Quality Standard for Assurance of Measles Immunity Among Health Care Workers


Objective. The objective of this quality standard is to prevent nosocomial transmission of measles by assuring universal measles-mumps-rubella (MMR) vaccination of all health care workers who lack immunity to measles. Although the primary emphasis is on health care workers in hospitals, those at other sites, such as clinics, nursing homes, and schools, are also included. It will be the responsibility of designated individuals at these institutions to implement the standard.

Options. We considered advocating the use of measles vaccine rather than MMR vaccine but chose the latter because it also protects against mumps and rubella and because it is more readily available.

Outcomes. The desired outcome is a reduction in the nosocomial transmission of measles.

Evidence. Although direct comparative studies are lacking, nosocomial outbreaks of measles have been reported (as recently as 1992) in institutions where measles immunization of nonimmune health care workers is not universal, whereas such outbreaks have not been reported in institutions with universal immunization.

Values and Validation. We consulted more than 50 infectious-disease experts from the fields of epidemiology, government, medicine, nursing, obstetrics and gynecology, pediatrics, and surgery. In light of disagreement regarding the implementation of the standard, we used group discussions to reach a consensus.

Benefits, harms, and costs. The consequences of the transmission of measles (and of mumps and rubella) in a health care institution include not only the morbidity and mortality attributable to the disease but also the significant cost of evaluating and containing an outbreak and the serious disruption of regular hospital routines when control measures are instituted. The potential harm to health care workers after the implementation of the standard consists of untoward effects of MMR vaccine, although the reactions of vaccines should be minimal with adherence to recommended vaccination procedures. Implementation of the standard should entail no expense to health care workers; the precise cost to institutions is unknown, but the expense would be mitigated by the prevention of measles outbreaks.

Recommendations. We recommend MMR vaccination of all health care workers who lack immunity to measles.

Sponsors. The Quality Standards Subcommittee of the Clinical Affairs Committee of the Infectious Diseases Society of America (IDSA) developed the standard. The subcommittee was composed of representatives of the IDSA (P.A.G. and J.E.M.), the Society for Hospital Epidemiology of America (R.P.W.), the Surgical Infection Society (E.P.D.), the Pediatric Infectious Diseases Society (P.J.K.), the Centers for Disease Control and Prevention (W.J.M.), the Obstetrics and Gynecology Infectious Diseases Society (R.L.S.), and the Association of Practitioners of Infection Control (T.L.B.). Funding was provided by the IDSA and the other cooperating organizations. The standard is endorsed by the IDSA.
ity to ascertain that their personnel are immune to measles. In a recent survey of hospital infection-control policies in Los Angeles County during a measles epidemic from 1987 to 1989 [3], investigators found that only 17% of acute-care hospitals had measles-control policies requiring written proof of measles vaccination, disease, or seropositivity: moreover, only 4% of hospitals had policies affecting students or volunteers.

When health care workers contract measles, they can spread the disease to hospitalized patients as well as to other workers. Medical personnel are at higher risk for acquiring measles than the general population. The recent (1989-1991) increase in the number of measles cases was attributable primarily to poor compliance with vaccination recommendations but also resulted from the expected failure of primary vaccination in 5% of recipients and from the susceptibility of persons born before 1957 who never had measles. Members of the latter group are likely to be susceptible because, when measles vaccine was introduced in 1963, most children >5 years of age were assumed to be immune as a result of natural disease and thus were not vaccinated [1-2, 4].

The prevention of measles is important because this disease may result in such complications as middle-ear infection, laryngotracheitis, pneumonia, gastroenteritis, and encephalitis [5]. Survivors of encephalitis often suffer permanent brain damage and mental retardation. Encephalitis and death from respiratory and neurological causes ensue in ~1/1,000 reported cases of measles [1]. The risk of death is greater among infants and adults than among children and adolescents. Subacute sclerosing panencephalitis is a slow-virus infection of the CNS that is associated with measles virus and that has been almost completely eliminated by vaccination. Measles that develops during pregnancy increases the likelihood of premature labor, spontaneous abortion, and low birth weight of the infant [6, 7].

