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*Epidemiologic Notes and Reports*

## Rubella Vaccination During Pregnancy — United States, 1971-1986

From January 1971 through December 1986, CDC received reports of 1,176 pregnant women who were given live attenuated rubella vaccine either within 3 months before or 3 months after their presumed dates of conception. These women were followed prospectively to determine the risk of fetal abnormalities following exposure to three types of licensed vaccine.

**Cendehill and HPV-77 Vaccines.** Before April 1979, data were collected on 538 women vaccinated during pregnancy with either Cendehill or HPV-77 rubella vaccines, as reviewed previously in the *MMWR* (*1*). None of the 290 infants born to these women had defects indicative of congenital rubella syndrome (CRS) (*2*); however, eight infants had serologic evidence of intrauterine infection (*1,3*). Three other women who received unknown strains of rubella vaccine delivered healthy infants who appeared normal.

**RA 27/3 Vaccine.** Since licensure of the RA 27/3 rubella vaccine in January 1979, CDC has received reports of 635 women who were given this vaccine during pregnancy (Table 1). Two hundred and twenty-four of these women had negative serologic testing for rubella within 12 months of vaccination and were, therefore, susceptible at the time of vaccination. Outcomes of pregnancy are known for 211 (94%) of these susceptible women. Of the 211 women, 170 (81%) delivered 172 living infants. An additional 30 immune women and 319 women of unknown immune status delivered 350 living infants. All of these 522 infants were free of defects indicative of

**TABLE 1. Pregnancy outcomes for 635 recipients of RA 27/3 vaccine — United States, January 1979-December 1986**

| Prevaccination Immunity Status | Total Women | Live Births | Spontaneous Abortions and Stillbirths | Induced Abortions | Outcome Unknown |
|---|---|---|---|---|---|
| Susceptible | 224 | 172 * | 11 | 30 | 13 |
| Immune | 32 | 30 | 1 | 0 | 1 |
| Unknown | 379 | 320 † | 8 | 24 | 28 |
| **Total** | **635** | **522** | **20** | **54** | **42** |

*Includes two twin births.
†Includes one twin birth.

*Rubella — Continued*

CRS. Outcomes of the 116 pregnancies that did not result in known live births are presented in Table 1.

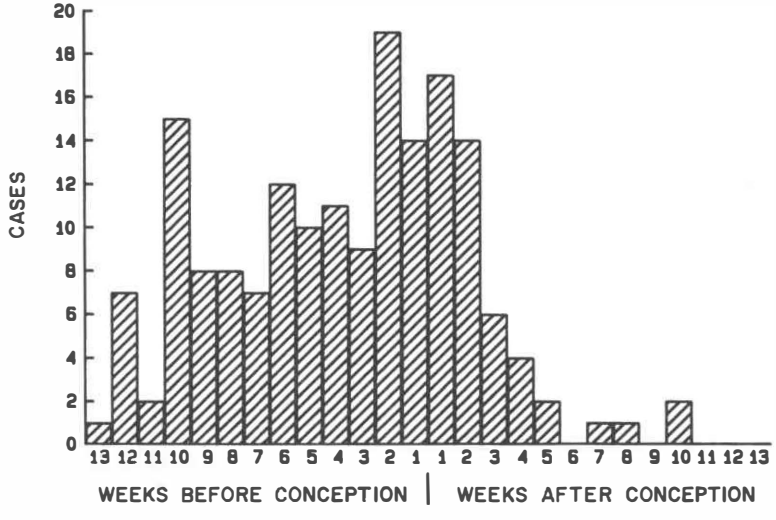
The dates of vaccination and estimated dates of confinement were known for all of the 170 susceptible women who had full-term pregnancies (Figure 1). Fifty-five women (32%) were vaccinated within 1 week before to 4 weeks after conception, the period of presumed highest risk for viremia and fetal malformations.

Serologic evaluations were performed on 136 (79%) of the 172 infants whose mothers were susceptible. Three (2%) of the 136 infants had normal examinations but measurable titers to rubella-specific IgM in cord blood, initially suggesting a subclinical infection. Prior to July 1985, the CDC laboratory performed hemagglutination inhibition (HI) tests for both rubella-specific IgM antibody and total rubella antibody titers. Such testing revealed that one infant who appeared normal had a rubella-specific IgM antibody titer of 8 in cord blood and a corresponding total rubella antibody titer of 128. The mother's total rubella antibody titer was also 128. Simultaneous retesting of cord blood and testing of a follow-up specimen taken when the infant was 2 months old showed a decrease in the titer of maternally derived antibody from 64 to 16 over the 2-month period, suggesting that subclinical infection may not have occurred. The infant had no evidence of defects indicative of CRS either at birth or at the 18-month and 29-month follow-up examinations. Sera could not be obtained for further follow-up testing to measure HI antibodies.

Since July 1985, the CDC laboratory has tested for rubella-specific IgG antibody using the RUBESTAT®* procedure (Whittaker Corporation, M.A. Bioproducts, Walkersville, MD), an indirect enzyme-linked immunosorbent assay (ELISA). Rubella-specific IgM antibodies were detected by ELISA using the same antigen-

*Use of trade names is for identification only and does not constitute endorsement by the Public Health Service, U.S. Department of Health and Human Services.

**FIGURE 1. Interval, in weeks, between receipt of rubella RA 27/3 vaccine and estimated date of conception among 170 susceptible women with live births — United States, January 1979-December 1986**



*Rubella – Continued*

coated plates, but with an enzyme-conjugated anti-human IgM serum. For IgM testing, sera were adsorbed with staphylococcal protein A to remove IgG and to eliminate interference by rheumatoid factor. An IgM index was calculated for each serum using a known low-positive IgM serum as a reference standard. An IgM index $\geq 1.0$ was considered positive, with increasing values indicating higher antibody levels. Using these tests, two additional infants who appeared normal had cord sera that were positive for rubella IgM.

Serologic studies were also obtained on 156 of the 320 infants (Table 1) born to mothers whose immune status was unknown at the time of vaccination (*4*). Subclinical infection was documented in two infants. One infant had a rubella-specific HI IgM antibody titer of 16 in cord blood. Both mother and infant had titers of 32 by HI at the time of birth; the infant still had a titer of 32 at 4 months of age. This infant had no evidence of defects indicative of CRS at birth or at the 10-month and 17-month examinations. A serum specimen was not obtained at subsequent follow-up visits. The second infant had a persistent HI titer of 8 at 3 months of age, suggesting that there had been subclinical infection. This infant was diagnosed as normal at the 3-month follow-up examination.

While none of the 172 infants born to susceptible women had defects indicative of CRS, two infants did have asymptomatic glandular hypospadias. However, both had negative rubella-specific IgM titers (<4) in cord blood at birth. Serum taken at the 6-month follow-up examination was available for one of the infants; he had a rubella-specific HI antibody titer of <8 (i.e., a negative titer).

Thirty susceptible women elected to have induced abortions (Table 1). Products of conception were available for viral isolation studies from 19 of these women, from two women who spontaneously aborted, and from 13 women whose case histories have been reported in the literature (*5-7*). Rubella virus has been isolated from the products of conception of one (3%) of these 34 susceptible women.

*Reported by: Viral Exanthems and Herpesvirus Br, Div of Viral Diseases, Center for Infectious Diseases; Surveillance, Investigations, and Research Br, Div of Immunization, Center for Prevention Svcs, CDC.*

**Editorial Note:** Since 1971, CDC has maintained a register to monitor and quantitate the risks to the fetus of exposure to live attenuated rubella vaccine virus. Data are obtained through reports from physicians and state and local health departments as well as directly from women vaccinated either within 3 months before or 3 months after conception. Follow-up study is conducted to determine the outcome of each pregnancy. In 1979, when RA 27/3 rubella vaccine replaced the other rubella vaccines, there was concern that it might have greater fetotropic and teratogenic potential than earlier vaccines. Data collected so far show that the RA 27/3 rubella vaccine, like the other vaccines, has not caused defects compatible with CRS.

Fifty-five (32%) of the 170 susceptible mothers were vaccinated with RA 27/3 vaccine during the highest risk period for viremia and fetal defects (1 week before to 4 weeks after conception) (*8,9*). Neither the infants born to these high-risk women nor those born to any of the other women had CRS. Therefore, the observed risk of CRS following rubella vaccination continues to be zero (Table 2). However, based on the 95% confidence limits of the binomial distribution, the theoretical maximum risk for the occurrence of CRS in this group of 172 children could be as high as 2.1%. If the 95 infants exposed to other rubella vaccines are included, the maximum theoretical risk is 1.4% (Table 2). This overall maximum risk remains far less than the 20% or greater

*Rubella — Continued*

risk of CRS associated with maternal infection with wild rubella virus during the first trimester of pregnancy (*3*) and is no greater than the 2%-3% rate of major birth defects in the absence of exposure to rubella vaccine (*10*).

These favorable data are consistent with the experiences in the Federal Republic of Germany and the United Kingdom (*11,12*). The vaccine has not been associated with the occurrence of CRS among infants born to susceptible mothers who had been vaccinated in either country. In Germany, 98 susceptible women vaccinated with either the Cendehill or RA 27/3 strain of vaccine gave birth to infants without CRS. In the United Kingdom, none of 21 infants born to susceptible mothers (not all of whom were prospectively followed) had defects compatible with CRS.

The occurrence of any congenital defect following maternal vaccination deserves careful analysis and follow-up. In the U.S. series, two infants born to susceptible mothers had asymptomatic glandular hypospadias. While hypospadias has been noted in CRS cases (*13,14*), there are no data to suggest that glandular hypospadias should be considered a CRS-associated defect. In any case, neither of the two infants in question had serologic evidence of rubella virus infection. Eight other infants born to mothers of unknown immune status and two born to mothers known to be immune at the time of vaccination had some type of defect (*15*). However, none of the defects were compatible with CRS, and serologic testing, when done, did not confirm rubella virus infection.

While no CRS-like defects have been noted, it is clear that rubella vaccine viruses, including the RA 27/3 strain, can cross the placenta and infect the fetus. Approximately 1%-2% of infants born to susceptible vaccinees had serologic evidence of subclinical infection, regardless of vaccine strain (*3*). On the other hand, while the rubella virus isolation rate from the products of conception of women who have received the RA 27/3 vaccine is only 3% (1/35), the rate of virus isolation from the products of conception of those receiving Cendehill and HPV-77 vaccines is 20% (17/85) (*3*). These data indicate that the risk of placental or fetal infection from RA 27/3 vaccine is low.

