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Decontaminating CPR Manikins

In past years, we have received numerous inquiries concerning the possible role of cardiopulmonary resuscitation (CPR) training manikins in transmitting viral hepatitis type B. Recently, inquiries have been received about the potential for transmission of not only hepatitis B but human T-cell lymphotropic virus type III/lymphadenopathy-associated virus (HTLV-III/LAV), herpes viruses, and various upper and lower respiratory infections (influenza, infectious mononucleosis, tuberculosis, etc.). The use of CPR manikins has increased rapidly because of expanded training programs sponsored by medical and emergency organizations. To date, it is estimated that over 40 million people have had direct contact with manikins during training courses. In the United States, a number of companies distribute multiple model lines of manikins for training programs in hospitals, police and fire departments, service organizations, lay groups, and schools as part of health, first aid, and physical education courses. Since practicing with a manikin is an integral part of CPR training, the care and maintenance of the manikins is of utmost importance. Instructors and training agencies rely heavily on manufacturer's recommendations for manikin use and maintenance, and these recommendations should be examined carefully before purchasing manikins.

To our knowledge, the use of CPR training manikins has never been documented as being responsible for an outbreak or even an isolated case of bacterial, fungal, or viral disease. It is our opinion, however, that manikin surfaces may present a risk of disease transmission under certain circumstances and that these surfaces should be cleaned and disinfected consistently to minimize this risk. Although the major portion of the following discussion was written in 1978 pertaining only to sanitary practices that should be followed to prevent transmission of hepatitis type B, the current revision is applicable to lessening the risks of transmitting a wide variety of infectious diseases. There are several important infection control considerations in CPR training. First, the act of mouth-to-mouth or mouth-to-nose artificial respiration obviously requires close physical contact in which a potential rescuer must ignore his or her concerns for personal protection or aesthetic apprehensions to save the life of a victim. Accordingly, in training sessions, students are urged to overcome such hesitations, and they may practice on manikins contaminated by the hands and oral fluids of

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previous students. This situation becomes especially obvious during the practice of two-rescuer CPR in which the manikin cannot be adequately cleaned between uses by the two students. Also, the practice of removing upper airway obstruction involves sweeping the back of the manikin throat with a finger, and in this situation, contamination from previous students may be smeared on the manikin face. In practice, there is usually no pause at this point to decontaminate the face before beginning mouth-to-mouth breathing. Additionally, the valve mechanisms and lungs in manikin airways invariably become contaminated during use, and if they are not appropriately dismantled and cleaned after class, they may serve as contamination sources for subsequent classes. There is no recognized evidence, however, that the manikin valve mechanisms produce aerosols even when air is forcibly expelled during chest compression exercises.

Some manufacturers have provided protective face shields for manikins to improve hygienic conditions during training sessions, but it is unlikely that such shields would be changed after each use by students learning the two-rescuer resuscitation method. Protective shields and detailed instructions for sanitizing the manikins between uses by students and classes are available from several manufacturers.

When dealing with potential contamination by microorganisms having either unknown chemical resistance levels or resistance levels that have not been fully characterized (e.g., hepatitis and herpes viruses), the manikins pose a difficult disinfection problem. Although there are several intermediate- to high-level disinfectants recommended for use in instances of contamination such as hepatitis B, the majority would meet with objection because of either material incompatibility with the manikin (e.g., staining or other damage of plastic materials by iodine compounds) or undesirable residues, odors, or toxicities that may affect students (e.g., formaldehyde, glutaraldehyde) when used during the training sessions. Alcohols, quaternary ammonium compounds, and phenolics are not generally recommended, since proper contact times for effective action are difficult to achieve (e.g., alcohols evaporate rapidly) or the compounds are not broad-spectrum agents (e.g., quaternary ammonium compounds have limited action against certain viruses and bacteria).

