina (trench mouth); and undertook various studies of the causes, prevention, and cure of dental caries. More important, he played a major role in shaping federal participation in basic dental science research at the NIDR, integrating investigations of dental health into mainstream medical research. As he stated in a national radio address in 1950: "We can't divorce the mouth from the rest of the body."

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Fluoridation — Continued

communities was comparable with what had been observed in cities where drinking water contained natural fluoride at 1.0 ppm. Epidemiologic investigations of patterns of water consumption and caries experience across different climates and geographic regions in the United States led in 1962 to the development of a recommended optimum range of fluoride concentration of 0.7–1.2 ppm, with the lower concentration recommended for warmer climates (where water consumption was higher) and the higher concentration for colder climates (*13*).

The effectiveness of community water fluoridation in preventing dental caries prompted rapid adoption of this public health measure in cities throughout the United States. As a result, dental caries declined precipitously during the second half of the 20th century. For example, the mean DMFT among persons aged 12 years in the United States declined 68%, from 4.0 in 1966–1970 (*14*) to 1.3 in 1988–1994 (CDC, unpublished data, 1999) (Figure 1). The American Dental Association, the American Medical Association, the World Health Organization, and other professional and scientific organizations quickly endorsed water fluoridation. Knowledge about the benefits of water fluoridation led to the development of other modalities for delivery of fluoride, such as toothpastes, gels, mouth rinses, tablets, and drops. Several countries in Europe and Latin America have added fluoride to table salt.

Effectiveness of Water Fluoridation

Early studies reported that caries reduction attributable to fluoridation ranged from 50% to 70%, but by the mid-1980s the mean DMFS scores in the permanent dentition of children who lived in communities with fluoridated water were only 18% lower than among those living in communities without fluoridated water (*15*). A review of studies on the effectiveness of water fluoridation conducted in the United States during 1979–1989 found that caries reduction was 8%–37% among adolescents (mean: 26.5%) (*16*).

Since the early days of community water fluoridation, the prevalence of dental caries has declined in both communities with and communities without fluoridated water in the United States. This trend has been attributed largely to the diffusion of fluoridated water to areas without fluoridated water through bottling and processing of foods and beverages in areas with fluoridated water and widespread use of fluoride toothpaste (*17*). Fluoride toothpaste is efficacious in preventing dental caries, but its effectiveness depends on frequency of use by persons or their caregivers. In contrast, water fluoridation reaches all residents of communities and generally is not dependent on individual behavior.

Although early studies focused mostly on children, water fluoridation also is effective in preventing dental caries among adults. Fluoridation reduces enamel caries in adults by 20%–40% (*16*) and prevents caries on the exposed root surfaces of teeth, a condition that particularly affects older adults.

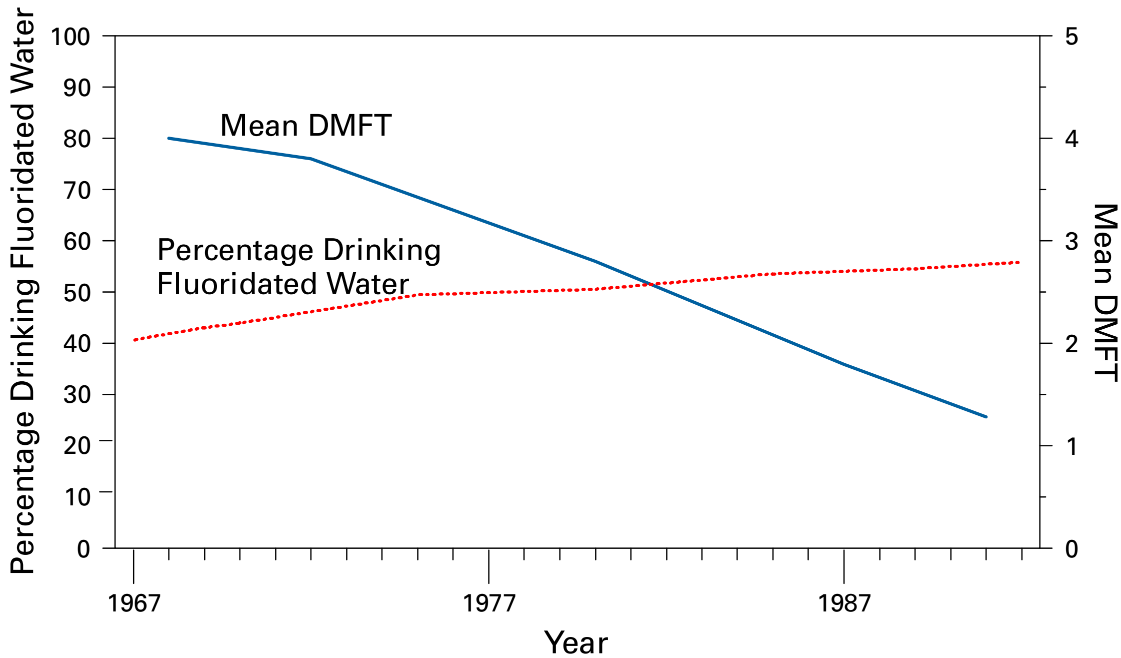
Water fluoridation is especially beneficial for communities of low socioeconomic status (*18*). These communities have a disproportionate burden of dental caries and have less access than higher income communities to dental-care services and other sources of fluoride. Water fluoridation may help reduce such dental health disparities.

Biologic Mechanism

Fluoride's caries-preventive properties initially were attributed to changes in enamel during tooth development because of the association between fluoride and

Fluoridation — Continued

FIGURE 1. Percentage of population residing in areas with fluoridated community water systems and mean number of decayed, missing (because of caries), or filled permanent teeth (DMFT) among children aged 12 years — United States, 1967–1992



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5. CDC, unpublished data, third National Health and Nutrition Examination Survey, 1988–1994.

cosmetic changes in enamel and a belief that fluoride incorporated into enamel during tooth development would result in a more acid-resistant mineral. However, laboratory and epidemiologic research suggests that fluoride prevents dental caries predominately after eruption of the tooth into the mouth, and its actions primarily are topical for both adults and children (*1*). These mechanisms include 1) inhibition of demineralization, 2) enhancement of remineralization, and 3) inhibition of bacterial activity in dental plaque (*1*).

Enamel and dentin are composed of mineral crystals (primarily calcium and phosphate) embedded in an organic protein/lipid matrix. Dental mineral is dissolved readily by acid produced by cariogenic bacteria when they metabolize fermentable

Fluoridation — Continued

carbohydrates. Fluoride present in solution at low levels, which becomes concentrated in dental plaque, can substantially inhibit dissolution of tooth mineral by acid.

Fluoride enhances remineralization by adsorbing to the tooth surface and attracting calcium ions present in saliva. Fluoride also acts to bring the calcium and phosphate ions together and is included in the chemical reaction that takes place, producing a crystal surface that is much less soluble in acid than the original tooth mineral (*1*).

Fluoride from topical sources such as fluoridated drinking water is taken up by cariogenic bacteria when they produce acid. Once inside the cells, fluoride interferes with enzyme activity of the bacteria and the control of intracellular pH. This reduces bacterial acid production, which directly reduces the dissolution rate of tooth mineral (*19*).

Population Served by Water Fluoridation

By the end of 1992, 10,567 public water systems serving 135 million persons in 8573 U.S. communities had instituted water fluoridation (*20*). Approximately 70% of all U.S. cities with populations of >100,000 used fluoridated water. In addition, 3784 public water systems serving 10 million persons in 1924 communities had natural fluoride levels ≥0.7 ppm. In total, 144 million persons in the United States (56% of the population) were receiving fluoridated water in 1992, including 62% of those served by public water systems. However, approximately 42,000 public water systems and 153 U.S. cities with populations ≥50,000 have not instituted fluoridation.

Cost Effectiveness and Cost Savings of Fluoridation

Water fluoridation costs range from a mean of 31 cents per person per year in U.S. communities of >50,000 persons to a mean of $2.12 per person in communities of <10,000 (1988 dollars) (*21*). Compared with other methods of community-based dental caries prevention, water fluoridation is the most cost effective for most areas of the United States in terms of cost per saved tooth surface (*22*).

Water fluoridation reduces direct health-care expenditures through primary prevention of dental caries and avoidance of restorative care. Per capita cost savings from 1 year of fluoridation may range from negligible amounts among very small communities with very low incidence of caries to $53 among large communities with a high incidence of disease (CDC, unpublished data, 1999). One economic analysis estimated that prevention of dental caries, largely attributed to fluoridation and fluoride-containing products, saved $39 billion (1990 dollars) in dental-care expenditures in the United States during 1979–1989 (*23*).

Safety of Water Fluoridation

Early investigations into the physiologic effects of fluoride in drinking water predated the first community field trials. Since 1950, opponents of water fluoridation have claimed it increased the risk for cancer, Down syndrome, heart disease, osteoporosis and bone fracture, acquired immunodeficiency syndrome, low intelligence, Alzheimer disease, allergic reactions, and other health conditions (*24*). The safety and effectiveness of water fluoridation have been re-evaluated frequently, and no credible evidence supports an association between fluoridation and any of these conditions (*25*).

Fluoridation — Continued

21st Century Challenges

Despite the substantial decline in the prevalence and severity of dental caries in the United States during the 20th century, this largely preventable disease is still common. National data indicate that 67% of persons aged 12–17 years (*26*) and 94% of persons aged ≥18 years (*27*) have experienced caries in their permanent teeth.