Recognizing that no amount of data collection can absolutely rule out a theoretical risk to the fetus, however small, the Immunization Practices Advisory Committee (ACIP) continues to state that: 1) pregnancy remains a contraindication to rubella vaccination because of the theoretical, albeit small, risk of CRS; 2) reasonable precautions should be taken to preclude vaccination of pregnant women, including

**TABLE 2. Maximum theoretical risks of congenital rubella syndrome (CRS) following rubella vaccination, by vaccine strain — United States, 1971-1986***

| Vaccine Strain | Susceptible Vaccinees | Normal Live Births | Risk of CRS | |
|---|---|---|---|---|
| | | | Observed | Theoretical |
| RA 27/3 | 170 | 172 † | 0 | 0%-2.1% |
| Cendehill or HPV-77 | 94 | 94 | 0 | 0%-3.8% |
| Unknown | 1 | 1 | 0 | — |
| **Total** | **265** | **267** | **0** | **0%-1.4%** |

*Through December 31, 1986. No women entered after 1980 in CDC's register of those receiving rubella vaccine within 3 months before or after conception were vaccinated with Cendehill or HPV-77 vaccine.

†Includes two twin births.

*Rubella — Continued*

asking women if they are pregnant, excluding those who say they are, and explaining the theoretical risks to the others; and 3) because the risk of CRS is so small as to be negligible, rubella vaccination of a pregnant woman should not ordinarily be a reason to consider interruption of pregnancy, even if vaccination does occur within 3 months of conception (*16*).

CDC encourages reporting of cases to its register of women receiving rubella vaccine within 3 months before or after conception. Only cases involving women known to have been susceptible at the time of vaccination, by virtue of negative serologic testing within the preceding year, should be reported to the Division of Immunization, Center for Prevention Services, (telephone:[404]329-1870). Although laboratory services for culture of placental and fetal tissue are no longer routinely available, serologic testing of women who have been enrolled in the registry and of their infants continues to be available at CDC.

*References*

1. CDC. Rubella vaccination during pregnancy—United States, 1971-1981. MMWR 1982;31: 477-81.
2. CDC. Rubella vaccination during pregnancy—United States, 1971-1985. MMWR 1986;35: 275-6,281-4,315.
3. Preblud SR, Stetler HC, Frank JA Jr, Greaves WL, Hinman AR, Herrmann KL. Fetal risk associated with rubella vaccine. JAMA 1981;246:1413-7.
4. Bart SW, Stetler HC, Preblud SR, et al. Fetal risk associated with rubella vaccine: an update. Rev Infect Dis 1985;7(suppl 1):S95-102.
5. Banatvala JE, O'Shea S, Best JM, Nicholls MWN, Cooper K. Transmission of RA27/3 rubella vaccine strain to products of conception [Letter]. Lancet 1981;1:392.
6. Furukawa T, Miyata T, Kondo K, Kuno K, Isomura S, Takekoshi T. Clinical trials of RA 27/3 (Wistar) rubella vaccine in Japan. Am J Dis Child 1969;118:262-3.
7. Bernstein DI, Ogra PL. Fetomaternal aspects of immunization with RA27/3 live attenuated rubella virus vaccine during pregnancy. J Pediatr 1980;97:467-70.
8. O'Shea S, Parsons G, Best JM, Banatvala JE, Balfour HH Jr. How well do low levels of rubella antibody protect? [Letter]. Lancet 1981;2:1284.
9. Balfour HH Jr, Groth KE, Edelman CK, Amren DP, Best JM, Banatvala JE. Rubella viraemia and antibody responses after rubella vaccination and reimmunization. Lancet 1981;1: 1078-80.
10. CDC. Congenital malformations surveillance report, January 1981-December 1983. Atlanta, Georgia: US Department of Health and Human Services, Public Health Service, 1985.
11. Sheppard S, Smithells RW, Dickson A, Holzel H. Rubella vaccination and pregnancy: preliminary report of a national survey. Br Med J 1986;292:727.
12. Enders G. Rubella antibody titers in vaccinated and nonvaccinated women and results of vaccination during pregnancy. Rev Infect Dis 1985;7(suppl 1):S103-7.
13. Desmond MM, Montgomery JR, Melnick JL, Cochran GG, Verniaud W. Congenital rubella encephalitis: effects on growth and early development. Am J Dis Child 1969;118:30-1.
14. Ziring PR. Congenital rubella: the teenage years. Pediatr Ann 1977;6:762-70.
15. CDC. Rubella vaccination during pregnancy—United States, 1971-1982. MMWR 1983;32: 429-32,437.
16. ACIP. Rubella prevention. MMWR 1984;33:301-10,315-8.

## *Current Trends*

### Traumatic Occupational Fatalities — United States, 1980-1984

To help fill a critical gap in information on fatal occupational injuries, CDC's National Institute for Occupational Safety and Health (NIOSH) began gathering data in 1985 to establish the National Traumatic Occupational Fatality (NTOF) data base. The

*Occupational Fatalities — Continued*

50 states and the District of Columbia provided death certificates indicating deaths from traumatic occupational fatalities for 1980-1984*. Preliminary analyses of these data revealed a total of 32,342 traumatic occupational fatalities occurring at an average annual crude rate of 8.8/100,000 workers and resulting in an annual average of 165,172 years of potential life lost (YPLL) before age 65.

The NTOF data base includes only data from death certificates indicating that: 1) death was related to external causes†, 2) the deceased was ≥16 years of age at the time of death, and 3) the injury occurred at work. Data from 16 of the reporting jurisdictions were incomplete because they did not include any certificates reporting homicides or suicides or stating the cause of death as "pending". NIOSH is currently acquiring this missing information. For the initial analysis of NTOF data, occupational homicides and suicides were estimated for those states that did not provide them. These estimates were made using a regression equation based on data from states that did provide this information. Age-specific fatality rates were calculated using 1980 Bureau of the Census data (*1*). Denominator data for state- and industry-specific rates were derived from Bureau of the Census annual County Business Patterns bulletins for 1980-1984 and the 1982 Census of Agriculture (*2,3*). Denominator data did not include persons employed in public administration.

Analysis of the NTOF data indicates that approximately 7,000 traumatic occupational fatalities occurred per year in all 50 states and the District of Columbia during the period studied. Male workers were involved in 94.6% of the deaths, and females, in 5.4%. For the 35 jurisdictions including homicides and suicides in their reports, 84.2% of fatalities resulted from unintentional injuries, 13.0% represented occupational homicides, and 2.8% represented occupational suicides§ (Table 1). Although the distribution for males was similar to the overall distribution, it was quite different for females. Forty-two percent of fatalities among females were homicides, and 4.6% were suicides. The number of reported fatalities for most age groups varied in direct proportion to the population of the work force in the age group. Fatality rates among the age groups generally ranged from 6.3 to 7.5/100,000 workers (Figure 1). Exceptions were the youngest age group (ages 16-19), which had a lower fatality rate (4.0), and the older age groups (55-59, 60-64, and >64), which had progressively higher rates (8.5, 9.7, and 17.7, respectively).

*Death certificates will be collected through 1990.
†Classified within the range of categories E800-E999 according to the International Classification of Diseases, 9th Edition.
§Suicides occurring in the workplace.

**TABLE 1. Traumatic occupational fatalities, by sex and classification of fatality — United States, 1980-1984**

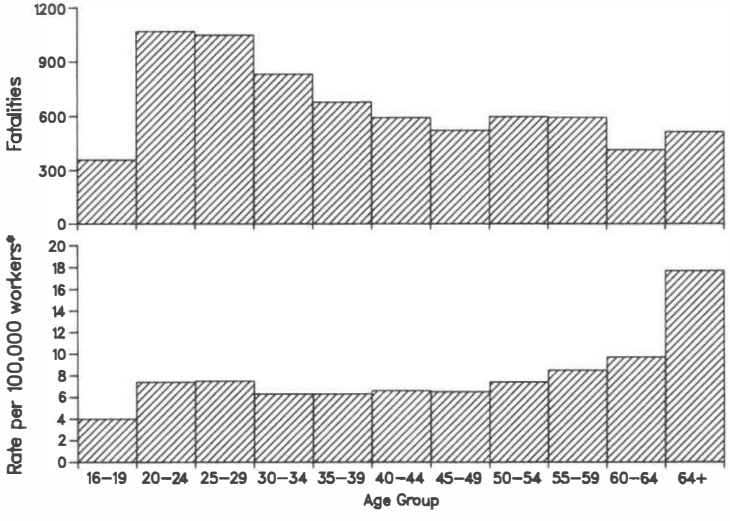
| | All Fatalities* | | Classification† (%) | | |
|---|---|---|---|---|---|
| | No. | (%) | Unintentional | Homicide | Suicide |
| Male | 30,692 | (94.6) | (86.1) | (11.2) | (2.7) |
| Female | 1,740 | (5.4) | (53.4) | (42.0) | (4.6) |
| **Total** | **32,432** | **(100.0)** | **(84.2)** | **(13.0)** | **(2.8)** |

*Based on totals provided by the 51 reporting units; does not include the 2,070 additional fatalities estimated for jurisdictions that did not include certificates reporting deaths attributable to homicide or suicide or stating the cause of death as "pending".
†Based on totals provided only by the 35 units that reported homicides and suicides.

*Occupational Fatalities — Continued*

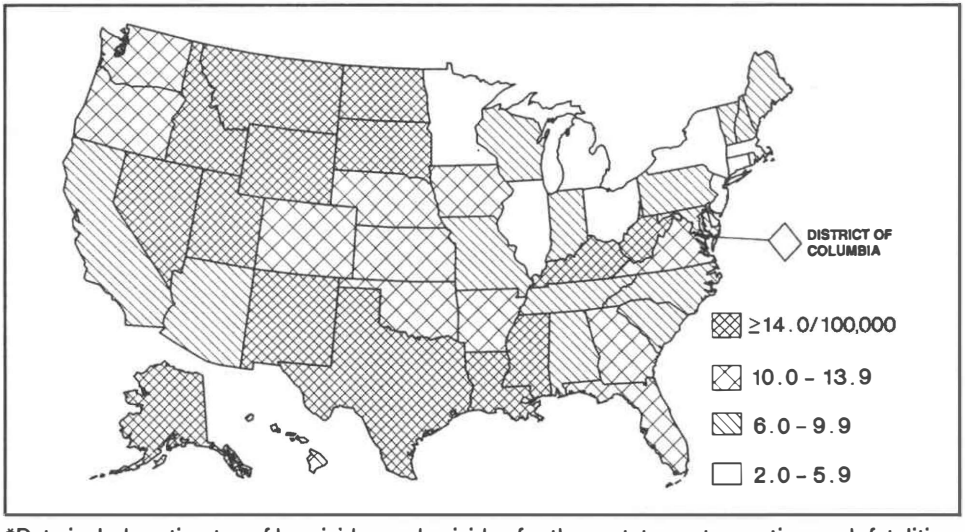
The states with the highest average rates of occupational fatalities per 100,000 workers over the 5-year period were Wyoming (34.6), Alaska (33.5), and Montana (24.8). The lowest rates were in Massachusetts (2.1) and Rhode Island (2.4) (Figure 2). States with similar rates tended to cluster into regional groups. State-specific values for YPLL ranged from 174 years (Rhode Island) to 21,990 years (Texas) and generally

**FIGURE 1. Traumatic occupational fatalities, by age group — United States, 1980**




*Employment data: Bureau of the Census, U.S. Department of Commerce, 1980

**FIGURE 2. State-specific traumatic occupational fatality rates, 1980-1984***




*Data include estimates of homicides and suicides for those states not reporting such fatalities.