Recommendations

1. Purchasers of training manikins should thoroughly examine the manufacturers' recommendations and provisions for sanitary practices.
2. Students should be told in advance that the training sessions will involve "close physical contact" with their fellow students.
3. Students should not actively participate in training sessions (hands-on training with manikins) if they have dermatologic lesions on hands or in oral or circumoral areas, if they are known to be seropositive for hepatitis B surface antigen (HBsAg), if they have upper-respiratory-tract infections, if they have Acquired Immunodeficiency Syndrome (AIDS), or if the student has reason to believe that he or she has been exposed to or is in the active stage of any infectious process (including persons who are HTLV-III/LAV antibody positive).
4. If more than one CPR manikin is used in a particular training class, students should preferably be assigned in pairs, with each pair having contact with only one manikin. This would lessen the possible contamination of several manikins by one individual and therefore limit possible exposures of other class members.
5. All persons responsible for CPR training should be thoroughly familiar with hygienic concepts (e.g., thorough handwashing prior to manikin contact, not eating during class to avoid contamination of manikins with food particles, etc.), as well as the procedures for cleaning and maintaining manikins and accessories (e.g., face shields). Manikins should be inspected routinely for signs of physical deterioration, such as cracks or tears in plastic surfaces, which make thorough cleaning difficult or impossible. The clothes and hair of manikins should be washed periodically; e.g., monthly or whenever visibly soiled.
6. During the training of two-rescuer CPR, there is no opportunity to disinfect the manikin between students when the "switching procedure" is practiced. In order to limit the potential for disease transmission during this exercise, the second student taking over ventilation on the manikin should simulate ventilation instead of blowing into the manikin. This recommendation is consistent with current training recommendations of the American Red Cross and the American Heart Associa[illegible]
7. Training of the "obstructed airway procedure" involves the student using his or her finger to sweep foreign matter out of the manikin's mouth. This action could contaminate the student's finger with exhaled moisture and saliva from previous students in the same class and/or contaminate the manikin with material from the student's finger. When practicing this procedure, the finger sweep should either be simulated or done on a manikin whose airway was decontaminated before the procedure and will be decontaminated after the procedure.
8. At the end of each class, the procedures listed below should be followed as soon as possible to avoid drying of contamination on manikin surfaces:
   a. Disassemble manikin as directed by manufacturer.
   b. As indicated, thoroughly wash all external and internal surfaces (also reusable protective face shields) with warm soapy water and brushes.
   c. Rinse all surfaces with fresh water.
   d. Wet all surfaces with a sodium hypochlorite solution having at least 500 ppm free available chlorine (e.g., 1/4 cup [approx. 60 ml] liquid household bleach [approx. 5% sodium hypochlorite] per gallon [approx. 4 liters] of tap water) for 10 minutes. This solution must be made fresh at each class and discarded after each use.
   e. Rinse with fresh water and immediately dry all external and internal surfaces; rinsing with alcohol will aid drying of internal surfaces, and this drying will prevent the survival and growth of bacterial or fungal

pathogens.

9. Each time a different student uses the manikin in a training class, the individual protective face shield, if used, should be changed. Between students or after the instructor demonstrates a procedure such as clearing any obstruction from the airway, the manikin face and inside the mouth should be wiped vigorously with clean absorbent material (e.g., 4″ × 4″ gauze pad) wet with either the hypochlorite solution described in recommendation No. 8 above or with 70% alcohol (isopropanol or ethanol). The surfaces should remain wet for at least 30 seconds before they are wiped dry with a second piece of clean absorbent material.

   We are somewhat reluctant to recommend use of alcohols in this instance and do so only as an alternative, since some persons find the odor of hypochlorite objectionable. Although highly bactericidal, alcohols are not considered to be broad-spectrum agents and use of alcohols here is recommended primarily as an aid in mechanical cleaning; also, in a short contact period alcohols may not be effective against bacteria or other pathogens. Nonetheless, in the context of vigorous cleaning with alcohol and absorbent material, little viable microbial contamination of any kind is likely after the cleaning procedure.