Among the most striking results of water fluoridation is the change in public attitudes and expectations regarding dental health. Tooth loss is no longer considered inevitable, and increasingly adults in the United States are retaining most of their teeth for a lifetime (*12*). For example, the percentage of persons aged 45–54 years who had lost all their permanent teeth decreased from 20.0% in 1960–1962 (*28*) to 9.1% in 1988–1994 (CDC, unpublished data, 1999). The oldest post-World War II "baby boomers" will reach age 60 years in the first decade of the 21st century, and more of that birth cohort will have a relatively intact dentition at that age than any generation in history. Thus, more teeth than ever will be at risk for caries among persons aged ≥60 years. In the next century, water fluoridation will continue to help prevent caries among these older persons in the United States.

Most persons in the United States support community water fluoridation (*29*). Although the proportion of the U.S. population drinking fluoridated water increased fairly quickly from 1945 into the 1970s, the rate of increase has been much lower in recent years. This slowing in the expansion of fluoridation is attributable to several factors: 1) the public, some scientists, and policymakers may perceive that dental caries is no longer a public health problem or that fluoridation is no longer necessary or effective; 2) adoption of water fluoridation can require political processes that make institution of this public health measure difficult; 3) opponents of water fluoridation often make unsubstantiated claims about adverse health effects of fluoridation in attempts to influence public opinion (*24*); and 4) many of the U.S. public water systems that are not fluoridated tend to serve small populations, which increases the per capita cost of fluoridation. These barriers present serious challenges to expanding fluoridation in the United States in the 21st century. To overcome the challenges facing this preventive measure, public health professionals at the national, state, and local level will need to enhance their promotion of fluoridation and commit the necessary resources for equipment, personnel, and training.

Reported by Div of Oral Health, National Center for Chronic Disease Prevention and Health Promotion, CDC.

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Fluoridation — Continued

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Progress Toward Poliomyelitis Eradication — Nepal, 1996–1999

In 1988, the World Health Assembly resolved to eradicate poliomyelitis globally by 2000 (*1*). In 1996, following the lead established by other countries of the South-East Asia Region (SEAR)*, Nepal accelerated polio eradication strategies by initiating National Immunization Days (NIDs)†. This report summarizes Nepal's progress toward polio eradication, focusing on the implementation of supplemental vaccination activities, the role of designated surveillance officers in the establishment of surveillance for polio eradication, and Nepal's plans for intensified supplemental vaccination to meet the 2000 eradication target (*2*).

Routine and Supplemental Vaccination Programs

Nepal's national routine vaccination coverage with three doses of oral poliovirus vaccine (OPV3) was reported to be 83% in 1996, 81% in 1997, and 83% in 1998 (*3*). However, estimates from an independent cluster survey in 1998 indicated that national OPV3 coverage was 70% (*4*). Of Nepal's 75 districts, 60 were included in the survey; of these, the 30 districts in the densely populated Terai plains along Nepal's southern border with India had lower OPV3 coverage (60%) than the 30 surveyed districts in the northern hill/mountain belt (79%) (*4*).

Since 1996, NIDs have been conducted in Nepal on one day each in December and January during the low season for poliovirus transmission. NIDs during 1996–1997, 1997–1998, and 1998–1999 targeted children aged <5 years, and reached 97%, 96%, and 95% of the target population (3.9 million), respectively. Nepal's NIDs have been synchronized with NIDs in other countries of south and east Asia, including Bangladesh, Bhutan, China, India, Myanmar, Pakistan, and Thailand (*5–8*).

Acute Flaccid Paralysis (AFP) Surveillance

AFP surveillance in Nepal was initiated in 1995 with passive reporting of AFP cases through the Early Warning Reporting System, a sentinel system for surveillance of six target diseases§. An expanded nationwide AFP surveillance system was established in July 1998 with the training and deployment of six designated Nepali regional surveillance officers (RSOs). These officers conduct active surveillance for AFP cases in government and private health-care facilities and provide training, technical assistance, and logistic support for polio eradication activities in their regions. Weekly and monthly reporting sites have been recruited since July 1998, and the reporting network continues to expand through inclusion of more peripheral health facilities.

AFP surveillance is evaluated by two key indicators: the sensitivity of reporting (target: one nonpolio AFP case per 100,000 population aged <15 years) and the completeness of stool specimen collection (target: two stool samples collected within 14 days of paralysis onset). The annualized nonpolio AFP rate increased from 0.2 in 1996 to 1.6 among children aged <15 years in 1999 (Table 1). The isolation rate of

*SEAR comprises Bangladesh, Bhutan, Democratic Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, and Thailand.

†Mass vaccination campaigns over a short period (days to weeks) in which two doses of oral poliovirus vaccine are administered to all children in the target group (usually aged <5 years), regardless of previous vaccination history, with an interval of 4–6 weeks between doses.

§Surveillance is conducted for neonatal tetanus, measles, acute flaccid paralysis, kala azar, malaria, and Japanese encephalitis.

Poliomyelitis Eradication — Continued

TABLE 1. Performance indicators for acute flaccid paralysis (AFP) surveillance — Nepal, 1996–1999

Indicator	Target	1996	1997	1998	1999*
Total AFP rate†	—	0.18	0.40	0.74	2.41
Nonpolio AFP rate§	≥1	0.2	0.26	0.41	1.60
Two stool specimens¶	≥80%	7%	33%	35%	79%
60-day follow-up	≥80%	47%	75%	100%	88%
Total poliomyelitis cases**	—	9	12	31	18
Wild poliovirus	—	1	1	0	0

* Annualized as of September 15, 1999.
† Total poliomyelitis cases + nonpolio AFP cases + cases pending classification per 100,000 children aged <15 years.
§ Number of nonpolio AFP cases per 100,000 children aged <15 years.
¶ Two stool samples collected within 14 days of paralysis onset.
** Nepal uses the World Health Organization clinical classification system.

nonpolio enteroviruses from stool specimens, a measure of specimen condition and laboratory performance, was 33% in 1998 and 28% as of September 15, 1999.

Confirmed Polio Cases

Nepal uses the World Health Organization (WHO) clinical system for classification¶ of polio cases. During 1998, of 69 reported AFP cases, 31 (45%) were confirmed as polio and 38 (55%) as nonpolio AFP (Figure 1). None of the 31 polio cases had collection of adequate stool specimens, and the classification of polio was made on clinical grounds (22 with residual weakness, four lost to follow-up, and five case-patients died before follow-up at 60 days). During 1999, of 164 reported AFP cases, 18 (11%) were classified as polio, 109 (66%) as nonpolio AFP, and 37 (23%) are pending classification (Table 1). The proportion of adequate stool specimens collected from AFP cases improved from 35% in 1998 to 79% in 1999, allowing a larger proportion of AFP cases to be classified as nonpolio AFP based on more accurate virologic information.

Isolation of Poliovirus

Intratypic differentiation identified wild poliovirus type 1 from one case in 1996 and one case in 1997 (Table 1). These numbers probably underestimate actual wild poliovirus circulation in Nepal because few AFP cases were reported or investigated before July 1998.

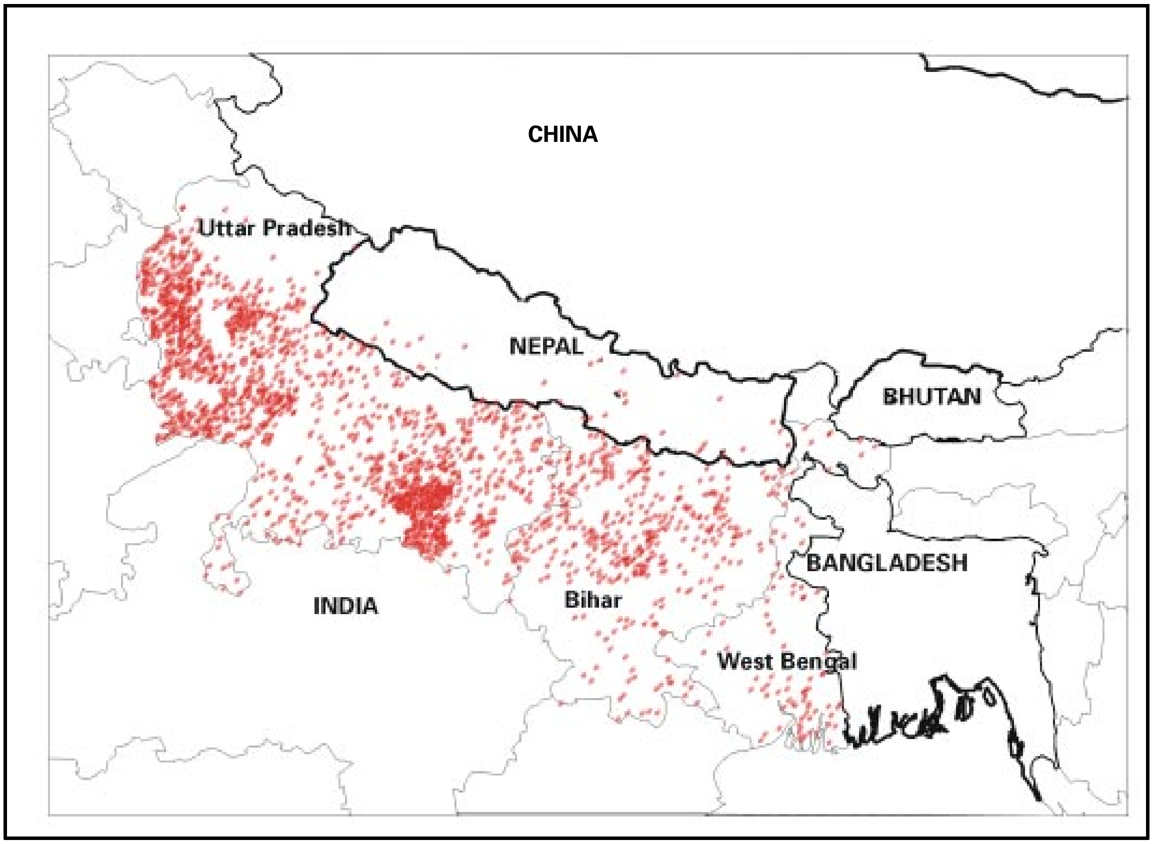
Reported by: Expanded Program on Immunization, Child Health Div, Ministry of Health, His Majesty's Government of Nepal; Expanded Program on Immunization, World Health Organization; United Nations Children's Fund National Office, Kathmandu. World Health Organization Regional Office of South East Asia, New Delhi, India. Global Program for Vaccines and Immunization, World Health Organization, Geneva, Switzerland. Respiratory and Enteric Viruses Br, Div of Viral and Rickettsial Diseases, National Center for Infectious Diseases; Vaccine Preventable Disease Eradication Div, National Immunization Program; State Br, Div of Applied Public Health Training, Epidemiology Program Office; and an EIS Officer, CDC.