*Occupational Fatalities — Continued*

reflected state-specific numbers of fatalities, which, in turn, depended largely on the size of each state's working population. Industry-specific rates of fatalities from all causes showed the highest annual average in mining (30.1/100,000 workers), construction (23.1), and agriculture (20.3); the lowest rate was in wholesale trade (1.1) (Table 2, see page 469). However, a significant proportion (20%) of the total reported fatalities could not be included in the industry-specific analysis because data were not adequate to determine the industry involved.

*Reported by: Div of Safety Research, National Institute for Occupational Safety and Health, CDC.*

**Editorial Note:** Although no complete and reliable nationwide census of traumatic occupational fatalities has been available previously, fatal occupational injuries—whether measured by numbers of fatalities, rates, or YPLL—are recognized as an important source of preventable mortality in the United States (*4*). Estimates of the magnitude of the problem have varied considerably, as illustrated by the following

*(Continued on page 469)*

**TABLE I. Summary — cases specified notifiable diseases, United States**

| Disease | 28th Week Ending | | | Cumulative, 28th Week Ending | | |
|---|---|---|---|---|---|---|
| | July 18, 1987 | July 12, 1986 | Median 1982-1986 | July 18, 1987 | July 12, 1986 | Median 1982-1986 |
| Acquired Immunodeficiency Syndrome (AIDS) | 496 | 274 | N | 9,714 | 6,592 | N |
| Aseptic meningitis | 282 | 240 | 235 | 3,328 | 2,924 | 2,694 |
| Encephalitis: Primary (arthropod-borne & unspec) | 24 | 23 | 33 | 475 | 444 | 514 |
| Post-infectious | 3 | - | 1 | 64 | 61 | 61 |
| Gonorrhea: Civilian | 11,154 | 18,988 | 17,832 | 417,472 | 454,664 | 454,664 |
| Military | 238 | 346 | 362 | 8,604 | 8,614 | 11,218 |
| Hepatitis: Type A | 449 | 363 | 361 | 13,203 | 11,682 | 11,412 |
| Type B | 515 | 505 | 430 | 13,685 | 13,621 | 13,265 |
| Non A, Non B | 53 | 64 | N | 1,660 | 1,911 | N |
| Unspecified | 52 | 70 | 99 | 1,688 | 2,513 | 3,025 |
| Legionellosis | 15 | 16 | N | 432 | 314 | N |
| Leprosy | 1 | 10 | 8 | 100 | 154 | 139 |
| Malaria | 25 | 18 | 33 | 391 | 484 | 475 |
| Measles: Total* | 82 | 148 | 86 | 2,846 | 4,520 | 1,993 |
| Indigenous | 80 | 138 | N | 2,537 | 4,284 | N |
| Imported | 2 | 10 | N | 309 | 230 | N |
| Meningococcal infections: Total | 48 | 36 | 39 | 1,796 | 1,580 | 1,745 |
| Civilian | 48 | 36 | 39 | 1,795 | 1,578 | 1,742 |
| Military | - | - | - | 1 | 2 | 6 |
| Mumps | 130 | 144 | 25 | 9,536 | 2,694 | 2,147 |
| Pertussis | 36 | 46 | 46 | 936 | 1,460 | 1,065 |
| Rubella (German measles) | 12 | 8 | 12 | 238 | 335 | 442 |
| Syphilis (Primary & Secondary): Civilian | 590 | 412 | 495 | 17,980 | 13,672 | 14,788 |
| Military | 1 | 1 | 4 | 87 | 95 | 180 |
| Toxic Shock syndrome | 6 | 8 | N | 160 | 188 | N |
| Tuberculosis | 424 | 412 | 412 | 10,960 | 11,208 | 11,208 |
| Tularemia | 10 | 4 | 9 | 83 | 56 | 110 |
| Typhoid Fever | 4 | 12 | 5 | 149 | 148 | 168 |
| Typhus fever, tick-borne (RMSF) | 33 | 27 | 30 | 278 | 293 | 379 |
| Rabies, animal | 53 | 78 | 82 | 2,633 | 3,020 | 3,020 |

**TABLE II. Notifiable diseases of low frequency, United States**

| | Cum. 1987 | | Cum. 1987 |
|---|---|---|---|
| Anthrax | - | Leptospirosis (La. 1) | 10 |
| Botulism: Foodborne | 4 | Plague | 3 |
| Infant (Conn. 1) | 32 | Poliomyelitis, Paralytic | - |
| Other | - | Psittacosis (S.C. 1, Wash. 1) | 52 |
| Brucellosis (Ga. 1) | 56 | Rabies, human | - |
| Cholera | - | Tetanus | 18 |
| Congenital rubella syndrome (Calif. 1) | 4 | Trichinosis | 26 |
| Congenital syphilis, ages < 1 year | - | Typhus fever, flea-borne (endemic, murine) | 16 |
| Diphtheria | 1 | (Tex. 1) | |

*Two of the 82 reported cases for this week were imported from a foreign country or can be directly traceable to a known internationally imported case within two generations.

## TABLE III. Cases of specified notifiable diseases, United States, weeks ending July 18, 1987 and July 12, 1986 (28th Week)

| Reporting Area | AIDS | Aseptic Meningitis | Encephalitis | | Gonorrhea (Civilian) | | Hepatitis(Viral), by type | | | | Legionellosis | Leprosy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Primary | Post-infectious | | | A | B | NA,NB | Unspecified | | |
| | Cum. 1987 | 1987 | Cum. 1987 | Cum. 1987 | Cum. 1987 | Cum. 1986 | 1987 | 1987 | 1987 | 1987 | 1987 | Cum. 1987 |
| UNITED STATES | 9,714 | 282 | 475 | 64 | 417,472 | 454,664 | 449 | 515 | 53 | 52 | 15 | 100 |
| NEW ENGLAND | 417 | 15 | 20 | 2 | 12,960 | 10,280 | 18 | 37 | 2 | 4 | - | 10 |
| Maine | 13 | 1 | 1 | - | 382 | 486 | - | 2 | - | - | - | - |
| N.H. | 11 | 6 | - | - | 215 | 261 | 2 | - | - | - | - | 2 |
| Vt. | 4 | 3 | 4 | - | 111 | 146 | 1 | 3 | - | - | - | - |
| Mass. | 250 | 2 | 10 | 1 | 4,626 | 4,447 | 9 | 24 | 1 | 4 | - | 7 |
| R.I. | 35 | - | 3 | 1 | 1,108 | 886 | - | 5 | 1 | - | - | - |
| Conn. | 104 | 3 | 2 | - | 6,518 | 4,054 | 6 | 3 | - | - | - | 1 |
| MID. ATLANTIC | 2,632 | 29 | 62 | 5 | 67,376 | 75,827 | 20 | 27 | 2 | 1 | 1 | 5 |
| Upstate N.Y. | 396 | 8 | 25 | 3 | 8,943 | 8,981 | 13 | 7 | 1 | - | 1 | - |
| N.Y. City | 1,461 | 3 | 5 | - | 35,695 | 44,397 | 1 | 11 | - | - | - | 5 |
| N.J. | 519 | 18 | 7 | - | 8,668 | 9,614 | 6 | 9 | 1 | 1 | - | - |
| Pa. | 256 | - | 25 | 2 | 14,070 | 12,835 | - | - | - | - | - | - |
| E.N. CENTRAL | 693 | 54 | 136 | 11 | 59,757 | 62,854 | 24 | 39 | 1 | 4 | 4 | 4 |
| Ohio | 112 | 10 | 54 | 5 | 13,419 | 15,205 | 2 | 6 | - | - | 2 | 1 |
| Ind. | 57 | 21 | 11 | - | 4,824 | 6,581 | 10 | 11 | - | 4 | 1 | - |
| Ill. | 346 | 3 | 21 | 6 | 18,095 | 16,644 | 5 | 8 | - | - | - | 1 |
| Mich. | 125 | 20 | 40 | - | 18,332 | 17,896 | 7 | 13 | 1 | - | 1 | 1 |
| Wis. | 53 | - | 10 | - | 5,087 | 6,528 | - | 1 | - | - | - | 1 |
| W.N. CENTRAL | 216 | 10 | 16 | - | 17,014 | 19,443 | 34 | 20 | 2 | 1 | - | - |
| Minn. | 60 | 1 | 10 | - | 2,654 | 2,711 | - | 3 | - | - | - | - |
| Iowa | 15 | 1 | 1 | - | 1,635 | 1,956 | - | 5 | 2 | - | - | - |
| Mo. | 96 | 5 | - | - | 8,797 | 9,880 | 12 | 9 | - | 1 | - | - |
| N. Dak. | 1 | - | - | - | 143 | 180 | - | - | - | - | - | - |
| S. Dak. | 2 | 2 | - | - | 310 | 393 | - | - | - | - | - | - |
| Nebr. | 14 | 1 | 3 | - | 1,101 | 1,371 | 3 | 1 | - | - | - | - |
| Kans. | 28 | - | 2 | - | 2,374 | 2,952 | 19 | 2 | - | - | - | - |
| S. ATLANTIC | 1,640 | 70 | 59 | 19 | 110,519 | 116,616 | 40 | 113 | 8 | 3 | 3 | 5 |
| Del. | 9 | 2 | 3 | 1 | 1,685 | 1,861 | 1 | 2 | - | - | - | - |
| Md. | 192 | 19 | 10 | 4 | 13,263 | 13,631 | 8 | 30 | 2 | - | 1 | 2 |
| D.C. | 220 | - | - | - | 7,411 | 8,763 | - | - | - | - | - | - |
| Va. | 116 | 6 | 19 | 2 | 8,056 | 9,548 | 4 | 11 | 2 | - | - | - |
| W. Va. | 13 | 4 | 8 | - | 804 | 1,216 | - | 1 | - | - | - | - |
| N.C. | 71 | 4 | 9 | - | 16,528 | 17,681 | 8 | 20 | 2 | 1 | - | - |
| S.C. | 38 | 4 | - | - | 9,161 | 10,310 | - | 10 | 1 | - | - | 1 |
| Ga. | 242 | 12 | - | - | 18,237 | 20,332 | 3 | 17 | - | - | 2 | - |
| Fla. | 739 | 19 | 10 | 12 | 35,374 | 33,274 | 16 | 22 | 1 | 2 | - | 2 |
| E.S. CENTRAL | 117 | 13 | 28 | 4 | 31,268 | 36,903 | 1 | 35 | 5 | 1 | 1 | - |
| Ky. | 21 | 6 | 14 | 1 | 3,153 | 4,149 | - | 4 | - | - | - | - |
| Tenn. | 10 | 1 | 6 | - | 10,996 | 14,273 | - | 16 | - | - | - | - |
| Ala. | 72 | 4 | 8 | - | 9,972 | 10,485 | 1 | 12 | 5 | 1 | 1 | - |
| Miss. | 14 | 2 | - | 3 | 7,147 | 7,996 | - | 3 | - | - | - | - |
| W.S. CENTRAL | 928 | 27 | 49 | 4 | 47,272 | 55,006 | 35 | 49 | 3 | 10 | 2 | 4 |
| Ark. | 23 | 3 | - | 2 | 4,927 | 5,078 | 4 | - | - | - | - | - |
| La. | 127 | 1 | 6 | - | 8,663 | 9,811 | 2 | 18 | - | 2 | 1 | - |
| Okla. | 50 | 7 | 12 | 1 | 5,210 | 6,118 | 4 | 3 | 2 | 1 | - | - |
| Tex. | 728 | 16 | 31 | 1 | 28,472 | 33,999 | 25 | 28 | 1 | 7 | 1 | 4 |
| MOUNTAIN | 261 | 19 | 13 | 3 | 11,023 | 13,476 | 44 | 48 | 3 | 1 | 1 | 1 |
| Mont. | 2 | - | - | - | 290 | 385 | 2 | - | - | - | - | - |
| Idaho | 4 | - | - | - | 404 | 452 | 3 | 7 | - | 1 | - | - |
| Wyo. | 3 | - | - | - | 228 | 310 | - | - | - | - | - | - |
| Colo. | 110 | 16 | 1 | - | 2,384 | 3,498 | 4 | 8 | - | - | - | - |
| N. Mex. | 15 | - | 1 | - | 1,206 | 1,349 | 2 | 4 | 1 | - | - | - |
| Ariz. | 77 | 3 | 9 | 1 | 3,814 | 4,428 | 29 | 24 | 2 | - | - | - |
| Utah | 17 | - | - | 2 | 339 | 579 | 2 | 1 | - | - | 1 | - |
| Nev. | 33 | - | 2 | - | 2,358 | 2,475 | 2 | 4 | - | - | - | 1 |
| PACIFIC | 2,810 | 45 | 92 | 16 | 60,283 | 64,259 | 233 | 147 | 27 | 27 | 3 | 71 |
| Wash. | 140 | - | 8 | 2 | 4,403 | 4,935 | 27 | 10 | 5 | 1 | 1 | 3 |
| Oreg. | 61 | - | - | - | 2,260 | 2,581 | 18 | 14 | 2 | 1 | - | - |
| Calif. | 2,551 | 43 | 80 | 14 | 52,202 | 54,469 | 185 | 116 | 20 | 24 | 2 | 53 |
| Alaska | 8 | 2 | 2 | - | 928 | 1,539 | 2 | 3 | - | 1 | - | - |
| Hawaii | 50 | - | 2 | - | 490 | 735 | 1 | 4 | - | - | - | 15 |
| Guam | - | - | - | - | 106 | 91 | - | - | - | - | - | - |
| P.R. | 73 | 1 | 1 | 1 | 1,173 | 1,285 | 1 | 2 | - | - | - | 5 |
| V.I. | - | - | - | - | 139 | 129 | 1 | - | - | - | - | - |
| Pac. Trust Terr. | - | - | - | - | 244 | 204 | - | - | - | - | - | 39 |
| Amer. Samoa | - | - | - | - | 47 | 26 | - | - | - | - | - | - |