10. People responsible for the use and maintenance of CPR manikins should be encouraged not to rely totally on the mere presence of a disinfectant to protect them and their students from cross-infection during training programs. Emphasis should be placed on the necessity of thorough physical cleaning (scrubbing, wiping) as the first step in an effective decontamination protocol. Microbial contamination is easily removed from smooth, nonporous surfaces by using disposable cleaning cloths moistened with a detergent solution, and there is no evidence that a soaking procedure alone in any liquid is as effective as the same procedure accompanied by vigorous scrubbing.

11. With specific regard to recent concerns about potential for hepatitis B and HTLV-III/LAV transmission in CPR training, it has recently been shown that the hepatitis B virus is not as resistant to disinfectant chemicals as it was once thought to be. Current recommendations for strategies dealing with HTLV-III/LAV contamination are the same as those for viral hepatitis B (see Bibliography below).

Adapted from a 1983 report by Members of the Multidisciplinary ad hoc *Committee for Evaluation of Sanitary Practices in Cardiopulmonary Resuscitation Training representing the following organizations: American Heart Association, Subcommittee on Emergency Cardiac Care; American Red Cross, First Aid and CPR Programs; Centers for Disease Control, Center for Infectious Diseases and the Laboratory Program Office.*

[These Recommendations have been independently reviewed and approved by the National Research Council of the National Academy of Sciences]

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Recommendation of the Immunization Practices Advisory Committee (ACIP) of the U.S. Public Health Service

Intradermal Rabies Vaccine: Supplementary Statement

The human diploid cell rabies vaccine (HDCV) produced by the Merieux Institute has been used extensively for preexposure immunization in a regimen of three 0.1-ml doses, one each on days 0, 7, and 21 or 28. The intradermal (ID) dose/route has previously been recommended by the ACIP as an alternative to the 1.0-ml intramuscular (IM) dose/route for rabies preexposure prophylaxis (*1*), but the manufacturer had not met the packaging and labeling requirements necessary to obtain approval by the U.S. Food and Drug Administration (FDA).

Merieux Institute has now developed a syringe containing a single dose of lyophilized HDCV (Imovax® Rabies ID) that is reconstituted in the syringe just before administration. The syringe is designed to reliably deliver 0.1 ml of HDCV and was approved by the FDA on May 30, 1986. Three 0.1-ml ID doses, given in the lateral aspect of the upper arm, on days 0, 7, and 21 or 28, are used for primary preexposure prophylaxis. One 0.1-ml ID dose is used for booster vaccination (based on previously outlined criteria [*1*]). Serologic testing is not necessary after preexposure prophylaxis with HDCV administered by either the ID or IM route. *The ID dose/route should not be used for postexposure prophylaxis.*

Chloroquine phosphate (administered for malaria chemoprophylaxis) and unidentified factors (that may include multiple concurrent vaccinations) may interfere with the antibody response to HDCV in persons traveling to developing countries (*2,3*). The IM dose/route of preexposure prophylaxis provides a sufficient margin of safety in this setting (*3*). HDCV should not be administered by the ID dose/route while a person is receiving chloroquine for malaria chemoprophylaxis. In persons receiving preexposure prophylaxis in preparation for travel to a rabies endemic area, the ID dose/route should be initiated early enough to allow the three-dose series to be completed 30 days or more before departure. If this is not possible, the IM dose/route should be used.