Editorial Note: Nepal is a geographic buffer between India, the world's largest reservoir for poliovirus, and China, which has been polio-free since 1995. During 1998, 85% of the world's polioviruses were isolated from polio cases in India (WHO, unpublished data, 1999); Uttar Pradesh and Bihar, two large Indian states on Nepal's southern

¶ A confirmed case of polio has either wild poliovirus isolation, residual paralysis at 60 days after onset of paralysis, is lost to follow-up, or has died.

Poliomyelitis Eradication — Continued

FIGURE 1. Confirmed poliomyelitis cases — South-East Asia Region, 1998*



*Bangladesh, Bhutan, Democratic Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, and Thailand.

border, accounted for 54% of India's polioviruses isolated. Uttar Pradesh also was the site of three polio outbreaks during 1997–1999 (*7*). Residents of Nepal and India may cross borders without passport or visa, and persons from border communities with low vaccination coverage frequently migrate in both directions.

In Nepal, the most recent case of paralytic polio confirmed by wild poliovirus isolation in December 1997 occurred in an unvaccinated child residing in a border district. Another case that was clinically consistent with paralytic polio occurred in January 1999 in an Indian child who presented for care in southern Nepal, but from whom adequate stool specimens had not been collected. Because national surveillance for AFP has exceeded the international certification levels only since June 1999, confirmation of the absence of polioviruses is still pending.

OPV3 coverage of infants aged 12 months ranged from 39% to 80% in Nepal Terai districts spanning the Indian border (WHO, unpublished data, 1999). In addition to improved routine vaccination and NIDs, intensified supplemental and house-to-house vaccination targeting children aged <5 years is needed in areas at high risk for poliovirus transmission.

The polio eradication initiative is entering its most difficult and labor-intensive final phase. In a 1-year period, Nepal's RSOs developed a strong national AFP surveillance system (*7*). A factor contributing to rapid improvement of surveillance for polio

Poliomyelitis Eradication — Continued

eradication has been the participation of eight officers in the CDC Stop Transmission of Polio (STOP) initiative. STOP mobilizes additional trained personnel for 3-month polio eradication assignments in high-priority countries. STOP officers in Nepal worked with RSOs to strengthen AFP surveillance, plan NIDs and sub-NIDs, and mobilize other sectors in support of polio eradication.

Fewer than 440 days remain to reach the target for global polio eradication by the end of 2000. Substantial and rapid improvement in NIDs and AFP surveillance has brought Nepal closer to the goal of eradication**. Priorities for polio eradication in Nepal in 1999 and 2000 include 1) execution of high-quality NIDs and supplemental vaccination campaigns targeting high risk areas and populations (five monthly rounds will be synchronized with India during November 1999–March 2000); 2) maintenance of sensitive AFP surveillance, especially in the densely populated districts bordering India; and 3) improving routine OPV3 coverage.

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**The polio eradication initiative in Nepal is supported by His Majesty's Government of Nepal, WHO, Rotary International, United Nations Children's Fund, U.S. Agency for International Development, the governments of Norway and Japan, and CDC.

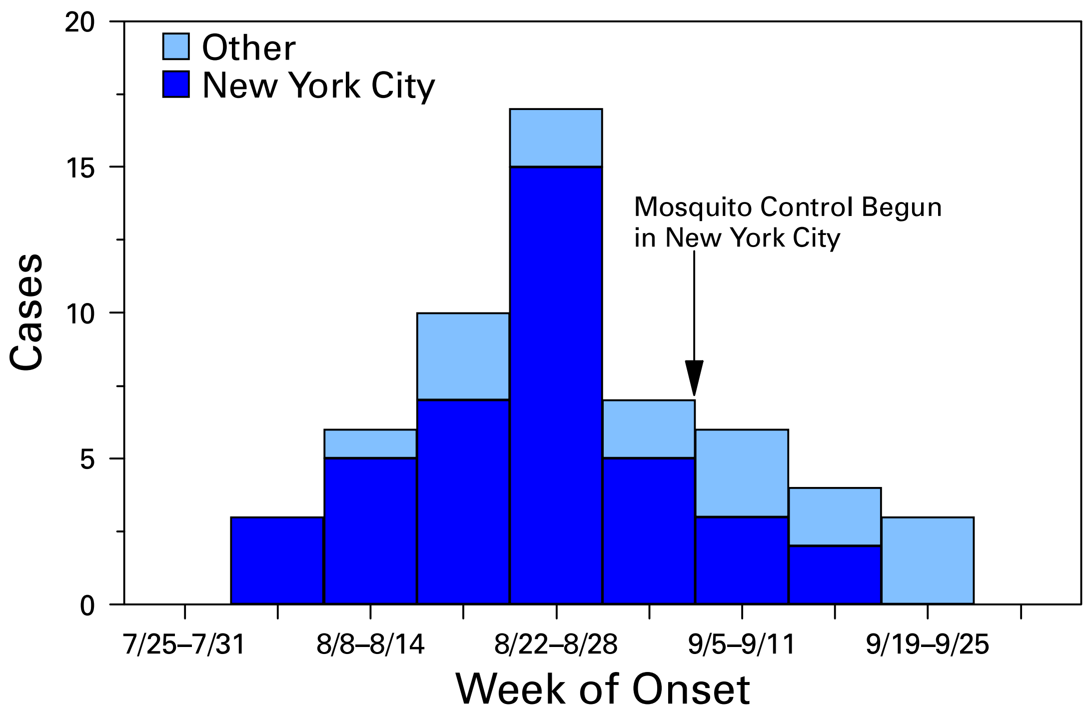
Update: West Nile Virus Encephalitis — New York, 1999

The West Nile virus (WNV) encephalitis outbreak continues to wane in the Northeast with the onset of cooler temperatures and continued vector-control operations. This report updates the progress of the ongoing investigation. Since the last published update (*1*), five additional domestic human cases and one international case have been identified. As of October 19, 56 (31 confirmed and 25 probable) cases of WNV infection have been identified, including seven deaths (Figure 1). The date of onset of the latest cases was September 22. The international case was a Canadian citizen who had visited the New York City (NYC) area in late August who had onset of fatal encephalitis on September 5. Active surveillance for human encephalitis cases in Connecticut and New Jersey has not detected any WNV cases.

Surveillance for WNV in mosquitoes and birds continues. As of October 19, 11 pools collected during September 12–October 4 of *Culex* spp. mosquitoes, positive for WNV, have been identified from NYC and Nassau and Suffolk counties. Pools of

West Nile Encephalitis — Continued

FIGURE 1. Number of seropositive cases of West Nile virus, by week of onset — New York, 1999



Culex and *Aedes vexans* mosquitoes collected during early to mid-September in Hudson County, New Jersey, tested positive for WNV by reverse transcriptase polymerase chain reaction (RT-PCR). Birds that tested positive for WNV now have been identified by RT-PCR on postmortem brain tissue from New York (NYC boroughs of Bronx, Brooklyn, Manhattan, Queens, and Staten Island; and Nassau, Orange, Rockland, Saratoga, Suffolk, and Westchester counties), New Jersey (Bergen, Burlington, Essex, Hudson, Hunterdon, Middlesex, Monmouth, Morris, Passaic, Somerset, Union, and Warren counties), and Connecticut (Fairfield County). In addition, postmortem brain tissue from birds from Fairfield and New Haven counties, Connecticut, have been reported as positive in culture for WNV by the Connecticut Department of Health. Although most WNV-positive birds have been American crows, infections also have been confirmed in other native species, including the ring-billed gull, yellow-billed cuckoo, rock dove, sandhill crane, fish crow, blue jay, bald eagle, laughing gull, black-crowned night heron, mallard, American robin, red-tailed hawk, and broad-winged hawk.

Laboratory studies conducted at CDC have identified the etiologic agent responsible for the human arboviral encephalitis outbreak in the NYC area as WNV. Confirmation of the genetic identity as WNV has been performed independently by collaborators at the United States Army Medical Research Institute for Infectious Diseases. WNV-specific gene sequences have been amplified by RT-PCR performed on RNA extracted from autopsy specimens (six case-patients). Sequences of genome fragments of WNV isolated from dead birds and mosquitoes are identical to gene sequences from the human autopsy specimens. Antigenic mapping of these isolates

West Nile Encephalitis — Continued

has been performed using a panel of monoclonal antibodies (Mabs) developed by CDC or provided by collaborators at the University of Queensland, Australia. These envelope (E)-glycoprotein specific Mabs, capable of distinguishing WN, Kunjin, and St. Louis encephalitis viruses, confirmed the sequence identification of these isolates as WNV.