N: Not notifiable U: Unavailable

## TABLE III. (Cont'd.) Cases of specified notifiable diseases, United States, weeks ending July 18, 1987 and July 12, 1986 (28th Week)

| Reporting Area | Malaria | Measles (Rubeola) | | | | | Menin-gococcal Infections | Mumps | | Pertussis | | | Rubella | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Indigenous | | Imported* | | Total | | | | | | | | | |
| | Cum. 1987 | 1987 | Cum. 1987 | 1987 | Cum. 1987 | Cum. 1986 | Cum. 1987 | 1987 | Cum. 1987 | 1987 | Cum. 1987 | Cum. 1986 | 1987 | Cum. 1987 | Cum. 1986 |
| UNITED STATES | 391 | 80 | 2,537 | 2 | 309 | 4,520 | 1,796 | 130 | 9,536 | 36 | 936 | 1,460 | 12 | 238 | 335 |
| NEW ENGLAND | 28 | - | 99 | 1 | 150 | 75 | 158 | 3 | 26 | 3 | 27 | 88 | - | 1 | 9 |
| Maine | - | - | 3 | - | - | 9 | 9 | - | - | 1 | 5 | 2 | - | 1 | - |
| N.H. | 1 | - | 51 | - | 102 | 35 | 16 | - | 8 | 2 | 4 | 43 | - | - | 1 |
| Vt. | - | - | 9 | - | 14 | - | 10 | - | 2 | - | 3 | 3 | - | - | 1 |
| Mass. | 9 | - | 21 | - | 27 | 27 | 76 | - | 3 | - | 6 | 23 | - | - | 4 |
| R.I. | 5 | - | 1 | - | 1 | 2 | 14 | - | 2 | - | 1 | 1 | - | - | 2 |
| Conn. | 13 | - | 14 | 1§ | 6 | 2 | 33 | 3 | 11 | - | 8 | 16 | - | - | 1 |
| MID. ATLANTIC | 35 | 1 | 470 | - | 43 | 1,345 | 213 | - | 153 | 1 | 115 | 107 | - | 10 | 28 |
| Upstate N.Y. | 16 | - | 24 | - | 9 | 54 | 75 | - | 73 | - | 86 | 70 | - | 8 | 20 |
| N.Y. City | 4 | 1 | 406 | - | 14 | 364 | 17 | - | - | - | - | 3 | - | 1 | 5 |
| N.J. | 8 | - | 19 | - | 3 | 905 | 44 | - | 39 | - | 6 | 9 | - | 1 | 3 |
| Pa. | 7 | - | 21 | - | 17 | 22 | 77 | - | 41 | 1 | 23 | 25 | - | - | - |
| E.N. CENTRAL | 17 | - | 255 | - | 18 | 916 | 255 | 36 | 5,550 | - | 106 | 224 | - | 27 | 52 |
| Ohio | 7 | - | 1 | - | 4 | 10 | 87 | - | 77 | - | 35 | 80 | - | - | - |
| Ind. | 3 | - | - | - | - | 7 | 29 | 24 | 780 | - | 4 | 22 | - | - | - |
| Ill. | 1 | - | 106 | - | 12 | 581 | 56 | 5 | 2,424 | - | 5 | 28 | - | 19 | 47 |
| Mich. | 6 | - | 29 | - | - | 31 | 68 | 7 | 807 | - | 28 | 23 | - | 8 | 4 |
| Wis. | - | - | 119 | - | 2 | 282 | 15 | - | 1,462 | - | 34 | 71 | - | - | 1 |
| W.N. CENTRAL | 11 | 2 | 194 | - | 21 | 267 | 78 | 62 | 1,254 | 2 | 52 | 70 | - | 1 | 10 |
| Minn. | 5 | - | 15 | - | 19 | 49 | 25 | 54 | 732 | - | 9 | 29 | - | - | - |
| Iowa | 2 | - | - | - | - | 70 | 3 | 6 | 367 | 1 | 10 | 9 | - | 1 | 1 |
| Mo. | 4 | 2 | 179 | - | 1 | 23 | 22 | - | 20 | - | 18 | 5 | - | - | 1 |
| N. Dak. | - | - | - | - | - | 25 | 1 | - | 6 | - | 1 | 3 | - | - | 1 |
| S. Dak. | - | - | - | - | - | - | 1 | 2 | 82 | - | 2 | 12 | - | - | - |
| Nebr. | - | - | - | - | - | 1 | 3 | - | 3 | - | 1 | 2 | - | - | - |
| Kans. | - | - | - | - | 1 | 99 | 23 | - | 44 | 1 | 11 | 10 | - | - | 7 |
| S. ATLANTIC | 68 | 7 | 87 | 1 | 10 | 508 | 301 | 2 | 217 | 4 | 185 | 543 | 1 | 13 | 3 |
| Del. | 1 | - | 27 | - | - | 1 | 4 | - | - | - | - | 221 | - | 2 | - |
| Md. | 15 | - | 2 | - | 2 | 29 | 28 | - | 19 | - | 5 | 150 | - | 2 | - |
| D.C. | 8 | - | - | - | 1 | 1 | 5 | 1 | 1 | - | - | - | - | - | - |
| Va. | 14 | - | 1 | - | - | 55 | 49 | 1 | 65 | - | 38 | 20 | - | 1 | - |
| W. Va. | 2 | - | - | - | - | 2 | 1 | - | 28 | - | 39 | 10 | - | - | - |
| N.C. | 7 | - | 1 | 1§ | 2 | 3 | 41 | - | 14 | 3 | 74 | 23 | 1 | 1 | - |
| S.C. | 3 | - | - | - | - | 301 | 29 | - | 12 | - | - | 9 | - | - | - |
| Ga. | 3 | - | - | - | 1 | 82 | 57 | - | 40 | - | 17 | 76 | - | 1 | - |
| Fla. | 15 | 7 | 56 | - | 4 | 34 | 87 | - | 38 | 1 | 12 | 34 | - | 6 | 3 |
| E.S. CENTRAL | 7 | - | 2 | - | - | 50 | 83 | 12 | 1,202 | 2 | 22 | 23 | - | 3 | 1 |
| Ky. | 1 | - | - | - | - | - | 15 | - | 210 | - | 1 | 1 | - | 2 | 1 |
| Tenn. | 1 | - | - | - | - | 48 | 30 | 11 | 940 | - | 6 | 6 | - | 1 | - |
| Ala. | 1 | - | - | - | - | - | 32 | 1 | 52 | 1 | 10 | 16 | - | - | - |
| Miss. | 4 | - | 2 | - | - | 2 | 6 | N | N | 1 | 5 | - | - | - | - |
| W.S. CENTRAL | 28 | 53 | 296 | - | 3 | 591 | 122 | 5 | 696 | 10 | 71 | 97 | - | 5 | 53 |
| Ark. | 1 | - | - | - | - | 283 | 16 | - | 278 | - | 5 | 7 | - | 2 | - |
| La. | - | - | - | - | - | 2 | 10 | 1 | 200 | 4 | 17 | 6 | - | - | - |
| Okla. | 4 | - | 1 | - | 1 | 27 | 17 | N | N | 6 | 49 | 56 | - | - | - |
| Tex. | 23 | 53 | 295 | - | 2 | 279 | 79 | 4 | 218 | - | - | 28 | - | 3 | 53 |
| MOUNTAIN | 17 | 3 | 449 | - | 15 | 296 | 64 | - | 180 | 3 | 89 | 141 | - | 19 | 19 |
| Mont. | - | - | 123 | - | 1 | 7 | 3 | - | 4 | - | 3 | 7 | - | 3 | 1 |
| Idaho | 2 | - | - | - | - | 1 | 5 | - | 3 | 1 | 27 | 31 | - | 1 | - |
| Wyo. | - | - | - | - | 2 | - | - | - | - | - | 5 | 1 | - | 1 | - |
| Colo. | 5 | - | 5 | - | - | 7 | 19 | - | 28 | 2 | 23 | 38 | - | - | 1 |
| N. Mex. | 1 | 1 | 295 | - | 9 | 31 | 3 | N | N | - | 7 | 15 | - | - | - |
| Ariz. | 7 | 2 | 24 | - | 1 | 243 | 21 | - | 134 | - | 23 | 29 | - | 4 | 2 |
| Utah | - | - | - | - | 1 | 6 | 9 | - | 8 | - | 1 | 17 | - | 10 | 12 |
| Nev. | 2 | - | 2 | - | 1 | 1 | 4 | - | 3 | - | - | 3 | - | - | 3 |
| PACIFIC | 180 | 14 | 685 | - | 49 | 472 | 522 | 10 | 258 | 11 | 269 | 167 | 11 | 159 | 160 |
| Wash. | 14 | 2 | 31 | - | 1 | 130 | 65 | 2 | 37 | 3 | 40 | 57 | - | - | 8 |
| Oreg. | 4 | - | 2 | - | 33 | 7 | 24 | N | N | - | 14 | 9 | - | 1 | - |
| Calif. | 158 | 12 | 652 | - | 11 | 315 | 421 | 8 | 202 | 3 | 109 | 95 | 8 | 100 | 150 |
| Alaska | 3 | - | - | - | - | - | 4 | - | 6 | - | 3 | 2 | - | 1 | - |
| Hawaii | 1 | - | - | - | 4 | 20 | 8 | - | 13 | 5 | 103 | 4 | 3 | 57 | 2 |
| Guam | - | - | 2 | - | - | 5 | 4 | - | 5 | - | - | - | - | 1 | 2 |
| P.R. | 1 | 16 | 649 | - | - | 33 | 3 | 1 | 6 | - | 12 | 7 | - | 2 | 58 |
| V.I. | - | - | - | - | - | - | - | - | 9 | - | - | - | - | - | - |
| Pac. Trust Terr. | - | - | 1 | - | - | - | 1 | - | 5 | - | 1 | - | - | 1 | - |
| Amer. Samoa | - | - | - | - | - | 2 | - | - | 3 | - | - | - | - | - | 1 |