Rubella in pregnant patients can cause miscarriage, stillbirth, and fetal anomalies associated with congenital rubella syndrome [8]. Rubella is also associated with joint symptoms in up to one-third of cases, with encephalitis in I of every 5,000 cases, and with thrombocytopenia in I of every 3,000 cases. Mumps is associated with meningeal signs in 15% of cases and with encephalitis in I of every 400-6,000 reported cases (with I in 6,000 probably being closer to the overall incidence). Sensorineural deafness is a serious though rare occurrence. Orchitis has been reported in 20%-30% of mumps cases in male adolescents and adults [9].

The consequences of the transmission of measles, mumps, or rubella in a health care institution include not only the related morbidity and mortality but also the significant cost of evaluating and containing an outbreak and the marked disruption of regular hospital routines when control measures are instituted [10-13]. Between 1989 and 1991, 187 (28%) of 668 health care workers who acquired measles in a medical setting were hospitalized, and 3 died: 561 of those infected had not been vaccinated (S. Katz, Duke University School of Medicine, personal communication). The control of a single nosocomial outbreak of measles has been reported to cost from $26,000 to more than $100,000. In inpatient settings, measles can be transmitted from one patient or staff member to another, from patients to staff members, and from staff members to patients. Transmission can also take place in such outpatient settings as emergency rooms, clinics, and outpatient therapy facilities. The document “Healthy People 2000: National Health Promotion and Disease Prevention Objectives” lists immunity to measles as one of the 18 priority indicators of health status [14]. Such immunity is considered a public health priority because it serves as a sentinel measure for immunity to other vaccine-preventable diseases. An insufficient level of measles immunity in a community can suggest inadequate access to health care and can indicate a need for preventive services.

**Determination of Measles Immunity Among Health Care Workers**

The generally accepted evidence of measles immunity is a physician’s diagnosis of natural disease earlier in life, positive results in laboratory tests, or a date of birth before 1957 [1, 15-19]. Not all health care workers born before 1957 necessarily are immune, however [1, 16, 19, 20]; for example, between 1985 and 1989, 97 (28%) of 341 health care workers with cases of measles reported to the Centers for Disease Control and Prevention were unvaccinated persons born before 1957 [18]. Moreover, among 1,553 hospital employees tested for ELISA antibody to measles virus in a recent study, 14% (64) of the 467 persons born after 1956 and 5% (50) of the 1,086 persons born before 1957 lacked serological evidence of immunity [16]. The authors observed that patients who thought they were immune had poorly documented evidence of having had the disease. They concluded that undocumented histories of disease and vaccination are not adequate predictors of serological status. They also concluded that since some medical personnel acquiring measles in medical facilities were born before 1957, institutions should consider at least one dose of measles vaccine for older employees who are at risk of occupational exposure to measles and do not have serological evidence of immunity.

The documentation of any concentration of measles-specific antibody constitutes adequate serological evidence for measles immunity in a health care worker [1, 15-17]. Either hemagglutination inhibition or the more sensitive ELISA is an acceptable serological test for this purpose.

Whether prevaccination antibody screening is cost-effective depends on the availability of an inexpensive test, a high prevalence of measles antibody in the target population, and assurances that once identified-serologically susceptible persons will be located and immunized. In light of the
current costs of measles vaccine and of screening for measles immunity and the current levels of immunity to measles among adults in the United States, prevaccination screening may be cost-effective in some situations [1, 19].

Measles Vaccine

Current recommendations for the vaccination of health care workers. Medical personnel should be immunized (if appropriate) at the start of their employment or during their credentialing. The receipt of two doses of measles vaccine after the first birthday and no less than 1 month apart should be documented. If a history of natural infection or vaccination cannot be documented, the employee should have a measles antibody test performed or be vaccinated. If the antibody test is negative, two doses of vaccine should be given: the first no later than the start of employment and the second no less than 1 month later. Most persons born before 1957 are likely to have been naturally infected with measles virus and generally need not be considered susceptible; however, vaccination may be offered to those persons if there is reason to believe that they may be susceptible. The Advisory Committee on Immunization Practices (ACIP) of the U.S. Public Health Service recommends that measles immunization of all medical personnel be considered. As resources permit, a health care institution may wish to extend the recommendation to all medical personnel who have direct contact with patients, not just those beginning employment.