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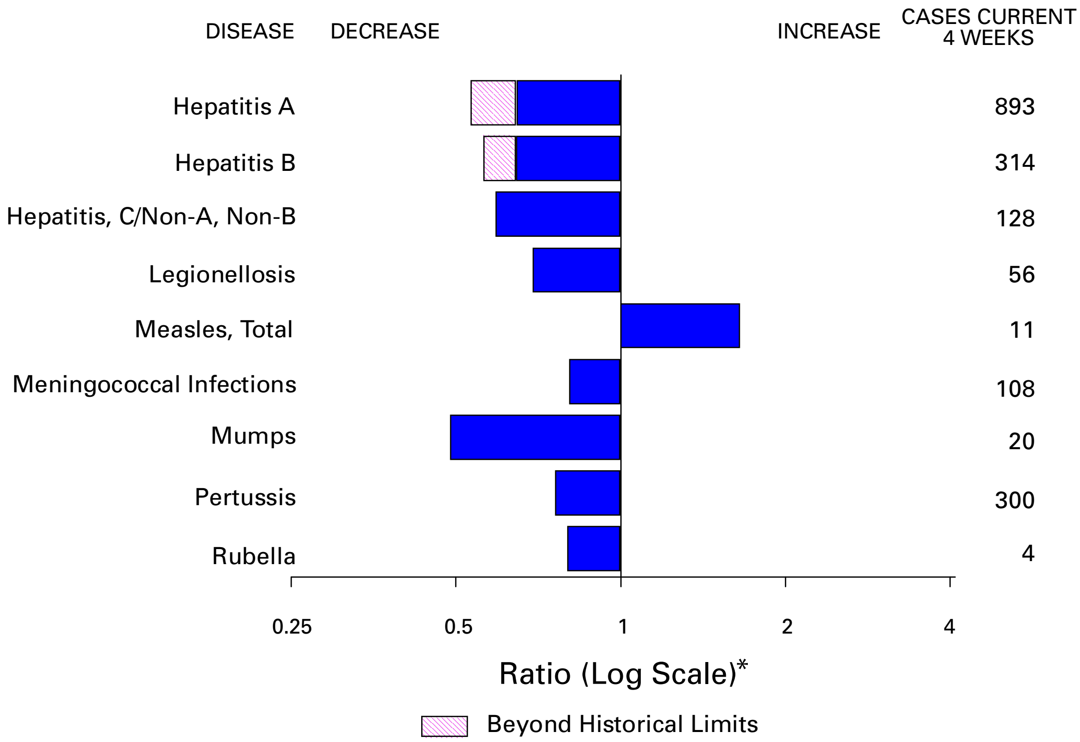
Editorial Note: The dates of onset of illness for laboratory-positive cases of WNV infection suggest that the outbreak peaked in late August. There have been no recognized cases of WNV infection with an onset date after September 22. WNV encephalitis has an incubation period of 5–15 days. The latest cases occurred outside NYC in Nassau and Westchester counties, which implemented mosquito-control measures later than NYC. Collectively, these data suggest that control measures, combined with cooler temperatures, have been effective in reducing the transmission cycle in nature and limiting further illnesses in humans. However, it is important to continue to recommend personal protective measures during outdoor activity at dusk and at night until the onset of cold weather in the affected areas (*1*).

The identification of WNV in birds from Orange and Saratoga counties, New York City, and Burlington County, New Jersey, may represent an extension northward and southward of the known area of natural transmission between birds and mosquitoes, but for this to be the case, either demonstration of WNV in vector mosquito populations or demonstration of neutralizing antibodies against WNV in resident birds is needed because these birds may have been infected elsewhere. The current known geographic distribution of infected dead birds is in counties surrounding the western half of Long Island Sound.

Serum samples collected from migrant and resident birds in several states will be analyzed for antibody to WNV. States included in this survey are New York, New Jersey, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida. Collaborators in this survey include university ornithologists, state wildlife biologists, and state health departments. In addition, wildlife and health officials in all mid-Atlantic and southeastern states have been alerted to investigate reports of unusual clusters of dead birds.

(Continued on page 955)

FIGURE I. Selected notifiable disease reports, comparison of provisional 4-week totals ending October 16, 1999, with historical data — United States



*Ratio of current 4-week total to mean of 15 4-week totals (from previous, comparable, and subsequent 4-week periods for the past 5 years). The point where the hatched area begins is based on the mean and two standard deviations of these 4-week totals.

TABLE I. Summary — provisional cases of selected notifiable diseases, United States, cumulative, week ending October 16, 1999 (41st Week)

	Cum. 1999		Cum. 1999
Anthrax	-	HIV infection, pediatric*§	109
Brucellosis*	36	Plague	5
Cholera	5	Poliomyelitis, paralytic	-
Congenital rubella syndrome	4	Psittacosis*	16
Cyclosporiasis*	48	Rabies, human	-
Diphtheria	4	Rocky Mountain spotted fever (RMSF)	432
Encephalitis: California*	43	Streptococcal disease, invasive Group A	1,665
eastern equine*	5	Streptococcal toxic-shock syndrome*	30
St. Louis*	3	Syphilis, congenital¶	146
western equine*	-	Tetanus	30
Ehrlichiosis human granulocytic (HGE)*	118	Toxic-shock syndrome	94
human monocytic (HME)*	34	Trichinosis	8
Hansen Disease*	78	Typhoid fever	251
Hantavirus pulmonary syndrome*†	16	Yellow fever	-
Hemolytic uremic syndrome, post-diarrheal*	77		

-: no reported cases
*Not notifiable in all states.
† Updated weekly from reports to the Division of Viral and Rickettsial Diseases, National Center for Infectious Diseases (NCID).
§ Updated monthly from reports to the Division of HIV/AIDS Prevention–Surveillance and Epidemiology, National Center for HIV, STD, and TB Prevention (NCHSTP), last update September 26, 1999.
¶ Updated from reports to the Division of STD Prevention, NCHSTP.

TABLE II. Provisional cases of selected notifiable diseases, United States, weeks ending October 16, 1999, and October 17, 1998 (41st Week)

Reporting Area	AIDS		Chlamydia		Cryptosporidiosis		*Escherichia coli* O157:H7* NETSS		*Escherichia coli* O157:H7* PHLIS	
	Cum. 1999†	Cum. 1998	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998
UNITED STATES	34,088	35,254	447,781	463,162	1,733	3,137	2,573	2,381	1,672	1,874
NEW ENGLAND	1,698	1,354	15,816	16,053	119	135	270	282	232	238
Maine	54	24	738	783	23	28	34	33	-	-
N.H.	36	25	750	785	17	14	28	42	29	42
Vt.	13	17	376	328	32	22	28	18	15	17
Mass.	1,116	684	7,248	6,590	44	64	155	130	115	135
R.I.	77	98	1,814	1,807	3	7	25	11	6	1
Conn.	402	506	4,890	5,760	-	-	U	48	67	43
MID. ATLANTIC	8,684	9,591	50,205	48,082	264	476	214	259	60	81
Upstate N.Y.	952	1,103	N	N	123	285	165	186	-	-
N.Y. City	4,588	5,419	21,963	20,800	109	170	7	12	15	12
N.J.	1,619	1,753	8,087	9,266	22	21	42	61	32	48
Pa.	1,525	1,316	20,155	18,016	10	N	N	N	13	21
E.N. CENTRAL	2,280	2,565	63,857	78,115	392	623	538	382	396	315
Ohio	345	549	18,521	20,951	47	60	185	100	157	59
Ind.	258	412	8,038	8,676	33	50	74	81	46	46
Ill.	1,108	986	21,533	21,146	17	74	178	101	81	73
Mich.	456	466	15,765	16,435	42	34	101	100	68	62
Wis.	113	152	U	10,907	253	405	N	N	44	75
W.N. CENTRAL	770	661	26,244	27,435	179	243	508	402	303	361
Minn.	138	135	5,396	5,539	67	79	200	175	152	193
Iowa	69	58	3,154	3,492	51	61	102	81	57	51
Mo.	370	310	9,298	9,986	24	20	41	41	55	57
N. Dak.	6	4	325	804	16	27	16	10	14	15
S. Dak.	14	13	1,244	1,205	6	19	38	25	13	32
Nebr.	60	60	2,601	2,137	14	31	90	42	-	-
Kans.	113	81	4,226	4,272	1	6	21	28	12	13
S. ATLANTIC	9,423	9,157	94,346	88,965	316	280	271	194	139	151
Del.	129	112	1,968	2,020	-	3	6	-	3	2
Md.	1,113	1,300	7,963	5,835	14	18	26	35	2	14
D.C.	412	690	N	N	8	21	-	1	U	U
Va.	608	687	10,964	11,053	21	20	63	N	48	50
W. Va.	53	68	1,204	1,891	3	1	10	8	6	8
N.C.	629	637	17,832	17,443	19	N	59	46	46	45
S.C.	797	598	9,850	13,656	-	-	19	11	14	8
Ga.	1,382	979	21,374	18,476	115	90	28	62	-	-
Fla.	4,300	4,086	23,191	18,591	136	127	60	31	20	24
E.S. CENTRAL	1,536	1,440	36,177	32,073	24	22	103	103	53	59
Ky.	214	221	5,917	4,991	6	10	34	32	-	-
Tenn.	588	519	11,088	10,698	6	7	43	45	33	38
Ala.	405	395	10,137	7,901	10	N	21	21	16	18
Miss.	329	305	9,035	8,483	2	5	5	5	4	3
W.S. CENTRAL	3,524	4,187	66,528	70,392	66	869	89	81	94	90
Ark.	132	159	4,690	3,079	1	6	12	10	8	10
La.	663	705	10,879	11,554	22	14	9	4	13	6
Okla.	101	238	6,121	7,794	9	N	20	13	17	7
Tex.	2,628	3,085	44,838	47,965	34	849	48	54	56	67
MOUNTAIN	1,343	1,230	25,008	25,778	84	118	247	309	134	216
Mont.	8	23	1,195	1,041	10	10	20	15	-	5
Idaho	19	19	1,355	1,577	7	17	39	36	8	23
Wyo.	10	1	609	536	1	2	14	52	5	55
Colo.	235	230	4,845	6,381	11	16	90	68	75	53
N. Mex.	74	178	2,943	2,793	38	46	10	17	5	18
Ariz.	697	501	9,889	9,183	10	18	28	41	19	26
Utah	116	101	1,714	1,660	N	N	32	65	20	21
Nev.	184	177	2,458	2,607	7	9	14	15	2	15
PACIFIC	4,830	5,069	69,600	76,269	289	371	333	369	261	363
Wash.	285	331	9,353	8,731	N	N	131	80	119	108
Oreg.	151	138	4,959	4,315	86	63	65	95	61	91
Calif.	4,319	4,452	51,549	59,728	203	305	128	190	71	150
Alaska	13	17	1,497	1,489	-	-	1	4	1	-
Hawaii	62	131	2,242	2,006	-	3	8	-	9	14
Guam	5	-	302	327	-	-	N	N	U	U
P.R.	1,013	1,244	U	U	-	N	5	5	U	U
V.I.	25	24	U	U	U	U	U	U	U	U
Amer. Samoa	-	-	U	U	U	U	U	U	U	U
C.N.M.I.	-	-	U	U	U	U	U	U	U	U