*For measles only, imported cases includes both out-of-state and international importations.

N: Not notifiable U: Unavailable †International §Out-of-state

## TABLE III. (Cont'd.) Cases of specified notifiable diseases, United States, weeks ending July 18, 1987 and July 12, 1986 (28th Week)

| Reporting Area | Syphilis (Civilian) (Primary& Secondary) | | Toxic-shock Syndrome | Tuberculosis | | Tula-remia | Typhoid Fever | Typhus Fever (Tick-borne) (RMSF) | Rabies, Animal |
|---|---|---|---|---|---|---|---|---|---|
| | Cum. 1987 | Cum. 1986 | 1987 | Cum. 1987 | Cum. 1986 | Cum. 1987 | Cum. 1987 | Cum. 1987 | Cum. 1987 |
| UNITED STATES | 17,980 | 13,672 | 6 | 10,960 | 11,208 | 83 | 149 | 278 | 2,633 |
| NEW ENGLAND | 287 | 275 | - | 349 | 352 | - | 16 | 3 | 4 |
| Maine | 1 | 15 | - | 17 | 27 | - | 1 | - | 1 |
| N.H. | 3 | 10 | - | 8 | 11 | - | - | - | - |
| Vt. | 1 | 6 | - | 7 | 11 | - | 1 | - | - |
| Mass. | 136 | 142 | - | 196 | 167 | - | 10 | 2 | - |
| R.I. | 8 | 16 | - | 25 | 24 | - | 1 | - | 1 |
| Conn. | 138 | 86 | - | 96 | 112 | - | 3 | 1 | 2 |
| MID. ATLANTIC | 3,321 | 1,941 | - | 1,849 | 2,266 | - | 17 | 5 | 192 |
| Upstate N.Y. | 105 | 95 | - | 274 | 332 | - | 7 | 3 | 18 |
| N.Y. City | 2,398 | 1,099 | - | 889 | 1,157 | - | - | - | - |
| N.J. | 368 | 355 | - | 342 | 399 | - | 10 | 1 | 6 |
| Pa. | 450 | 392 | - | 344 | 378 | - | - | 1 | 168 |
| E.N. CENTRAL | 483 | 548 | 2 | 1,337 | 1,360 | 1 | 18 | 28 | 89 |
| Ohio | 56 | 71 | 1 | 249 | 223 | 1 | 6 | 23 | 6 |
| Ind. | 33 | 66 | - | 130 | 145 | - | 4 | - | 11 |
| Ill. | 259 | 294 | - | 555 | 614 | - | 5 | 1 | 31 |
| Mich. | 95 | 91 | 1 | 343 | 312 | - | 2 | 4 | 12 |
| Wis. | 40 | 26 | - | 60 | 66 | - | 1 | - | 29 |
| W.N. CENTRAL | 80 | 129 | - | 344 | 318 | 25 | 8 | 37 | 606 |
| Minn. | 10 | 21 | - | 73 | 81 | - | 3 | - | 148 |
| Iowa | 11 | 6 | - | 19 | 24 | 3 | 2 | - | 166 |
| Mo. | 40 | 69 | - | 193 | 157 | 15 | 3 | 11 | 33 |
| N. Dak. | - | 3 | - | 5 | 4 | - | - | - | 76 |
| S. Dak. | 8 | 2 | - | 17 | 15 | 4 | - | - | 136 |
| Nebr. | 7 | 11 | - | 12 | 5 | 1 | - | - | 16 |
| Kans. | 4 | 17 | - | 25 | 32 | 2 | - | 26 | 31 |
| S. ATLANTIC | 6,273 | 4,100 | - | 2,354 | 2,163 | 4 | 12 | 96 | 710 |
| Del. | 45 | 27 | - | 22 | 26 | 1 | - | - | - |
| Md. | 322 | 243 | - | 211 | 156 | - | 3 | 29 | 244 |
| D.C. | 186 | 174 | - | 78 | 73 | - | - | - | 28 |
| Va. | 161 | 212 | - | 241 | 190 | 1 | 1 | 5 | 216 |
| W. Va. | 6 | 11 | - | 64 | 63 | - | 1 | 4 | 29 |
| N.C. | 336 | 277 | - | 261 | 301 | 1 | 1 | 24 | 5 |
| S.C. | 403 | 340 | - | 231 | 277 | - | - | 24 | 34 |
| Ga. | 831 | 811 | - | 350 | 320 | - | - | 10 | 104 |
| Fla. | 3,983 | 2,005 | - | 896 | 757 | 1 | 6 | - | 50 |
| E.S. CENTRAL | 1,037 | 913 | 1 | 874 | 993 | 4 | 2 | 31 | 192 |
| Ky. | 8 | 44 | - | 241 | 245 | 1 | 1 | 5 | 97 |
| Tenn. | 435 | 334 | - | 191 | 299 | 1 | 1 | 18 | 51 |
| Ala. | 261 | 295 | 1 | 272 | 313 | - | - | 6 | 44 |
| Miss. | 333 | 240 | - | 170 | 136 | 2 | - | 2 | - |
| W.S. CENTRAL | 2,269 | 2,827 | 1 | 1,299 | 1,400 | 30 | 9 | 67 | 395 |
| Ark. | 128 | 154 | - | 157 | 188 | 17 | 1 | 3 | 80 |
| La. | 395 | 466 | - | 144 | 228 | 2 | - | - | 11 |
| Okla. | 85 | 74 | 1 | 124 | 123 | 11 | 2 | 57 | 18 |
| Tex. | 1,661 | 2,133 | - | 874 | 861 | - | 6 | 7 | 286 |
| MOUNTAIN | 362 | 326 | 2 | 256 | 258 | 9 | 8 | 9 | 201 |
| Mont. | 8 | 6 | - | 9 | 13 | 1 | - | 7 | 102 |
| Idaho | 3 | 6 | 1 | 17 | 11 | 1 | - | - | 1 |
| Wyo. | 1 | - | - | - | - | - | - | 1 | 44 |
| Colo. | 61 | 82 | - | 20 | 23 | 2 | - | - | 3 |
| N. Mex. | 32 | 43 | - | 51 | 54 | 1 | 8 | - | 1 |
| Ariz. | 172 | 132 | 1 | 139 | 122 | 3 | - | - | 43 |
| Utah | 15 | 9 | - | 6 | 20 | 1 | - | 1 | 2 |
| Nev. | 70 | 48 | - | 14 | 15 | - | - | - | 5 |
| PACIFIC | 3,868 | 2,613 | - | 2,298 | 2,098 | 10 | 59 | 2 | 244 |
| Wash. | 46 | 86 | - | 136 | 108 | 4 | 6 | - | - |
| Oreg. | 135 | 57 | - | 60 | 69 | 3 | 1 | - | - |
| Calif. | 3,675 | 2,450 | - | 1,952 | 1,777 | 2 | 49 | 2 | 241 |
| Alaska | 3 | - | - | 34 | 33 | 1 | - | - | 3 |
| Hawaii | 9 | 20 | - | 116 | 111 | - | 3 | - | - |
| Guam | 2 | 1 | - | 25 | 31 | - | - | - | - |
| P.R. | 543 | 442 | - | 167 | 165 | - | - | - | 37 |
| V.I. | 3 | - | - | 2 | 1 | - | - | - | - |
| Pac. Trust Terr. | 112 | 148 | - | 96 | 32 | - | 16 | - | - |
| Amer. Samoa | 2 | - | - | - | 3 | - | 1 | - | - |