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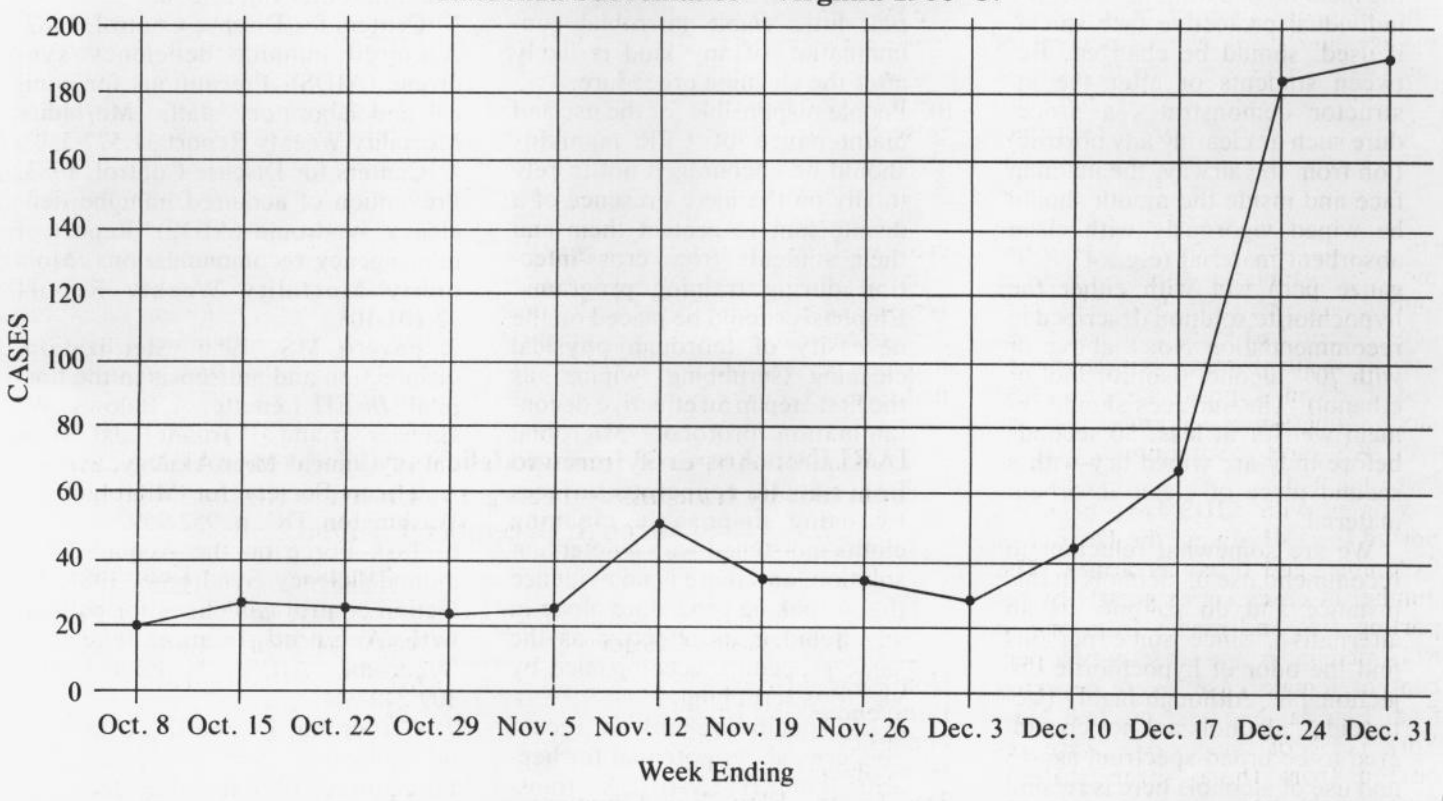
Reprinted from MMWR 1986;35:767-8.



Influenza-like illness reports from 34 sentinel physicians increased over baseline at the end of December. Several laboratories reported the isolation of infuenza type A viruses. These have been further identified as A/Taiwan/86(H1N1)-like viruses. Nationally, over 20 states have reported to CDC the isolation of A/Taiwan/86(H1N1)-like viruses. Influenza A(H3N2) and influenza B viruses have also been isolated.