N: Not notifiable U: Unavailable -: no reported cases C.N.M.I.: Commonwealth of Northern Mariana Islands

*Individual cases may be reported through both the National Electronic Telecommunications System for Surveillance (NETSS) and the Public Health Laboratory Information System (PHLIS).

†Updated monthly from reports to the Division of HIV/AIDS Prevention–Surveillance and Epidemiology, National Center for HIV, STD, and TB Prevention, last update September 26, 1999.

TABLE II. (Cont'd.) Provisional cases of selected notifiable diseases, United States, weeks ending October 16, 1999, and October 17, 1998 (41st Week)

Reporting Area	Gonorrhea		Hepatitis C/NA,NB		Legionellosis		Lyme Disease	
	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998
UNITED STATES	245,721	275,632	2,615	2,621	671	1,035	8,669	13,157
NEW ENGLAND	4,831	4,768	59	53	59	70	3,063	4,118
Maine	42	54	2	-	3	1	41	70
N.H.	88	74	-	-	6	5	16	36
Vt.	37	32	6	4	13	5	18	11
Mass.	1,999	1,737	48	46	19	30	946	653
R.I.	469	298	3	3	7	19	401	444
Conn.	2,196	2,573	-	-	11	10	1,641	2,904
MID. ATLANTIC	29,586	29,711	107	173	129	256	4,160	7,178
Upstate N.Y.	5,360	5,523	72	86	49	78	3,027	3,392
N.Y. City	9,463	9,391	-	-	9	33	29	197
N.J.	5,042	6,250	-	U	13	15	390	1,538
Pa.	9,721	8,547	35	87	58	130	714	2,051
E.N. CENTRAL	42,601	53,959	1,319	565	187	344	101	675
Ohio	11,132	13,623	3	7	61	108	66	35
Ind.	4,425	5,106	1	5	31	59	19	33
Ill.	16,054	17,623	38	37	10	47	10	14
Mich.	10,990	12,629	686	385	56	68	1	12
Wis.	U	4,978	591	131	29	62	5	581
W.N. CENTRAL	10,720	13,408	157	35	38	58	178	187
Minn.	2,072	2,118	7	9	6	6	115	142
Iowa	834	1,185	-	8	11	9	19	23
Mo.	4,686	6,975	139	12	14	15	21	11
N. Dak.	31	66	-	-	1	-	1	-
S. Dak.	143	185	-	-	2	3	-	-
Nebr.	1,128	876	5	4	4	18	10	3
Kans.	1,826	2,003	6	2	-	7	12	8
S. ATLANTIC	70,363	74,153	176	89	107	114	908	749
Del.	1,229	1,173	1	-	10	12	25	57
Md.	6,375	7,143	37	12	24	28	652	544
D.C.	2,969	3,450	1	-	3	6	3	4
Va.	7,160	7,388	10	11	26	16	106	55
W. Va.	363	691	17	6	N	N	15	11
N.C.	15,841	15,185	33	19	13	11	63	48
S.C.	5,679	8,680	22	5	7	10	5	4
Ga.	14,359	15,789	1	9	1	8	-	5
Fla.	16,388	14,654	54	27	23	23	39	21
E.S. CENTRAL	29,057	30,892	213	243	35	55	69	93
Ky.	2,686	2,910	15	19	18	26	8	23
Tenn.	8,973	9,367	80	145	14	17	30	41
Ala.	9,125	10,116	2	4	3	5	18	16
Miss.	8,273	8,499	116	75	-	7	13	13
W.S. CENTRAL	37,355	43,189	186	430	6	27	28	19
Ark.	2,452	3,191	11	16	-	1	4	6
La.	8,653	9,823	102	73	2	2	-	4
Okla.	2,988	4,272	14	12	3	12	4	2
Tex.	23,262	25,903	59	329	1	12	20	7
MOUNTAIN	7,321	7,202	122	325	41	62	16	13
Mont.	39	32	5	7	-	2	-	-
Idaho	68	140	6	86	2	2	5	4
Wyo.	24	27	37	79	-	1	3	1
Colo.	1,846	1,655	20	25	11	15	-	-
N. Mex.	597	705	7	82	1	2	1	4
Ariz.	3,559	3,309	33	8	6	14	-	-
Utah	170	182	6	19	15	20	5	-
Nev.	1,018	1,152	8	19	6	6	2	4
PACIFIC	13,887	18,350	276	708	69	49	146	125
Wash.	1,623	1,534	13	20	11	9	7	7
Oreg.	711	633	17	16	N	N	11	18
Calif.	10,987	15,515	246	618	57	38	128	99
Alaska	242	253	-	-	1	1	-	1
Hawaii	324	415	-	54	-	1	N	N
Guam	39	54	1	1	-	2	-	1
P.R.	247	300	-	-	-	-	N	N
V.I.	U	U	U	U	U	U	U	U
Amer. Samoa	U	U	U	U	U	U	U	U
C.N.M.I.	U	U	U	U	U	U	U	U

N: Not notifiable U: Unavailable -: no reported cases

TABLE II. (Cont'd.) Provisional cases of selected notifiable diseases, United States, weeks ending October 16, 1999, and October 17, 1998 (41st Week)

Reporting Area	Malaria		Rabies, Animal		Salmonellosis* NETSS		Salmonellosis* PHLIS	
	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998
UNITED STATES	991	1,169	4,696	6,035	28,297	32,937	22,311	27,913
NEW ENGLAND	50	48	714	1,207	1,361	1,987	1,392	1,909
Maine	3	4	133	199	116	144	83	53
N.H.	2	5	48	71	113	154	120	196
Vt.	4	1	84	55	78	111	73	86
Mass.	15	16	170	422	949	1,114	718	1,139
R.I.	4	4	76	78	105	107	52	34
Conn.	22	18	203	382	U	357	346	401
MID. ATLANTIC	220	353	865	1,304	3,137	5,334	2,955	4,944
Upstate N.Y.	56	78	642	914	1,043	1,290	860	1,165
N.Y. City	99	200	U	U	1,060	1,609	853	1,291
N.J.	44	49	150	173	508	1,146	535	1,141
Pa.	21	26	73	217	526	1,289	707	1,347
E.N. CENTRAL	94	124	135	114	4,197	5,184	2,812	3,951
Ohio	18	14	32	52	1,027	1,251	867	960
Ind.	18	10	12	9	409	551	329	448
Ill.	20	50	9	N	1,328	1,596	399	1,246
Mich.	33	41	79	34	801	945	782	860
Wis.	5	9	3	19	632	841	435	437
W.N. CENTRAL	62	75	582	608	1,822	1,865	1,792	1,940
Minn.	33	42	88	101	525	448	588	532
Iowa	13	7	137	131	224	317	158	254
Mo.	12	14	13	34	563	512	751	710
N. Dak.	-	2	125	121	41	48	47	67
S. Dak.	-	-	129	139	75	96	58	102
Nebr.	-	1	3	7	175	153	-	35
Kans.	4	9	87	75	219	291	190	240
S. ATLANTIC	283	244	1,727	1,983	6,840	6,562	4,229	4,971
Del.	1	3	34	39	107	66	137	105
Md.	78	73	331	388	717	747	765	730
D.C.	16	16	-	-	62	64	U	U
Va.	57	48	450	474	1,063	880	789	739
W. Va.	2	2	93	64	136	121	126	124
N.C.	26	23	362	491	1,022	948	1,051	1,148
S.C.	15	6	123	121	533	492	349	444
Ga.	21	32	178	247	1,120	1,286	651	1,229
Fla.	67	41	156	159	2,080	1,958	361	452
E.S. CENTRAL	21	25	221	234	1,470	1,816	880	1,322
Ky.	7	5	33	27	323	306	-	124
Tenn.	7	13	79	122	324	471	429	582
Ala.	6	5	108	83	473	562	374	492
Miss.	1	2	1	2	350	477	77	124
W.S. CENTRAL	15	32	86	26	2,638	3,528	2,723	2,579
Ark.	2	1	14	26	514	464	120	300
La.	10	13	-	-	334	472	472	635
Okla.	2	3	72	N	355	378	271	180
Tex.	1	15	-	-	1,435	2,214	1,860	1,464
MOUNTAIN	39	55	169	223	2,440	2,053	1,698	1,738
Mont.	4	1	52	47	50	70	1	42
Idaho	3	7	-	N	89	95	57	77
Wyo.	1	-	41	55	52	57	22	50
Colo.	14	16	1	38	602	461	615	438
N. Mex.	2	12	8	6	286	251	217	222
Ariz.	9	8	55	45	790	634	650	599
Utah	3	1	7	26	419	293	83	122
Nev.	3	10	5	6	152	192	53	188
PACIFIC	207	213	197	336	4,392	4,608	3,830	4,559
Wash.	22	17	-	-	515	397	670	541
Oreg.	19	14	1	7	367	252	419	276
Calif.	158	176	189	306	3,181	3,694	2,486	3,469
Alaska	1	2	7	23	47	50	15	31
Hawaii	7	4	-	-	282	215	240	242
Guam	-	2	-	-	24	29	U	U
P.R.	-	-	57	42	255	585	U	U
V.I.	U	U	U	U	U	U	U	U
Amer. Samoa	U	U	U	U	U	U	U	U
C.N.M.I.	U	U	U	U	U	U	U	U