U: Unavailable

# TABLE IV. Deaths in 121 U.S. cities,* week ending July 18, 1987 (28th Week)

| Reporting Area | All Causes, By Age (Years) | | | | | | P&I** |
|---|---|---|---|---|---|---|---|
| | All Ages | ≥65 | 45-64 | 25-44 | 1-24 | <1 | Total |
| NEW ENGLAND | 641 | 438 | 124 | 47 | 16 | 16 | 37 |
| Boston, Mass. | 176 | 106 | 46 | 11 | 5 | 8 | 26 |
| Bridgeport, Conn. | 39 | 25 | 7 | 5 | 2 | - | - |
| Cambridge, Mass. | 19 | 14 | 4 | - | 1 | - | - |
| Fall River, Mass. | 25 | 17 | 6 | 2 | - | - | - |
| Hartford, Conn.§ | 61 | 40 | 13 | 5 | 1 | 2 | 1 |
| Lowell, Mass. | 11 | 8 | 2 | 1 | - | - | - |
| Lynn, Mass. | 30 | 27 | 3 | - | - | - | - |
| New Bedford, Mass. | 30 | 22 | 5 | 3 | - | - | - |
| New Haven, Conn. | 61 | 46 | 5 | 5 | 3 | 2 | 1 |
| Providence, R.I. | 46 | 30 | 10 | 2 | 3 | 1 | - |
| Somerville, Mass. | 12 | 9 | 1 | 2 | - | - | - |
| Springfield, Mass. | 32 | 22 | 6 | 2 | - | 2 | 3 |
| Waterbury, Conn. | 36 | 23 | 8 | 4 | 1 | - | 1 |
| Worcester, Mass. | 63 | 49 | 8 | 5 | - | 1 | 5 |
| MID. ATLANTIC | 2,718 | 1,753 | 547 | 270 | 74 | 74 | 111 |
| Albany, N.Y. | 52 | 38 | 12 | - | 1 | 1 | 1 |
| Allentown, Pa. | 21 | 13 | 6 | 2 | - | - | - |
| Buffalo, N.Y. | 127 | 84 | 32 | 6 | 2 | 3 | 7 |
| Camden, N.J. | 46 | 26 | 14 | 2 | 2 | 2 | - |
| Elizabeth, N.J. | 20 | 15 | 2 | 3 | - | - | 1 |
| Erie, Pa.† | 46 | 32 | 7 | 4 | 2 | 1 | 3 |
| Jersey City, N.J. | 55 | 38 | 11 | 4 | - | 2 | 3 |
| N.Y. City, N.Y. | 1,394 | 865 | 282 | 172 | 38 | 37 | 46 |
| Newark, N.J. | 61 | 25 | 15 | 14 | 5 | 2 | 4 |
| Paterson, N.J. | 32 | 22 | 1 | 5 | - | 4 | - |
| Philadelphia, Pa. | 401 | 262 | 88 | 32 | 12 | 7 | 21 |
| Pittsburgh, Pa.† | 78 | 54 | 14 | 3 | 3 | 4 | 3 |
| Reading, Pa. | 32 | 29 | 1 | 2 | - | - | 2 |
| Rochester, N.Y. | 128 | 88 | 26 | 8 | 2 | 4 | 12 |
| Schenectady, N.Y. | 33 | 27 | 3 | 3 | - | - | 2 |
| Scranton, Pa.† | 29 | 26 | 2 | 1 | - | - | - |
| Syracuse, N.Y. | 78 | 57 | 9 | 2 | 6 | 4 | 5 |
| Trenton, N.J. | 36 | 16 | 15 | 4 | 1 | - | - |
| Utica, N.Y. | 21 | 17 | 2 | 1 | - | 1 | 1 |
| Yonkers, N.Y. | 28 | 19 | 5 | 2 | - | 2 | - |
| E.N. CENTRAL | 2,375 | 1,532 | 489 | 172 | 93 | 89 | 76 |
| Akron, Ohio | 61 | 42 | 12 | 2 | 2 | 3 | - |
| Canton, Ohio | 51 | 27 | 18 | 4 | 2 | - | 3 |
| Chicago, Ill.§ | 564 | 362 | 125 | 45 | 10 | 22 | 16 |
| Cincinnati, Ohio | 183 | 106 | 36 | 18 | 17 | 6 | 6 |
| Cleveland, Ohio | 163 | 93 | 40 | 11 | 9 | 10 | 1 |
| Columbus, Ohio | 128 | 70 | 31 | 8 | 7 | 12 | 3 |
| Dayton, Ohio | 122 | 81 | 24 | 8 | 8 | 1 | 4 |
| Detroit, Mich. | 261 | 154 | 54 | 35 | 9 | 9 | 6 |
| Evansville, Ind. | 41 | 28 | 10 | 1 | 1 | 1 | 2 |
| Fort Wayne, Ind. | 43 | 32 | 7 | 1 | 3 | - | - |
| Gary, Ind. | 20 | 10 | 4 | 2 | 3 | 1 | 2 |
| Grand Rapids, Mich. | 67 | 48 | 11 | 4 | 3 | 1 | 4 |
| Indianapolis, Ind. | 176 | 125 | 30 | 7 | 4 | 10 | 6 |
| Madison, Wis. | 36 | 26 | 4 | 3 | 3 | - | 1 |
| Milwaukee, Wis. | 147 | 109 | 25 | 8 | 2 | 3 | 6 |
| Peoria, Ill. | 39 | 24 | 9 | - | 1 | 5 | 1 |
| Rockford, Ill. | 46 | 35 | 4 | 5 | 1 | 1 | 3 |
| South Bend, Ind. | 34 | 25 | 4 | 2 | 2 | 1 | - |
| Toledo, Ohio | 117 | 85 | 26 | 4 | 1 | 1 | 10 |
| Youngstown, Ohio | 76 | 50 | 15 | 4 | 5 | 2 | 2 |
| W.N. CENTRAL | 845 | 598 | 149 | 42 | 26 | 30 | 37 |
| Des Moines, Iowa | 88 | 62 | 14 | 1 | 5 | 6 | 11 |
| Duluth, Minn. | 32 | 21 | 9 | - | 1 | 1 | 1 |
| Kansas City, Kans. | 40 | 27 | 8 | 1 | 3 | 1 | 2 |
| Kansas City, Mo. | 104 | 79 | 18 | 4 | 1 | 2 | 5 |
| Lincoln, Nebr. | 40 | 27 | 11 | 1 | 1 | - | 2 |
| Minneapolis, Minn. | 173 | 124 | 31 | 8 | 7 | 3 | 5 |
| Omaha, Nebr. | 87 | 50 | 18 | 9 | 3 | 7 | 5 |
| St. Louis, Mo. | 155 | 111 | 23 | 13 | 3 | 5 | - |
| St. Paul, Minn. | 66 | 52 | 12 | 1 | 1 | - | 1 |
| Wichita, Kans. | 60 | 45 | 5 | 4 | 1 | 5 | 5 |

| ReportingArea | All Causes, By Age (Years) | | | | | | P&I** |
|---|---|---|---|---|---|---|---|
| | All Ages | ≥65 | 45-84 | 25-44 | 1-24 | <1 | Total |
| S. ATLANTIC | 1,236 | 765 | 265 | 108 | 61 | 36 | 46 |
| Atlanta, Ga. | 91 | 59 | 15 | 11 | 5 | 1 | 1 |
| Baltimore, Md. | 221 | 131 | 55 | 19 | 10 | 6 | 3 |
| Charlotte, N.C. | 80 | 43 | 20 | 7 | 6 | 4 | 3 |
| Jacksonville, Fla. | 110 | 77 | 21 | 7 | 4 | 1 | 7 |
| Miami, Fla. | 99 | 57 | 19 | 11 | 9 | 3 | - |
| Norfolk, Va. | 67 | 38 | 16 | 9 | 2 | 2 | 7 |
| Richmond, Va. | 91 | 58 | 21 | 6 | 3 | 2 | 7 |
| Savannah, Ga. | 34 | 26 | 7 | - | 1 | - | 1 |
| St. Petersburg, Fla. | 76 | 62 | 6 | 3 | 3 | 2 | 3 |
| Tampa, Fla. | 78 | 46 | 18 | 7 | 4 | 3 | 7 |
| Washington, D.C. | 259 | 147 | 60 | 27 | 13 | 12 | 7 |
| Wilmington, Del. | 30 | 21 | 7 | 1 | 1 | - | - |
| E.S. CENTRAL | 827 | 514 | 177 | 63 | 31 | 42 | 43 |
| Birmingham, Ala. | 122 | 72 | 32 | 5 | 7 | 6 | 4 |
| Chattanooga, Tenn. | 70 | 45 | 14 | 6 | 1 | 4 | 3 |
| Knoxville, Tenn. | 109 | 60 | 24 | 13 | 6 | 6 | 7 |
| Louisville, Ky. | 104 | 56 | 29 | 11 | 3 | 5 | 5 |
| Memphis, Tenn. | 193 | 122 | 33 | 14 | 8 | 16 | 9 |
| Mobile, Ala. | 60 | 48 | 5 | 4 | 2 | 1 | 6 |
| Montgomery, Ala. | 44 | 28 | 8 | 5 | 2 | 1 | 1 |
| Nashville, Tenn. | 125 | 83 | 32 | 5 | 2 | 3 | 8 |
| W.S. CENTRAL | 1,281 | 779 | 283 | 123 | 60 | 36 | 51 |
| Austin, Tex. | 53 | 34 | 12 | 4 | 2 | 1 | - |
| Baton Rouge, La. | 20 | 14 | 4 | 1 | - | 1 | - |
| Corpus Christi, Tex.§ | 44 | 29 | 10 | 3 | 1 | 1 | - |
| Dallas, Tex. | 210 | 109 | 59 | 20 | 13 | 9 | 6 |
| El Paso, Tex. | 69 | 42 | 13 | 6 | 5 | 3 | - |
| Fort Worth, Tex | 90 | 54 | 20 | 8 | 6 | 2 | 9 |
| Houston, Tex.§ | 308 | 176 | 74 | 34 | 13 | 11 | 7 |
| Little Rock, Ark. | 85 | 49 | 15 | 12 | 4 | 5 | 6 |
| New Orleans, La. | 102 | 65 | 15 | 17 | 4 | 1 | - |
| San Antonio, Tex. | 176 | 116 | 39 | 14 | 6 | 1 | 17 |
| Shreveport, La. | 24 | 17 | 5 | 1 | 1 | - | 1 |
| Tulsa, Okla. | 100 | 74 | 17 | 3 | 5 | 1 | 5 |
| MOUNTAIN | 659 | 410 | 137 | 53 | 29 | 29 | 38 |
| Albuquerque, N. Mex. | 79 | 38 | 26 | 9 | 3 | 3 | 2 |
| Colo. Springs, Colo. | 43 | 25 | 10 | 4 | 2 | 2 | 5 |
| Denver, Colo. | 91 | 63 | 11 | 8 | 7 | 2 | 4 |
| Las Vegas, Nev. | 89 | 54 | 21 | 5 | 5 | 3 | 5 |
| Ogden, Utah | 27 | 21 | 5 | - | - | 1 | 4 |
| Phoenix, Ariz. | 164 | 103 | 31 | 13 | 4 | 13 | 4 |
| Pueblo, Colo. | 26 | 16 | 5 | 5 | - | - | 2 |
| Salt Lake City, Utah | 41 | 23 | 7 | 7 | 4 | - | 2 |
| Tucson, Ariz. | 99 | 67 | 21 | 2 | 4 | 5 | 10 |
| PACIFIC | 1,865 | 1,167 | 367 | 171 | 84 | 69 | 95 |
| Berkeley, Calif. | 23 | 17 | 6 | - | - | - | 1 |
| Fresno, Calif. | 63 | 39 | 10 | 5 | 2 | 7 | 6 |
| Glendale, Calif. | 31 | 25 | 5 | 1 | - | - | 2 |
| Honolulu, Hawaii | 77 | 59 | 13 | 4 | - | 1 | 7 |
| Long Beach, Calif. | 42 | 22 | 10 | 2 | 1 | 7 | 1 |
| Los Angeles Calif. | 558 | 337 | 115 | 70 | 23 | 6 | 15 |
| Oakland, Calif. | 66 | 45 | 11 | 6 | 4 | - | 6 |
| Pasadena, Calif. | 27 | 21 | 2 | 2 | 2 | - | 3 |
| Portland, Oreg. | 128 | 80 | 24 | 10 | 7 | 7 | 5 |
| Sacramento, Calif. | 146 | 81 | 32 | 9 | 12 | 12 | 9 |
| San Diego, Calif. | 154 | 94 | 24 | 14 | 12 | 10 | 12 |
| San Francisco, Calif. | 145 | 95 | 24 | 23 | 2 | 1 | 4 |
| San Jose, Calif. | 170 | 106 | 30 | 13 | 11 | 10 | 10 |
| Seattle, Wash. | 153 | 88 | 41 | 10 | 8 | 6 | 7 |
| Spokane, Wash. | 41 | 28 | 12 | - | - | 1 | 5 |
| Tacoma, Wash. | 41 | 30 | 8 | 2 | - | 1 | 2 |
| TOTAL | 12,447†† | 7,956 | 2,538 | 1,049 | 474 | 421 | 534 |

*Mortality data in this table are voluntarily reported from 121 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 these 3 Pennsylvania cities, these numbers are partial counts for the current week. Complete counts will be available in 4 to 6 weeks.