Vaccine should be stored at 2°C-8°C (35.6°F-46.4°F) [1, 21] and protected from light. When shipped, it should be kept at 10°C (50°F). It should then be stored in a refrigerator. If vaccine is not used within 8 hours after reconstitution, it should be discarded. The usual dose of MMR vaccine is 0.5 mL administered subcutaneously. (The package insert provides full prescribing and administering information.) Documentation of the vaccination should be placed in the health care worker’s permanent medical record. For both doses, MMR vaccine rather than measles vaccine alone should be administered unless the health care worker has documented immunity to rubella and mumps, in which case monovalent measles vaccine is preferred. The inclusion of the mumps and rubella components will prevent these diseases in individuals who are susceptible because of previous noncompliance with MMR vaccination recommendations or because of primary vaccine failure, which has been documented for each of the three components of MMR vaccine in ~5% of recipients.

Efficacy of vaccination. The rate of efficacy of measles vaccine is 95% (confidence interval, 89%-97%) except when vaccine is administered after exposure in an epidemic setting, when it is only 4% [22]. Previous studies have shown that explosive outbreaks of measles can occur even when relatively few susceptibles are present [1, 23]. Herd immunity is not very effective in preventing disease: infection takes place even in immunity. These factors all favor universal immunization in the nonepidemic setting.

Adverse reactions to vaccine. Adverse reactions to MMR vaccine include fever (>103°F [>39.4°C]) and transient rash [1, 24], which develop in 5%-15% of vaccinees. These reactions begin 5-12 days after vaccination and usually last for several days. CNS abnormalities, including encephalitis and encephalopathy, have been reported with a frequency of <1 case per 1 million doses of vaccine administered [1, 25]. The incidence of encephalitis and encephalopathy after measles vaccination of healthy children is lower than the observed incidence of encephalitis of unknown etiology. This finding suggests that at least some of the severe neurological disorders temporally associated with measles vaccination are not the result of vaccinations.

Adverse reactions to rubella vaccine include joint abnormalities. Joint pain has been noted in ~0.5% of children and in 1%-3% of females >12 years of age. Arthralgia and arthritis are most frequent among previously unvaccinated postpubertal females. The administration of a second dose of vaccine to a person who has already seroconverted does not carry the same risk of side effects [26]. Chronic joint symptoms and signs have been reported by some groups of investigators. The incidence of chronic joint complaints, however, is higher after natural rubella infection than after RA 27/3 rubella vaccination [6, 27].

Precautions. Pregnant women should not be given MMR vaccine.

Persons with a history of anaphylactic reaction—e.g., hives, swelling of the mouth and throat, difficulty in breathing, hypertension, or shock—after eating eggs either should not be vaccinated at all or should be vaccinated only with extreme caution. In a recent study, 140 children with various degrees of hypersensitivity to eggs were given MMR vaccine without incident [28]. Protocols are available for vaccinating such persons [1, 29-31].

Trace amounts of neomycin are present in MMR vaccine. Allergy to neomycin is usually manifested by contact dermatitis rather than anaphylaxis; a history of contact dermatitis in response to neomycin does not preclude the administration of MMR vaccine.