N: Not notifiable U: Unavailable -: no reported cases

*Individual cases may be reported through both the National Electronic Telecommunications System for Surveillance (NETSS) and the Public Health Laboratory Information System (PHLIS).

TABLE II. (Cont'd.) Provisional cases of selected notifiable diseases, United States, weeks ending October 16, 1999, and October 17, 1998 (41st Week)

Reporting Area	Shigellosis*				Syphilis (Primary & Secondary)		Tuberculosis	
	NETSS		PHLIS					
	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998	Cum. 1999†	Cum. 1998†
UNITED STATES	11,814	16,457	5,640	9,382	5,000	5,645	11,071	13,022
NEW ENGLAND	564	361	387	321	44	63	315	343
Maine	5	12	-	-	-	1	13	11
N.H.	16	15	14	18	-	2	10	-
Vt.	6	6	4	-	3	4	1	4
Mass.	515	240	315	231	26	35	190	196
R.I.	22	30	9	13	2	1	33	41
Conn.	U	58	45	59	13	20	68	91
MID. ATLANTIC	693	1,995	370	1,502	204	250	2,020	2,256
Upstate N.Y.	232	468	45	164	24	33	248	285
N.Y. City	220	610	82	542	67	57	1,091	1,114
N.J.	170	596	121	560	48	79	408	486
Pa.	71	321	122	236	65	81	273	371
E.N. CENTRAL	2,155	2,306	1,083	1,213	930	816	1,038	1,291
Ohio	358	417	114	106	74	119	198	189
Ind.	235	140	76	35	356	161	72	129
Ill.	832	1,262	592	1,014	315	342	462	604
Mich.	351	226	233	4	185	141	229	287
Wis.	379	261	68	54	U	53	77	82
W.N. CENTRAL	927	859	575	503	102	108	345	365
Minn.	200	263	198	292	9	7	122	116
Iowa	46	58	23	40	9	1	37	28
Mo.	569	107	313	82	67	82	134	142
N. Dak.	2	7	2	3	-	-	6	8
S. Dak.	11	31	5	21	-	1	12	16
Nebr.	62	335	-	19	7	4	15	16
Kans.	37	58	34	46	10	13	19	39
S. ATLANTIC	1,957	3,414	376	1,060	1,590	2,059	2,326	2,379
Del.	12	27	8	25	6	19	12	32
Md.	132	173	46	61	294	550	213	247
D.C.	45	25	U	U	54	71	34	87
Va.	109	162	43	78	123	120	221	222
W. Va.	8	11	4	7	2	2	33	31
N.C.	167	240	72	127	400	596	348	339
S.C.	106	146	51	68	217	240	206	227
Ga.	185	896	37	214	248	231	450	414
Fla.	1,193	1,734	115	480	246	230	809	780
E.S. CENTRAL	897	829	444	616	913	978	704	909
Ky.	212	108	-	45	81	84	148	132
Tenn.	508	278	387	364	507	459	257	292
Ala.	94	397	47	200	182	222	243	305
Miss.	83	46	10	7	143	213	56	180
W.S. CENTRAL	1,735	3,145	1,716	1,017	780	856	1,232	1,930
Ark.	70	169	23	54	57	93	135	114
La.	118	247	99	222	200	341	U	211
Okla.	421	346	143	96	151	76	101	141
Tex.	1,126	2,383	1,451	645	372	346	996	1,464
MOUNTAIN	873	988	517	614	190	202	321	434
Mont.	7	8	-	3	1	-	10	18
Idaho	23	18	7	13	1	2	14	7
Wyo.	3	3	1	1	-	1	3	4
Colo.	154	164	120	128	2	10	U	50
N. Mex.	103	240	62	136	9	22	48	54
Ariz.	456	473	309	290	169	151	177	157
Utah	52	38	12	28	2	3	32	45
Nev.	75	44	6	15	6	13	37	99
PACIFIC	2,013	2,560	172	2,536	247	313	2,770	3,115
Wash.	90	164	79	144	57	27	156	206
Oreg.	76	121	67	119	9	4	86	111
Calif.	1,819	2,235	-	2,235	178	278	2,350	2,614
Alaska	2	6	2	3	1	1	43	43
Hawaii	26	34	24	35	2	3	135	141
Guam	8	31	U	U	1	1	11	75
P.R.	62	46	U	U	131	150	41	122
V.I.	U	U	U	U	U	U	U	U
Amer. Samoa	U	U	U	U	U	U	U	U
C.N.M.I.	U	U	U	U	U	U	U	U

N: Not notifiable U: Unavailable -: no reported cases

*Individual cases may be reported through both the National Electronic Telecommunications System for Surveillance (NETSS) and the Public Health Laboratory Information System (PHLIS).

†Cumulative reports of provisional tuberculosis cases for 1999 are unavailable ("U") for some areas using the Tuberculosis Information System (TIMS).

TABLE III. Provisional cases of selected notifiable diseases preventable by vaccination, United States, weeks ending October 16, 1999, and October 17, 1998 (41st Week)

Reporting Area	*H. influenzae,* invasive		Hepatitis (Viral), by type				Measles (Rubeola)					
			A		B		Indigenous		Imported*		Total	
	Cum. 1999†	Cum. 1998	Cum. 1999	Cum. 1998	Cum. 1999	Cum. 1998	1999	Cum. 1999	1999	Cum. 1999	Cum. 1999	Cum. 1998
UNITED STATES	929	865	12,152	17,755	5,025	7,671	-	50	-	23	73	76
NEW ENGLAND	75	59	219	237	76	168	-	6	-	5	11	3
Maine	5	2	11	16	1	2	-	-	-	-	-	-
N.H.	17	10	15	11	13	15	-	-	-	1	1	-
Vt.	5	6	16	14	2	8	-	-	-	-	-	1
Mass.	27	35	64	106	32	59	-	5	-	3	8	2
R.I.	5	5	14	14	28	58	-	-	-	-	-	-
Conn.	16	1	99	76	-	26	-	1	-	1	2	-
MID. ATLANTIC	139	138	733	1,382	512	995	-	-	-	2	2	14
Upstate N.Y.	68	47	215	284	153	189	-	-	-	2	2	2
N.Y. City	31	37	212	487	157	349	-	-	-	-	-	-
N.J.	39	47	57	283	40	173	-	-	-	-	-	8
Pa.	1	7	249	328	162	284	-	-	-	-	-	4
E.N. CENTRAL	142	149	2,280	2,855	523	1,166	-	1	-	1	2	15
Ohio	50	45	542	258	78	64	-	-	-	-	-	1
Ind.	20	36	95	125	36	92	-	1	-	-	1	3
Ill.	59	52	516	645	1	199	-	-	-	-	-	-
Mich.	13	9	1,091	1,658	403	375	-	-	-	1	1	10
Wis.	-	7	36	169	5	436	-	-	-	-	-	1
W.N. CENTRAL	79	75	630	1,176	249	326	-	-	-	-	-	-
Minn.	38	58	61	108	41	41	-	-	-	-	-	-
Iowa	9	2	117	379	33	48	-	-	-	-	-	-
Mo.	23	8	352	551	133	191	-	-	-	-	-	-
N. Dak.	1	-	2	3	-	4	U	-	U	-	-	-
S. Dak.	1	-	8	21	1	2	-	-	-	-	-	-
Nebr.	3	1	50	25	14	18	-	-	-	-	-	-
Kans.	4	6	40	89	27	22	U	-	U	-	-	-
S. ATLANTIC	209	158	1,652	1,546	995	807	-	9	-	6	15	8
Del.	-	-	2	3	1	3	U	-	U	-	-	1
Md.	54	50	297	333	139	115	-	-	-	-	-	1
D.C.	4	-	54	55	21	11	U	-	U	-	-	-
Va.	16	16	138	173	74	84	-	9	-	3	12	2
W. Va.	6	6	32	6	22	8	-	-	-	-	-	-
N.C.	29	23	132	99	194	173	-	-	-	1	1	-
S.C.	5	3	41	33	63	31	-	-	-	-	-	-
Ga.	55	35	400	485	143	127	-	-	-	-	-	2
Fla.	40	25	556	359	338	255	-	-	-	2	2	2
E.S. CENTRAL	52	48	324	323	341	404	-	2	-	-	2	2
Ky.	6	7	55	27	34	40	-	2	-	-	2	-
Tenn.	28	28	142	186	170	226	-	-	-	-	-	1
Ala.	15	11	45	59	68	62	-	-	-	-	-	1
Miss.	3	2	82	51	69	76	-	-	-	-	-	-
W.S. CENTRAL	45	44	2,357	3,120	702	1,693	-	5	-	4	9	-
Ark.	2	-	46	73	38	89	-	-	-	-	-	-
La.	7	20	73	76	77	121	U	-	U	-	-	-
Okla.	32	22	383	471	107	71	-	-	-	-	-	-
Tex.	4	2	1,855	2,500	480	1,412	-	5	-	4	9	-
MOUNTAIN	96	96	1,069	2,687	474	684	-	3	-	-	3	-
Mont.	2	-	17	85	17	5	-	-	-	-	-	-
Idaho	1	-	35	221	25	38	-	-	-	-	-	-
Wyo.	1	1	7	33	12	7	-	-	-	-	-	-
Colo.	11	21	187	263	77	87	-	-	-	-	-	-
N. Mex.	18	5	42	124	149	267	-	-	-	-	-	-
Ariz.	52	46	625	1,607	127	149	-	1	-	-	1	-
Utah	8	4	42	163	27	62	-	2	-	-	2	-
Nev.	3	19	114	191	40	69	U	-	U	-	-	-
PACIFIC	92	98	2,888	4,429	1,153	1,428	-	24	-	5	29	34
Wash.	4	8	263	853	55	86	-	-	-	-	-	1
Oreg.	36	37	212	348	78	150	-	9	-	-	9	-
Calif.	40	43	2,393	3,162	994	1,167	-	15	-	4	19	7
Alaska	5	3	8	16	14	12	-	-	-	-	-	26
Hawaii	7	7	12	50	12	13	-	-	-	1	1	-
Guam	-	-	2	1	2	2	U	1	U	-	1	-
P.R.	1	2	112	51	102	198	-	-	-	-	-	-
V.I.	U	U	U	U	U	U	U	U	U	U	U	U
Amer. Samoa	U	U	U	U	U	U	U	U	U	U	U	U
C.N.M.I.	U	U	U	U	U	U	U	U	U	U	U	U