††Total includes unknown ages.

*Occupational Fatalities — Continued*

1984 estimates: the Bureau of Labor Statistics (BLS) reported 3,750 such deaths in 1984 (*5*); the National Safety Council (NSC) reported 11,500 (*6*); and the National Center for Health Statistics (NCHS) reported 4,960 (unpublished data). While the discrepancies can be attributed in part to the use of different methodologies, sampling strategies, and exclusions, they illustrate the need for more complete data. The NTOF data base represents an attempt to provide a complete census of work-related traumatic deaths rather than a sampling of such deaths.

There is adequate justification for basing NTOF surveillance on data from death certificates. This type of surveillance for occupational fatalities has found increasing use (*7,8*). The certificates are standardized and universally available, and they provide the required data (e.g., demographics, location, industry/occupation, etc.) with acceptable accuracy. The preliminary analyses reported here indicate that this surveillance system can provide current numbers of occupational fatalities, identify high-risk industries (or occupations) at the state level, and monitor trends over time. The average of 7,000 fatalities per year falls in the middle range of estimates reported by BLS, NSC, and NCHS, lending credence to the NTOF figures. The identification of mining, construction, and agriculture as highest risk industries is also consistent with other nationwide and state-based studies (*4,9*).

While this study demonstrates the potential value of this surveillance method, it also indicates some limitations currently in the system. Death certificates are selected

**TABLE 2. Average annual traumatic occupational fatalities and years of potential life lost (YPLL), by industry — United States, 1980-1984**

| Industry* | Employment (*2*) | Number of Deaths† | Fatality Rates§ | YPLL |
|---|---|---|---|---|
| Agriculture, Forestry, Fisheries | 3,479,322 | 707 | 20.3 | 15,205 |
| Mining | 1,047,871 | 315 | 30.1 | 9,406 |
| Construction | 4,127,483 | 952 | 23.1 | 25,471 |
| Manufacturing | 19,741,833 | 838 | 4.2 | 21,354 |
| Transportation, Communication, Public Utilities | 4,619,397 | 901 | 19.5 | 23,329 |
| Wholesale Trade | 5,244,168 | 56 | 1.1 | 1,367 |
| Retail Trade | 15,335,591 | 287 | 1.8 | 6,766 |
| Finance, Insurance, Real Estate | 5,492,639 | 72 | 1.3 | 1,569 |
| Services | 18,554,496 | 545 | 2.9 | 15,081 |
| Public Sector | N/A ¶ | 450 | N/A | 13,597 |
| Industry Unknown** | N/A | 1,358 | N/A | N/A |

*Industries classified according to U.S. Office of Management and Budget, Standard Industrial Classification System, 1972 Edition.

†Does not include the 2,070 additional fatalities estimated for jurisdictions that did not include certificates reporting deaths attributable to homicide or suicide or stating the cause of death as "pending".

§Per 100,000 workers.

¶N/A = not available.

**Cases for which industry was not listed or was unclassifiable.

*Occupational Fatalities — Continued*

and initially processed by different reporting units, and there may be inconsistencies in the way different jurisdictions determine whether or not an injury occurred at work (e.g., 16 reporting units failed to classify homicides and suicides as work-related). Another potential source of undercounting might be a failure to include work-related motor vehicle accidents.

This study also illustrates the difficulties encountered in obtaining denominator data to calculate rates. No single source of employment data provides complete information on geographic location, demographics, and industry/occupation for all workers. Therefore, NIOSH used 1980 census data to compute overall age-specific rates, but used separate census data bases to calculate state- and industry-specific rates. Even so, some analyses were incomplete because denominator data did not include certain worker populations (e.g., those employed in public administration). Fully satisfactory sources of denominator data must yet be identified for surveillance of occupational safety and health.

Nevertheless, the NTOF appears to provide the most accurate analysis of traumatic occupational fatalities to date and may well provide the data necessary to identify high-risk populations and, thus, reduce such deaths. Except for the homicides and suicides that occur "at work" and pose additional social parameters, the national toll of occupational traumatic deaths reported in the NTOF is largely preventable. The identification of particular states with higher fatality rates suggests possibilities for state-based or regional intervention efforts.

*References*

1. Bureau of the Census. 1980 census of population: U.S. summary. Washington, DC: US Department of Commerce, 1983; publication no. PC 80-1-B1.
2. Bureau of the Census. County business patterns (1980, 1981, 1982, 1983, 1984). Washington, DC: US Department of Commerce, 1982, 1983, 1984, 1985, 1986.
3. Bureau of the Census. 1982 census of agriculture. Washington, DC: US Department of Commerce, 1984.
4. CDC. Leading work-related diseases and injuries—United States. MMWR 1984;33:213-5.
5. Bureau of Labor Statistics. Occupational injuries and illnesses in the United States by industry, 1984. Washington, DC: US Department of Labor, 1986; bulletin 259.
6. National Safety Council. Accident facts, 1985 edition. Chicago, Illinois: National Safety Council, 1985.
7. Milham S. Occupational mortality in Washington state, 1950-1979. Cincinnati, Ohio: US Department of Health and Human Services, Public Health Service, CDC, 1983; DHHS publication no. (NIOSH)83-116.
8. Dubrow R, Wegman DH. Occupational characteristics of cancer victims in Massachusetts, 1971-1973. Cincinnati, Ohio: US Department of Health and Human Services, Public Health Service, CDC, 1984; DHHS publication no. (NIOSH)84-109.
9. CDC. Fatal occupational injuries—Texas, 1982. MMWR 1985;34:130-4, 139.

## *Epidemiologic Notes and Reports*

### Serum Dioxin* in Vietnam-Era Veterans — Preliminary Report

Agent Orange, a defoliant used in Vietnam, was a mixture of 2,4-D† and 2,4,5-T§. During manufacture 2,4,5-T was contaminated with TCDD*, a compound with marked toxicity in some species of experimental animals (*1-4*). In 1979, the U.S. Congress

*2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) or "dioxin".
†2,4-dichlorophenoxyacetic acid (2,4-D).
§2,4,5-trichlorophenoxyacetic acid (2,4,5-T).

*Serum Dioxin — Continued*

responded to concerns of Vietnam veterans by passing Public Law 96-151 mandating epidemiologic studies of the possible health effects on Vietnam veterans of exposure to herbicides and their associated dioxin contaminants. In 1983, CDC developed a protocol (*5*) for a historical cohort study (the Agent Orange Exposure Study) of U.S. Army veterans who had served in heavily sprayed areas of Vietnam. The protocol specified that the degree of exposure to Agent Orange be based on a score estimating the "likelihood of exposure" and calculated from information in military records.

Men who served in the III Corps military region (around Saigon) during the period 1967-1968 were selected for study because this region was heavily sprayed during that time. The U.S. Army and Joint Services Environmental Support Group (ESG) found that 65 U.S. Army combat battalions had spent at least 18 months in the III Corps area during the period 1967-1968. The ESG abstracted daily locations of companies within these battalions from military records and obtained personnel records of men who had served in those companies. Using existing records of each application of Agent Orange by fixed-wing aircraft, helicopter, or ground-based equipment and ESG troop location data, CDC developed several different methods for computing exposure scores for each man. These methods were based on each man's daily proximity (in time and space) to recorded Agent Orange applications.

Subsequent evaluation of military records by CDC and ESG revealed that daily tracking of individual soldiers was not always possible. The ESG evaluation also suggested that many helicopter and ground-based sprays, which were often near troops, were not recorded. Consequently, CDC has conducted a validation study using current TCDD levels in serum as a biological marker to determine whether scores based on military records or on veterans' self-assessed exposures to herbicides could identify those veterans who had received heavy exposure in Vietnam.

During 1986, CDC's Division of Environmental Health Laboratory Sciences, Center for Environmental Health, developed a method for measuring TCDD in human serum. The measurement, which is based on lipid weight, is highly correlated with paired measurements of TCDD in adipose tissue ($r = .98$) (*6,7*). The same laboratory subsequently used paired sera (drawn in 1982 and 1987) to estimate the half-life of the TCDD body-burden in man as approximately 6-10 years (CDC, unpublished data). The sera came from Air Force personnel involved in spraying Agent Orange in Vietnam during 1968. Some of these sera still show markedly elevated TCDD levels in 1987. These new developments suggest that only about 2 to 2.5 TCDD half-lives have elapsed since potential exposure in Vietnam and that serum TCDD can serve as a biological marker for previous Agent Orange exposure. These findings are the basis for the study of U.S. Army veterans reported here.

Vietnam veterans invited to participate in this study had served in at least one of the 65 selected battalions between October 1966 and March 1969. They were chosen from the 9,727 men whose records were sufficiently complete for exposure scoring and who met the original selection criteria proposed in 1983 (e.g., only a single tour of duty in Vietnam and pay grade of E1 to E5 at discharge). The exposure score used to select Vietnam veteran participants was the total number of occasions on which the veteran's unit was within 2 km of a documented Agent Orange spray within 6 days after that spray. This score is based on the assumption that TCDD undergoes rapid

*Serum Dioxin — Continued*

degradation on vegetation (*8-10*). All but 10[¶] of the 314 men with a high exposure (a score of 5 or more) were invited to participate in this study. A stratified random sample of 235 of the 1,351 men with a score from 1 to 4 were invited, and a sample of 440 of the remaining 8,062, all of whom had a score of 0, were invited. These men averaged over 300 days of service in Vietnam. A stratified random sample of 200 non-Vietnam veterans of the same era were invited as a comparison group. While they did not have Vietnam-related exposure to Agent Orange, their demographic and other personal characteristics were similar to the Vietnam veterans.

Of the 979 invited Vietnam veterans, 871 (89%) completed telephone interviews, and 665 (68%) also completed medical examinations and gave blood for TCDD measurement at CDC. Those reporting health problems in the telephone interview were more likely to participate in the examinations and blood sampling than were those reporting good health. Of the 200 non-Vietnam veterans invited, 103 (52%) participated fully. This lower participation rate does not affect exposure scores or TCDD levels in Vietnam veterans. Each participant underwent a detailed interview regarding military and civilian exposures to herbicides. Table 1 shows selected characteristics of the participants by exposure groups. While 25% of Vietnam veterans reported direct exposures (present during spraying or handled spraying equipment) and 70% reported indirect exposure (walked through defoliated areas), 6% of non-Vietnam veterans reported such exposures. Those who were both interviewed and examined were similar with respect to the characteristics shown in Table 1 to those who were interviewed only.