In patients with impaired immune status, the replication of vaccine viruses can be enhanced. This phenomenon has been documented among persons with immunodeficiency-inducing diseases and among those with immunosuppression arising from conditions such as leukemia, lymphoma, or generalized malignancy or from therapy with alkylating agents, antimetabolites, radiation, or systemic corticosteroids. These patients generally should not be given live measles virus vaccine, even though complications of measles vaccination in this situation have been observed only with Edmonston B vaccine and not with further attenuated vaccines. Asymptomatic patients who are infected with human immunodeficiency virus (HIV) and who are in need of protection from
measles, however, should be vaccinated because of the potential for severe complications of natural measles and the lack of serious adverse reactions to vaccination reported thus far [32]. When MMR vaccine is indicated for HIV-infected persons, it should be given [I]. The antibody responses of these patients may be less predictable than those of persons not infected with HIV. Patients with leukemia in remission who have not received chemotherapy for at least 3 months may receive live-virus vaccines [I]. Short-term therapy (<2 weeks) with low to moderate doses of systemic corticosteroids, topical steroid therapy (e.g., treatment by nasal insufflation; skin), long-term alternate-day treatment with low to moderate doses of short-acting systemic steroids, and injection (intraarticular, bursal, or tendinous) of corticosteroids are not considered immunosuppressive and are not contraindications to measles vaccination. Decisions about the vaccination of such individuals should be made on a case-by-case basis.

Recent administration of any preparation of human immunoglobulin is a cause for delay in the administration of measles vaccine [1, 24]. In fact, the vaccine should not be given for at least 5 months after a person has received immunoglobulin, whole blood, or any other antibody-containing blood product [33]. If an outbreak of measles occurs, vaccination can be undertaken after an interval of 2-3 months but should be followed up with a determination of the concentration of measles antibody. Measles vaccination should precede the administration of immunoglobulin by at least 2 weeks to prevent interference with the replication of the vaccine virus.

Atypical measles may develop if an individual who has received inactivated measles vaccine is exposed to natural measles. Although revaccination with live attenuated measles vaccine may result in localized swelling and erythema at the vaccination site and fever lasting 1 or 2 days, such reactions are likely to be less serious than atypical measles [34]. Therefore, persons previously given either inactivated vaccine or vaccine of an unknown type in 1963-1967 should be revaccinated [1, 24]. It should be noted that inactivated measles vaccine was used in Canada, Sweden, and several other countries after 1967. The recipients of inactivated measles vaccine are distinguishable from other vaccinees in having received multiple doses at 1-month intervals.

Illnesses that are considered minor, such as mild upper-respiratory infection with or without low-grade fever, are not contraindications to vaccination.

Simultaneous administration of MMR vaccine and other vaccines, such as adult tetanus-diphtheria and/or poliovirus vaccine (either oral or inactivated), is acceptable and entails no increase in the risk of adverse reactions [I]. Tuberculin testing may be done on the day of vaccination, if necessary [I]. Otherwise, the skin test should be postponed until 4-6 weeks after vaccination because measles vaccine may render the recipient temporarily anergic.

Reporting of adverse events. The National Childhood Vaccine Injury Act of 1986 requires physicians and other health care providers who administer vaccines to maintain permanent immunization records and to report adverse events specified in the act [35]. These adverse events as well as others that require medical attention must be reported to the U.S. Department of Health and Human Services. All such reports are now directed to the VAERS (Vaccine Adverse Events Reporting System) channel. Forms and instructions are available in the FDA Drug Bulletin or through a 24-hour information recording (1-800-822-7967).

Control of Measles Outbreaks Among Health Care Workers

For the control of measles outbreaks in medical facilities, all health care workers who ordinarily interact directly with patients but who have no evidence of immunity to measles should be removed from direct patient contact on days 5-21 after exposure, even if they have received measles vaccine or immunoglobulin in response to the current outbreak. The rate of efficacy of immunoglobulin for the prevention of measles after exposure has been reported to be as low as 8% in clinical settings but can be 100% with appropriate administration [20]. If susceptible health care workers develop measles, they should be relieved of their duties for 7 days after the rash appears. The recommendations for vaccination, revaccination, and administration of immunoglobulin in epidemic situations have been reviewed elsewhere [I].

The Standard

The strength of these recommendations is rated A (indicating strong evidence for use as outlined in table 1 of “Purpose of Quality Standards for Infectious Diseases” [36]). The quality of evidence (as outlined in table 2 of the same document [36]) is rated II on the basis of at least five studies (uncontrolled) documenting nosocomial outbreaks of measles in institutions that lacked universal immunization.