Update: Acquired Immunodeficiency Syndrome

As of December 8, 1986, physicians and health departments in the United States had reported 28,098 patients (27,704 adults and 394 children) meeting the acquired immunodeficiency syndrome (AIDS) case definition for national reporting (*1-3*). Of these patients, 15,757 (56% of adults and 61% of children) are known to have died, including over 79% of those patients diagnosed before January 1985. Since the initial reports of AIDS in early 1981 (*4-5*), the number of cases reported for each 6-month period continues to increase. However, the increases are not exponential, as evidenced by the lengthening period of time required to double the number of cases (Table 1). During the past 3 months, an average of 58 AIDS cases have been reported to CDC daily. This compares with 35 cases reported during the same period in 1985, 20 cases in 1984, and 10 cases in 1983. Cases have been reported from all 50 states, the District of Columbia, and four U.S. Territories.

Adult patients. Among adult AIDS patients, 25,834 (93%) are men. There has been no significant change over time in distribution of male patients by age and race. Ninety percent of men with AIDS are 20 to 49 years of age (mean = 36.8 years); 63% are white; 22%, black; 14%, Hispanic; and 1%, other or unknown race/ethnicity.

Pneumocystis carinii pneumonia (PCP) continues to be the most common opportunistic disease reported among AIDS patients. Sixty-four percent of men had PCP; 21% had other opportunistic diseases without PCP; and 15% had Kaposi's sarcoma (KS) alone. Ninety-five percent of patients with KS have been homosexual or bisexual men.

Women with AIDS have been reported from 41 states, the District of Columbia, and three territories. The number of cases varies greatly by reporting area and ranges from one to 877 (median = 6); seventy-two percent of female cases were reported from Florida, New Jersey, and New York (42% of male cases were reported from these three states). Eighty-eight percent of women reported with AIDS are 20 to 49 years of age (mean = 34.9 years); 27% are white; 52%, black; 20%, Hispanic; and 1%, other or unknown race/ethnicity. Sixty-seven percent of women had PCP, 31% had other opportunistic diseases without PCP, and 2% had KS alone.

TABLE 1. Acquired immunodeficiency syndrome cases, by date of report and doubling time —United States, through December 8, 1986

Cumulative cases reported	Date*	Doubling time* (months)
110	September 1981	–
220	January 1982	5
439	June 1982	6
878	December 1982	6
1,756	July 1983	7
3,512	February 1984	8
7,025	December 1984	9
14,049	October 1985	11
28,098	December 1986	13

*Doubling time was calculated in days but is reported here to nearest month.

Ninety-seven percent of all adult AIDS patients can be placed in groups* that suggest a possible means of disease acquisition (Table 2). Homosexual or bisexual men who are not known to have used intravenous (IV) drugs represent 66% of all reported cases (70% of male cases). Heterosexual IV drugs users comprise 17% of all cases (15% of male cases and 51% of female cases). Homosexual or bisexual men who have used IV drugs comprise 8% of all cases (8% of males). Persons with hemophilia/coagulation disorders represent 1% of all cases (1% of males; 0.4% of females). Heterosexual sex partners of persons with AIDS or at risk for AIDS represent 4% of all cases (2% of males and 27% of females). This latter category includes persons without other identified risks who were born in countries in which heterosexual transmission is believed to play a major role. Recipients of transfused blood or blood components account for 2% of all cases (1% of males and 10% of females). For 3% of AIDS patients (3% of males and 11% of females), the possible means of disease acquisition is undetermined. Except for women with a coagulation disorder, the number of AIDS cases reported per year continues to increase in all patient groups.

AIDS patients reported as not belonging to recognized risk groups are investigated by local health officials to determine if possible risk factors exist. Of all AIDS patients reported to CDC who were initially identified as not belonging to a risk group and who

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**Patient groups are hierarchically ordered; patients with multiple risk factors are tabulated only in the group listed first.*

TABLE 2. Acquired immunodeficiency syndrome (AIDS) cases reported, by transmission category, United States and Virginia, through December 15, 1986.