N: Not notifiable U: Unavailable -: no reported cases

*For imported measles, cases include only those resulting from importation from other countries.

†Of 176 cases among children aged <5 years, serotype was reported for 90 and of those, 24 were type b.

TABLE III. (Cont'd.) Provisional cases of selected notifiable diseases preventable by vaccination, United States, weeks ending October 16, 1999, and October 17, 1998 (41st Week)

Reporting Area	Meningococcal Disease		Mumps			Pertussis			Rubella		
	Cum. 1999	Cum. 1998	1999	Cum. 1999	Cum. 1998	1999	Cum. 1999	Cum. 1998	1999	Cum. 1999	Cum. 1998
UNITED STATES	1,897	2,117	4	263	547	66	4,246	5,084	1	226	341
NEW ENGLAND	94	94	-	6	7	7	509	822	-	7	38
Maine	5	5	-	-	-	-	-	5	-	-	-
N.H.	12	11	-	1	-	1	78	88	-	-	-
Vt.	4	5	-	1	-	-	52	66	-	-	-
Mass.	55	41	-	4	4	6	341	616	-	7	8
R.I.	4	7	-	-	1	-	24	9	-	-	1
Conn.	14	25	-	-	2	-	14	38	-	-	29
MID. ATLANTIC	168	222	-	28	178	4	688	506	-	22	146
Upstate N.Y.	52	59	-	9	6	4	602	269	-	18	114
N.Y. City	44	27	-	3	155	-	10	31	-	-	18
N.J.	39	51	-	-	6	-	12	18	-	1	13
Pa.	33	85	-	16	11	-	64	188	-	3	1
E.N. CENTRAL	331	322	1	33	69	10	325	639	-	2	-
Ohio	119	116	1	14	26	7	173	225	-	-	-
Ind.	55	56	-	4	6	-	54	113	-	1	-
Ill.	87	85	-	8	9	-	49	86	-	1	-
Mich.	40	38	-	7	26	3	45	57	-	-	-
Wis.	30	27	-	-	2	-	4	158	-	-	-
W.N. CENTRAL	210	183	1	12	28	7	297	437	-	123	35
Minn.	45	29	-	1	12	-	154	242	-	5	-
Iowa	39	34	1	6	10	4	46	62	-	29	-
Mo.	82	67	-	2	3	3	50	30	-	2	2
N. Dak.	3	5	U	-	2	U	4	3	U	-	-
S. Dak.	11	7	-	-	-	-	5	8	-	-	-
Nebr.	12	13	-	-	-	-	3	15	-	87	-
Kans.	18	28	U	3	1	U	35	77	U	-	33
S. ATLANTIC	334	346	1	43	43	12	340	268	-	36	18
Del.	7	2	U	-	-	U	4	5	U	-	-
Md.	48	25	-	3	-	-	97	52	-	1	1
D.C.	1	1	U	2	-	U	-	1	U	-	-
Va.	44	31	-	9	7	-	19	27	-	-	1
W. Va.	6	14	-	-	-	-	2	1	-	-	-
N.C.	37	48	-	8	10	2	85	89	-	35	13
S.C.	41	49	-	4	6	-	15	25	-	-	-
Ga.	52	79	-	4	1	1	35	22	-	-	-
Fla.	98	97	1	13	19	9	83	46	-	-	3
E.S. CENTRAL	119	165	-	11	13	-	69	108	-	1	2
Ky.	26	29	-	-	-	-	20	48	-	-	-
Tenn.	43	58	-	-	1	-	28	32	-	-	2
Ala.	29	44	-	8	7	-	18	24	-	1	-
Miss.	21	34	-	3	5	-	3	4	-	-	-
W.S. CENTRAL	146	257	-	30	53	8	148	314	1	15	87
Ark.	31	27	-	-	11	1	18	63	1	6	-
La.	34	50	U	3	6	U	3	8	U	-	-
Okla.	26	35	-	1	-	-	12	31	-	-	-
Tex.	55	145	-	26	36	7	115	212	-	9	87
MOUNTAIN	121	118	-	23	35	16	565	895	-	16	5
Mont.	2	4	-	-	-	-	2	9	-	-	-
Idaho	10	9	-	1	4	1	130	211	-	-	-
Wyo.	4	5	-	-	1	-	2	8	-	-	-
Colo.	31	22	-	5	6	11	163	217	-	1	-
N. Mex.	13	24	N	N	N	2	110	86	-	-	1
Ariz.	41	37	-	7	6	2	98	179	-	13	1
Utah	13	10	-	5	5	-	55	146	-	1	2
Nev.	7	7	U	5	13	U	5	39	U	1	1
PACIFIC	374	410	1	77	121	2	1,305	1,095	-	4	10
Wash.	59	58	-	2	8	-	581	266	-	-	5
Oreg.	65	70	N	N	N	2	44	75	-	-	-
Calif.	240	274	1	61	88	-	648	725	-	4	3
Alaska	5	3	-	2	2	-	4	14	-	-	-
Hawaii	5	5	-	12	23	-	28	15	-	-	2
Guam	2	2	U	1	5	U	1	1	U	-	-
P.R.	5	9	-	-	3	-	16	4	-	-	12
V.I.	U	U	U	U	U	U	U	U	U	U	U
Amer. Samoa	U	U	U	U	U	U	U	U	U	U	U
C.N.M.I.	U	U	U	U	U	U	U	U	U	U	U

N: Not notifiable U: Unavailable -: no reported cases

TABLE IV. Deaths in 122 U.S. cities,* week ending October 16, 1999 (41st Week)