(1) All health care workers born in or after 1957 and beginning their employment at an institution (including physicians, students in training, and volunteers directly involved in caring for patients) shall be required to provide evidence of receipt of two doses of live attenuated measles vaccine after the first birthday or other evidence of measles immunity - i.e., documentation of natural measles by a physician or positive results in laboratory tests. Health care workers born before 1957 who do not have evidence of vaccination or a physician-documented history of measles shall be required to undergo tests for measles antibody and to be vaccinated if the result is negative. Adherence to this recommendation shall be a condition of employment, credentialling, student affiliation, or volunteer service.

(2) When there is no evidence of measles immunity, the health care worker shall receive one dose of measles vaccine and have a test for measles antibody performed at least 6
weeks after vaccination. If the result is negative, a second dose of measles vaccine shall be given. If documentation of one prior dose of measles vaccine exists and the result of measles antibody test is negative, the health care worker shall receive a second dose of measles vaccine. MMR vaccine is preferred to measles vaccine alone.

(3) Health care facilities with very limited resources can consider two modifications to the above recommendations. Health care workers born before 1957 are likely to have had measles and might either be required to have at least one dose of measles vaccine or be exempted from the recommendations outlined in paragraph 1 and/or paragraph 2. Likewise, health care workers already employed at a facility might be exempted, with only newly employed workers required to follow the standard.

(4) Vaccination may be refused on religious grounds or in light of valid medical contraindications. In this event, the health care institution may request supporting documentation. An outbreak-response plan should be developed with reference to these individuals to prevent or minimize nosocomial transmission.

**Implementation**

The measles status of health care workers at health care institutions and schools should be evaluated. Health care workers include all hospital staff members who have direct contact with patients—e.g., physicians, dentists, nurses, technicians, ward secretaries, students, and volunteers. Also included are full-time, part-time, clinical, nonclinical, permanent, and temporary staff members. The precautions described in the recommendations outlined above should be observed. Specific actions to be taken with regard to the staff of these institutions are listed below.

**New Employees**

Documentation of measles immunity (as defined in paragraph 1 of the standard) should be sought at the time of employment by the hospital’s employee health service. In the absence of such documentation, a blood specimen should be drawn and tested for evidence of measles immunity. In the absence of serological evidence of immunity, the person should be immunized with two doses of vaccine: one given at the start of employment and the other no less than 1 month later. Health care facilities may consider requiring documentation of detectable antibody or administration of at least one dose of measles vaccine for employees born before 1957 who are at risk of occupational exposure to measles.

**Current Employees**

If resources are available, health care facilities should consider extending the recommendations for new employees to current employees as well, especially workers in emergency departments, clinics, or pediatric settings.

**Contract (Registry) Employees**

A requirement for documentation of measles immunity should be written into all contracts with agencies supplying temporary employees for any patient-care area.

**Nonemployee Physicians and Dental Staff Members**

These individuals should be required to provide evidence of measles immunity, as delineated in the standard. They should be screened through the credentialling process at the time of their reappointment as well as at the time of their initial appointment. In the absence of evidence of immunity, measles vaccination should be considered or required if there is a community outbreak of measles.

**Students and Volunteers**

As a standard part of affiliation contracts and volunteer services in patient-care areas, students and volunteers should be required to provide evidence of measles immunity before beginning to work at a hospital. In the absence of the required evidence of immunity, they should receive two doses of vaccine.

**Summary**

A number of organizations are recommending the standard for health care workers that we have presented herein. The guidelines we have described are consistent with the recommendations of the ACIP. Preschool-entry immunization requirements have been legislated in most states for many years. Now the National Coalition for Adult Immunization has drafted model legislation on which states can base laws requiring universal measles immunization of college students. “Healthy People 2000: National Health Promotion and Disease Prevention Objectives” has also endorsed this concept [14]. The Infectious Diseases Society of America, in cooperation with the Obstetrics and Gynecology Infectious Diseases Society and the Surgical Infection Society, recommends that health care institutions adopt the standard to prevent their health care workers from acquiring this vaccine-preventable disease.

**References**

3. Enguidanos R. Mascola L. Frederick P. A survey of hospital infection