	Virginia		United States	
Transmission Category	Cases	Percent of Total	Cases	Percent of Total
Homosexual/Bisexual	262	77.1	20,417	72.3
Intravenous (IV) Drug Use	28	8.2	4,760	16.8
Pediatric	6	1.8	403	1.4
Hemophilliac	3	.9	242	.9
Transfusion—Blood/Blood Products	14	4.1	508	1.8
Heterosexual Contact*	9	2.6	1,060	3.8
None of the above/unknown	18	5.3	856	3.0
Total	340	100.0	28,246	100.0

*with a person with AIDS or at risk for AIDS

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were available for the followup, 72% have been reclassified because risk factors were identified or because the patient was found not to meet the surveillance case definition. Of the 856 AIDS patients currently listed as not belonging to recognized risk groups, information is incomplete on 206 due to: death (158), refusal to be interviewed (34), or loss to followup (14). Of the remaining 650 patients, 461 are currently under investigation. No risk was identified for 189 patients who were interviewed or for whom other followup information was obtained. However, of those patients responding to a standardized questionnaire, 40/125 (32%) gave histories of gonorrhea and/or syphilis, and 19 of the 70 men (27%) gave a history of prostitute contact, indicating that these AIDS patients were at potential risk for other sexually-transmitted infections.

The availability of laboratory tests to detect human immunodeficiency virus (HIV) antibody made it possible to increase the sensitivity and specificity of the AIDS case definition used for national reporting (*3*). Of the AIDS case reports submitted to CDC, HIV antibody test results were included for 6,897 (24.5%) of patients (6,558 with recognized risk factors and 339 for whom no risk has been identified). Eighty-nine (1.4%) of the tested patients with recognized risk factors, compared with 27 (8%) of those without identified risk factors were reported negative for HIV antibody ($p < 0.001$).

Pediatric patients. Among 403 AIDS patients < 13 years of age, 355 (88%) are < 5 years old. Of those, 20% are white; 57%, black; and 22%, Hispanic. Fifty-five percent are male. Fifty-two percent were diagnosed with PCP, 47% with other opportunistic diseases and no PCP, and 1% with KS alone. Three hundred eighteen (79%) pediatric patients came from families in which one or both parents had AIDS or were at increased risk for developing AIDS; 6% had hemophilia, and 13% had received transfusions of blood or blood components before onset of illness. Risk factor information on the parents of the remaining cases is incomplete. Pediatric patients have been reported from 29 states, the District of Columbia, and Puerto Rico; reported cases per area ranged from one to 141 (median = 4). Over 72% of pediatric patients who acquired infection perinatally are residents of Florida, New Jersey, and New York.

Other modes of transmission. There continues to be no evidence of nonspecific transmission through casual contact; insect bites; or foodborne, waterborne, or environmental spread among AIDS cases. The situation is most clear in the 5- to 15-year-old age group, which lies between the youngest children for whom perinatal transmission is the most important and the adult age groups where sexual and drug related transmission predominates. Five to 15 year olds, who include the majority of school children, comprise 16% of the U.S. population (*6*). However, only 62 AIDS cases (0.2% of total cases) have occurred in this large group, which is exposed like other groups to casual contact with HIV-infected persons, insects, and environmental factors. Of these, 61 (98%) fit into established risk categories. The risk factor investigation is incomplete on the remaining case.

Reported by State and Territorial Epidemiologists; AIDS Program, Center for Infectious Diseases, CDC.

Editorial Note: The number of reported AIDS cases continues to increase. An analysis of past trends using empirical models projects a cumulative case total of 270,000 by 1991 (*7,8*). The proportion of AIDS cases among most transmission categories has remained relatively constant. The geographic distribution of men and women with AIDS differs significantly ($p < .001$). Most reports of women with AIDS continue to come from Florida, New Jersey, and New York, while these states account for a much smaller proportion of male cases. Since most pediatric AIDS cases result from perinatal transmission of HIV, the race/ethnicity and geographic distribution of pediatric AIDS patients is similar to that of reported AIDS cases among women.