The preliminary TCDD distributions, which are shown in Figure 1 and are based on the first 519 specimens processed, represent a 68% random sample of the participants. All of these men except one had TCDD levels (based on lipid weight) below 20 parts per trillion (ppt), which is considered the upper limit for residents of the United States without known TCDD exposure (*6,7,11,12*). There was no significant difference among the three Vietnam veteran exposure groups selected on the assumption of short environmental availability of TCDD ($p = .83$). Likewise, no association was found between TCDD levels and two other methods of scoring exposure that were chosen to reflect a longer environmental persistence of TCDD (one method accounted for the distance from the spray, without regard to the time since spraying, and the other accounted for total days spent in heavily sprayed areas). Finally, no association was found between TCDD levels and self-perceived herbicide exposure in the military (either direct exposure or delayed exposure). The median TCDD levels for all exposure groups were between 3.5 and 4.3 ppt. Furthermore, TCDD medians for Vietnam veterans (median = 3.8 ppt) and non-Vietnam veterans (median = 3.9 ppt) were virtually the same. A full report will be published after TCDD measurements have been completed for all participants and the full report has been reviewed by the Agent Orange Working Group of the Domestic Policy Council (Executive Branch) and by the Congressional Office of Technology Assessment.

*Reported by: Agent Orange Projects, Div of Chronic Disease Control, Div of Environmental Health Laboratory Sciences, Center for Environmental Health, CDC.*

**Editorial Note:** The purpose of this study was to determine whether estimates of exposure based on military records or on interviews of U.S. Army veterans can

[¶]Ten men who were given scores of less than 5 at the time that invitations were issued were later assigned scores of 5 or more on the basis of corrected company location and military service data provided by ESG.

*Serum Dioxin — Continued*

identify those with heavy exposure to TCDD. Serum TCDD levels measured in 1987 were not associated with any of the indirect exposure scoring methods evaluated. Because of the purpose of the study, men with higher exposure scores were deliberately over-sampled. The distribution of TCDD levels reported here cannot be generalized with confidence to all U.S. Army Vietnam veterans since the study did not use a random sample of all such veterans.

While CDC was processing sera from the U.S. Army veterans reported here, it was concurrently processing sera from other groups with known occupational exposure to dioxin prior to but not after 1970. Some of those who were occupationally exposed had TCDD levels more than 30-fold higher in 1987 (CDC, unpublished data) than the median levels of approximately 4 ppt reported here for Vietnam veterans.

The distribution of TCDD levels for the Vietnam veterans, with all but one below the upper limit for unexposed U.S. residents, suggests that few of the participants in

**TABLE 1. Selected characteristics of participants in the Agent Orange Validation Study, by levels of exposure to Agent Orange***

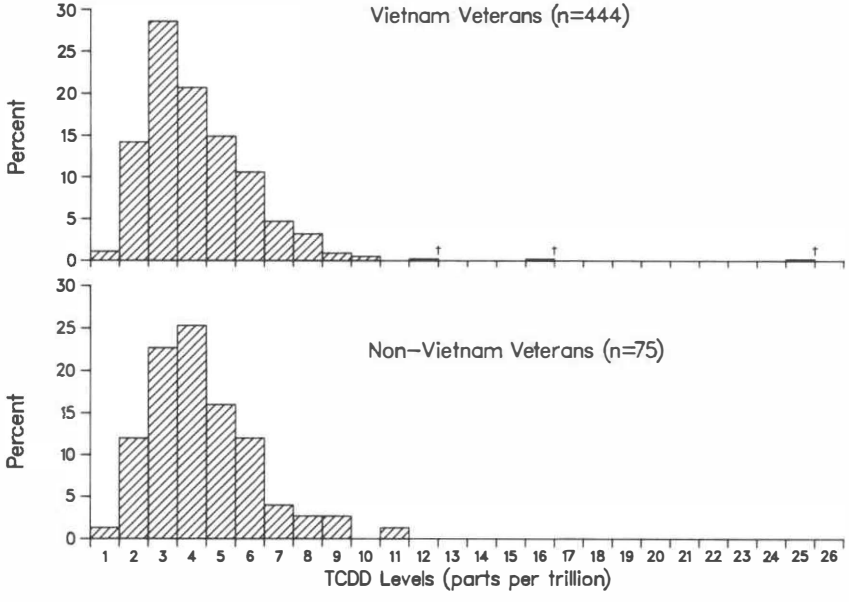
| | Vietnam Veterans | | | | |
|---|---|---|---|---|---|
| | Agent Orange Exposure Scores | | | | Non-Vietnam Veterans |
| Characteristics | High (n = 194) | Medium (n = 164) | Low (n = 307) | All (n = 665) | (n = 103) |
| Demographic characteristics | | | | | |
| Age (mean) | 40 | 41 | 40 | 40 | 39 |
| Race (nonwhite) | 25 % | 30 % | 25 % | 26 % | 20 % |
| Military service characteristics | | | | | |
| Type of enlistment (draftee) | 73 % | 80 % | 84 % | 80 % | 74 % |
| Tactical MOS† | 68 % | 87 % | 89 % | 82 % | 28 % |
| Reported combat exposure (mean score§) | 36 | 41 | 38 | 38 | — |
| Days in Vietnam (mean) | 338 | 322 | 306 | 320 | — |
| Self-reported herbicide exposure | | | | | |
| Military: | | | | | |
| Direct | 23 % | 26 % | 26 % | 25 % | 6 % |
| Indirect | 69 % | 69 % | 72 % | 70 % | 6 % |
| Civilian: | | | | | |
| Occupational | 19 % | 20 % | 20 % | 19 % | 32 % |
| Home use | 35 % | 29 % | 35 % | 34 % | 44 % |
| Current health characteristics | | | | | |
| Smoking (cigarette) | 47 % | 49 % | 51 % | 49 % | 48 % |
| Alcohol use (mean number of drinks/month) | 66 | 46 | 66 | 61 | 54 |
| Body mass index (mean) | 27 | 28 | 28 | 27 | 27 |

*2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) or "dioxin".
†MOS = military occupational specialty.
§From questionnaire; possible range of 0-72. A higher score indicates more combat experience.

*Serum Dioxin — Continued*

this study have had unusually heavy dioxin exposure. No threshold level has been determined as yet for the health effects of TCDD on humans.

**FIGURE 1. Serum TCDD* levels of Vietnam and non-Vietnam veterans participating in the Agent Orange Validation Study — United States, 1987**




*2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) or "dioxin."
†One veteran had this level of TCDD.

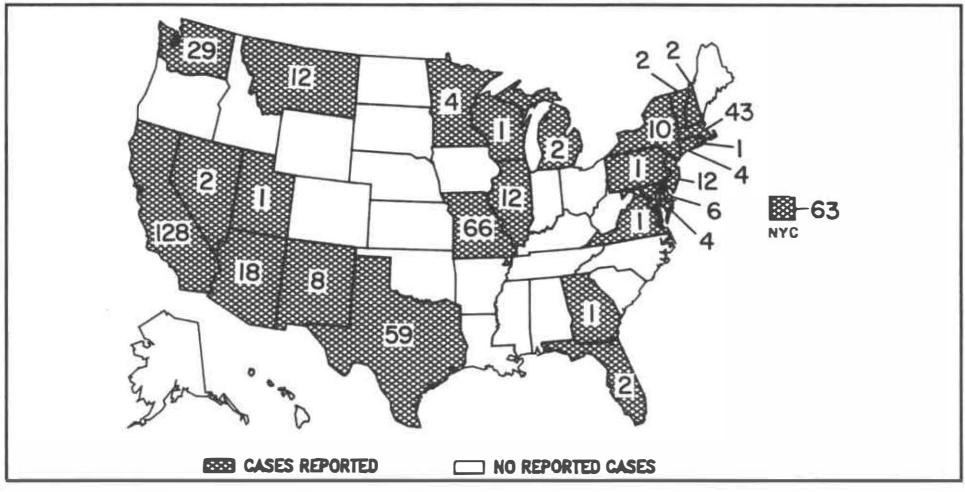
*References*

1. Allen JR, Barsotti DA, Van Miller JP, Abrahamson LJ, Lalich JJ. Morphological changes in monkeys consuming a diet containing low-levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin. Food Cosmet Toxicol 1977;15:401-10.
2. Norback DH, Allen JR. Biological responses of the nonhuman primate, chicken and rat to chlorinate dibenzo-p-dioxin ingestion. Environ Health Perspect 1973;5:233-40.
3. Schwetz BA, Norris JM, Sparschu GL, et al. Toxicity of chlorinated dibenzo-p-dioxins. Environ Health Perspect 1973;5:87-99.
4. Zinkl JG, Vos JG, Moore JA, Gupta BN. Hematologic and clinical chemistry effects of 2,3,7,8-tetrachlorodibenzo-p-dioxin in laboratory animals. Environ Health Perspect 1973; 5:111-8.
5. CDC. Protocol for epidemiologic studies of the health of Vietnam veterans. Atlanta, Georgia: US Department of Health and Human Services, Public Health Service, 1983.
6. Patterson DG Jr, Hoffman RE, Needham LL, et al. 2,3,7,8-tetrachlorodibenzo-p-dioxin levels in adipose tissue of exposed and control persons in Missouri: an interim report. JAMA 1986;256:2683-6.
7. Patterson DG Jr, Needham LL, Pirkle JL, et al. Levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin in paired human serum and adipose tissue samples. Presented at Dioxin 86, Fukuoka, Japan, September 16-19, 1986.
8. Crosby DG, Wong AS. Environmental degradation of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Science 1977;195:1337-8.
9. Nash RG, Beall ML Jr. Distribution of silvex, 2,4-D, and TCDD applied to turf in chambers and field plots. J Agric Food Chem 1980;28:614-23.

*Serum Dioxin — Continued*

10. Jensen DJ, Getzendaner ME, Hummel RA, Turley J. Residue studies for (2,4,5-trichlorophenoxy) acetic acid and 2,3,7,8-tetrachlorodibenzo-p-dioxin in grass and rice. J Agric Food Chem 1983;31:118-22.
11. Gross ML, Lay JO Jr, Lyon PA, et al. 2,3,7,8-tetrachlorodibenzo-p-dioxin levels in adipose tissue of Vietnam veterans. Environ Res 1984;33:261-8.
12. Kahn PC, Gochfeld M, Rappe C, et al. Analysis of adipose tissue and blood samples from Vietnam veterans: project outline and preliminary results. Presented at Dioxin 86, Fukuoka, Japan, September 16-19, 1986.

**FIGURE I. Reported measles cases — United States, weeks 24-27, 1987**

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