Reporting Area	All Causes, By Age (Years)						P&I† Total
	All Ages	>65	45-64	25-44	1-24	<1	
NEW ENGLAND	545	381	107	33	12	12	41
Boston, Mass.	151	90	38	12	7	4	8
Bridgeport, Conn.	39	28	7	3	1	-	-
Cambridge, Mass.	21	16	4	-	1	-	1
Fall River, Mass.	26	21	5	-	-	-	1
Hartford, Conn.	U	U	U	U	U	U	U
Lowell, Mass.	22	16	3	3	-	-	3
Lynn, Mass.	20	16	2	2	-	-	1
New Bedford, Mass.	23	21	2	-	-	-	3
New Haven, Conn.	42	26	7	5	-	4	5
Providence, R.I.	70	53	10	4	-	3	6
Somerville, Mass.	5	3	2	-	-	-	-
Springfield, Mass.	44	33	8	1	2	-	2
Waterbury, Conn.	21	15	6	-	-	-	2
Worcester, Mass.	61	43	13	3	1	1	9
MID. ATLANTIC	2,145	1,527	385	134	40	59	93
Albany, N.Y.	63	41	12	4	4	2	4
Allentown, Pa.	U	U	U	U	U	U	U
Buffalo, N.Y.	99	65	28	3	1	2	7
Camden, N.J.	28	18	5	4	1	-	1
Elizabeth, N.J.	11	8	1	2	-	-	2
Erie, Pa.	37	29	6	2	-	-	1
Jersey City, N.J.	48	32	11	5	-	-	-
New York City, N.Y.	1,077	767	206	71	18	15	26
Newark, N.J.	41	20	8	7	2	4	4
Paterson, N.J.	31	24	3	2	1	1	-
Philadelphia, Pa.	296	201	41	19	10	25	5
Pittsburgh, Pa.§	52	37	9	3	1	2	6
Reading, Pa.	37	33	4	-	-	-	6
Rochester, N.Y.	114	98	12	3	-	1	9
Schenectady, N.Y.	27	22	4	1	-	-	2
Scranton, Pa.	30	24	2	2	1	1	2
Syracuse, N.Y.	110	78	23	4	1	4	13
Trenton, N.J.	44	30	10	2	-	2	5
Utica, N.Y.	U	U	U	U	U	U	U
Yonkers, N.Y.	U	U	U	U	U	U	U
E.N. CENTRAL	1,429	1,003	274	81	32	39	109
Akron, Ohio	38	27	7	2	-	2	7
Canton, Ohio	40	32	7	1	-	-	7
Chicago, Ill.	U	U	U	U	U	U	U
Cincinnati, Ohio	99	65	14	9	6	5	10
Cleveland, Ohio	125	78	32	7	2	6	2
Columbus, Ohio	158	115	27	3	3	10	13
Dayton, Ohio	120	87	22	8	1	2	11
Detroit, Mich.	U	U	U	U	U	U	U
Evansville, Ind.	50	35	13	1	-	1	3
Fort Wayne, Ind.	60	44	6	6	1	3	1
Gary, Ind.	14	6	6	1	1	-	1
Grand Rapids, Mich.	79	56	17	3	1	2	12
Indianapolis, Ind.	193	124	47	15	6	1	8
Lansing, Mich.	42	37	3	-	2	-	5
Milwaukee, Wis.	119	86	22	5	3	3	10
Peoria, Ill.	47	33	9	2	2	1	5
Rockford, Ill.	60	40	9	8	1	2	2
South Bend, Ind.	36	25	8	3	-	-	4
Toledo, Ohio	104	73	20	7	3	1	6
Youngstown, Ohio	45	40	5	-	-	-	2
W.N. CENTRAL	753	542	129	46	20	16	42
Des Moines, Iowa	U	U	U	U	U	U	U
Duluth, Minn.	25	17	8	-	-	-	3
Kansas City, Kans.	31	25	4	1	1	-	2
Kansas City, Mo.	90	61	16	8	3	2	6
Lincoln, Nebr.	58	52	5	-	1	-	2
Minneapolis, Minn.	198	142	38	12	3	3	19
Omaha, Nebr.	76	54	15	2	4	1	1
St. Louis, Mo.	111	67	18	13	7	6	2
St. Paul, Minn.	77	64	8	2	-	3	3
Wichita, Kans.	87	60	17	8	1	1	4
S. ATLANTIC	796	528	158	69	15	22	58
Atlanta, Ga.	U	U	U	U	U	U	U
Baltimore, Md.	113	70	23	17	3	-	9
Charlotte, N.C.	100	69	16	6	-	8	11
Jacksonville, Fla.	94	60	21	8	2	3	3
Miami, Fla.	111	58	27	19	6	-	6
Norfolk, Va.	48	35	8	2	-	3	4
Richmond, Va.	64	42	12	5	-	5	5
Savannah, Ga.	45	38	5	-	1	1	3
St. Petersburg, Fla.	59	48	6	4	-	1	8
Tampa, Fla.	151	105	32	8	3	1	9
Washington, D.C.	U	U	U	U	U	U	U
Wilmington, Del.	11	3	8	-	-	-	-
E.S. CENTRAL	741	476	170	60	16	19	69
Birmingham, Ala.	149	99	35	11	1	3	19
Chattanooga, Tenn.	57	45	4	4	2	2	5
Knoxville, Tenn.	66	41	19	4	2	-	8
Lexington, Ky.	63	35	17	9	1	1	8
Memphis, Tenn.	141	103	25	7	1	5	15
Mobile, Ala.	78	49	18	6	3	2	5
Montgomery, Ala.	68	34	23	7	1	3	5
Nashville, Tenn.	119	70	29	12	5	3	4
W.S. CENTRAL	1,383	847	310	143	38	45	76
Austin, Tex.	70	42	16	7	2	3	4
Baton Rouge, La.	24	14	4	4	1	1	1
Corpus Christi, Tex.	58	38	10	5	2	3	2
Dallas, Tex.	179	98	51	15	8	7	4
El Paso, Tex.	81	57	11	10	2	1	1
Ft. Worth, Tex.	95	66	16	10	-	3	8
Houston, Tex.	350	205	89	39	7	10	28
Little Rock, Ark.	49	26	10	5	5	3	-
New Orleans, La.	129	75	32	16	2	4	12
San Antonio, Tex.	163	96	37	19	6	5	10
Shreveport, La.	55	41	5	8	-	1	4
Tulsa, Okla.	130	89	29	5	3	4	2
MOUNTAIN	914	589	198	78	26	22	58
Albuquerque, N.M.	110	81	17	5	4	3	8
Boise, Idaho	34	25	4	2	1	2	2
Colo. Springs, Colo.	53	33	13	6	-	1	2
Denver, Colo.	103	56	29	12	4	2	10
Las Vegas, Nev.	182	118	45	12	4	3	10
Ogden, Utah	34	25	6	1	2	-	3
Phoenix, Ariz.	152	83	35	21	6	6	6
Pueblo, Colo.	26	20	5	-	1	-	1
Salt Lake City, Utah	86	58	13	11	3	1	7
Tucson, Ariz.	134	90	31	8	1	4	9
PACIFIC	1,612	1,128	276	131	49	27	129
Berkeley, Calif.	18	13	4	1	-	-	-
Fresno, Calif.	83	58	19	4	2	-	6
Glendale, Calif.	17	13	3	-	1	-	-
Honolulu, Hawaii	73	58	13	-	2	-	7
Long Beach, Calif.	78	49	16	8	2	3	10
Los Angeles, Calif.	312	199	56	39	8	10	11
Pasadena, Calif.	U	U	U	U	U	U	U
Portland, Oreg.	123	77	20	20	5	1	8
Sacramento, Calif.	161	121	26	10	2	2	26
San Diego, Calif.	138	92	28	9	6	3	11
San Francisco, Calif.	130	95	13	13	4	4	12
San Jose, Calif.	170	128	29	6	5	2	14
Santa Cruz, Calif.	25	18	3	3	1	-	1
Seattle, Wash.	114	77	21	9	5	2	10
Spokane, Wash.	59	49	3	6	1	-	8
Tacoma, Wash.	111	81	22	3	5	-	5
TOTAL	10,318¶	7,021	2,007	775	248	261	675

U: Unavailable -: no reported cases

*Mortality data in this table are voluntarily reported from 122 cities in the United States, most of which have populations of 100,000 or more. A death is reported by the place of its occurrence and by the week that the death certificate was filed. Fetal deaths are not included.

†Pneumonia and influenza.

§Because of changes in reporting methods in this Pennsylvania city, these numbers are partial counts for the current week. Complete counts will be available in 4 to 6 weeks.

¶Total includes unknown ages.

West Nile Encephalitis — Continued

All state epidemiologists have been informed of the characteristics of this outbreak and encouraged to enhance surveillance for cases of human encephalitis. Monitoring of mosquitoes and birds has been increased in several states with existing vector-control programs. Training to institute programs for arbovirus and mosquito vector surveillance will be offered to states without programs, beginning with Atlantic coast states. In addition, the emerging infections sentinel networks coordinated by the Infectious Diseases Society of America (IDSA EIN) and the International Society of Travel Medicine (GeoSentinel) are assisting case-finding efforts to define the extent of the outbreak in the United States.

A previous publication indicated that the New York virus was more closely related to Kunjin virus (*2*). Data in this report based on phylogenetic analysis comparing published E-glycoprotein sequences from WNVs and other flaviviruses, including Kunjin, St. Louis encephalitis, and Japanese encephalitis indicate that the New York virus is WN. Complete genome sequencing of multiple WNV isolates is in progress.

References

1. CDC. Update: West Nile-like viral encephalitis—New York, 1999. MMWR 1999;48:890–2.
2. Briese T, Jia XY, Huang C, Grady LJ, Lipkin WI. Identification of a Kunjin/West Nile-like flavivirus in brains of patients with New York encephalitis [Letter]. Lancet 1999;354:1261–2.

Notice to Readers

Update: Changes to *MMWR* Continuing Education Data Management System

MMWR Recommendations and Reports first published a Continuing Education (CE) component on October 16, 1998. Since then, eight additional CE programs have been published in *MMWR Recommendations and Reports* to provide continuing medical education (CME), continuing nursing education (CNE), and continuing education unit (CEU) credits for physicians, nurses, and other health-care professionals at no cost to the user. Approximately 35,000 examinations have been submitted in print or electronically by *MMWR* readers. Because of the unexpectedly large response to the program, reviewing print examinations and mailing certificates to *MMWR* readers have been delayed.

To address the backlog in processing previously submitted examinations, and to effectively manage a program of this size, *MMWR* has installed a new examination management system. The new system speeds processing of examinations submitted by mail and allows the user to complete tests and receive credit through the World-Wide Web (http://www2.cdc.gov/mmwr/cme/conted.html). To reduce the costs of this free service, *MMWR* readers are encouraged to use the online examinations. The new system will require prior users of the online system to re-register. Users who registered and took examinations online before October 21, 1999, will not be able to view their complete transcripts until the old database is merged with the new database, which should be completed by January 2000. Questions concerning the change should be sent by e-mail to the continuing education coordinator at mmwrce@cdc.gov.

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