The proportion of AIDS patients diagnosed with KS is declining (*9-11*), but most KS (95%) continues to be diagnosed among homosexual or bisexual men. KS alone is infrequently diagnosed among women (3% of cases) and children (4%) with AIDS. The reasons that certain patients develop KS remain unclear (*12,13*).

Numerous studies and continuing investigations of AIDS patients not belonging to recognized risk groups have not supported the existence of new modes of HIV transmission (*14-17*). History of other sexually transmitted diseases among the "no identified risk" group as well as prostitute contact among male AIDS patients suggest that sexual contact with partners whose risk was unrecognized or unreported by the patient may be the mode of HIV transmission for some of these patients. Given current epidemiologic data, AIDS patients who were born outside the United States and who do not have one of the predominant risk exposures have been moved for U.S. tabulations from the "undetermined" transmission category to the "heterosexual contact" category. This move has increased the "heterosexual contact" category from 2% to 4% of adult cases and has decreased the "undetermined" category from 5% to 3%.

The HIV antibody test allows further refinement of the case definition, especially in disease categories of lower specificity. CDC proposes, with the advice of outside consultants, to revise the case definition for national reporting of AIDS. One major objective of this revision is to increase the sensitivity and specificity of the case definition through greater diagnostic use of HIV antibody test results.

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Adapted from MMWR 1986;35:757-60, 765-6.

Cases of selected notifiable diseases, Virginia, for the period December 1, 1986 through December 31, 1986

Disease	State					Regions				
	This Month	Last Month	Total to Date 1985	Total to Date 1986	Mean 5 Year To Date	This Month N.W.	This Month N.	This Month S.W.	This Month C.	This Month E.
Measles	0	0	28	60	17	0	0	0	0	0
Mumps	2	6	49	46	57	0	0	1	0	1
Pertussis	15	5	21	56	26	0	0	7	1	7
Rubella	0	0	2	0	5	0	0	0	0	0
Meningitis—Aseptic	21	53	418	312	311	1	3	3	4	10
*Bacterial	14	22	256	239	231	2	2	1	3	6
Hepatitis A (Infectious)	20	28	171	151	162	0	8	8	1	3
B (Serum)	42	73	558	542	530	3	11	2	9	17
Non-A, Non-B	7	13	101	77	84	0	1	0	0	6
Salmonellosis	71	185	1651	1460	1481	9	22	7	17	16
Shigellosis	10	15	88	101	389	1	7	1	0	1
Campylobacter Infections	40	62	746	597	533	6	8	3	8	15
Tuberculosis	64	41	488	414	579	8	10	10	17	19
Syphilis (Primary & Secondary)	8	14	299	326	524	0	1	2	2	3
Gonorrhea	1267	1734	19234	18787	20636	—	—	—	—	—
Rocky Mountain Spotted Fever	0	0	24	52	62	0	0	0	0	0
Rabies in Animals	11	22	179	210	389	5	4	0	2	0
Meningococcal Infections	8	8	57	79	74	4	1	0	1	2
Influenza	355	109	1007	4481	1684	20	3	0	5	307
Toxic Shock Syndrome	1	0	8	11	8	0	0	0	0	1
Reyes Syndrome	0	0	3	2	6	0	0	0	0	0
Legionellosis	4	7	27	29	27	2	1	0	0	1
Kawasaki's Disease	3	0	30	26	25	1	0	0	1	1
Acquired Immunodeficiency Syndrome	15	17	105	173	—	2	4	1	5	3

Counties Reporting Animal Rabies: Cumberland 1 skunk; Fredericksburg 1 raccoon; Henrico 1 raccoon; Loudoun 1 red fox, 2 raccoons; Page 1 skunk; Prince William 1 raccoon; Shenandoah 1 calf, 2 raccoons.

Occupational Illnesses: Asbestosis 19; Carpal tunnel syndrome 14; Hearing loss 12; Pneumoconioses 12; Byssinosis 1; Mesothelioma 1.

*other than meningococcal

Typhoid
Lyme
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}*

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