

Editorial

Measles and Healthcare Workers

William L. Atkinson, MD, MPH

See also pages 4, 8, 12, and 18.

This issue of *Infection Control and Hospital Epidemiology* contains three articles that help answer several fundamental questions in the prevention of measles among healthcare workers: the magnitude of measles susceptibility^{1,2}; the effect of vaccination on susceptibility levels²; and the cost of ensuring that healthcare workers are protected against measles.³ Measles among healthcare workers accounts for a small but important proportion of reported cases. Healthcare workers with measles often serve to amplify outbreaks in medical settings because of transmission to patients and other healthcare workers, and may serve as a source of infection for family members and other contacts.

The National Immunization Program routinely collects information on the most likely setting of transmission of reported measles cases. From 1985 through 1991, medical facilities were identified as the most likely setting of transmission for 2,997 reported measles cases⁴ (4% of cases; CDC, unpublished data). Almost half of these medical setting cases were acquired in hospital inpatient units. The remainder were almost divided equally between physician's offices and hospital emergency departments. Adults ≥ 18 years of age accounted for 1,234 (41%) of medical setting measles cases. Only colleges and household contacts accounted for more measles cases among adults.

Based on case investigations conducted by state health departments, of all adults who acquired measles in medical settings, 170 (14%) were patients. A few were visitors or persons for whom an occupation

was unknown. But 795 (64%) of these adults were healthcare workers. Not surprisingly, the largest groups of healthcare workers who acquired measles at work were nurses (29%) and physicians (15%). Other occupational groups were represented, including laboratory and radiology technicians (11%), clerks (11%), nursing assistants (4%), and medical and nursing students (4%). Cases of measles have been reported from virtually all occupations that provide healthcare or ancillary support-maintenance and housekeepers, respiratory therapists, emergency medical technicians and paramedics, security guards, dietitians, pharmacists, electrocardiography technicians, administrators, volunteers, and translators. In many instances, the patient contact that led to measles in the healthcare worker did not qualify as "direct patient care," a fact that illustrates the extreme transmissibility of measles virus.

Only 16% of healthcare workers with measles were able to document receipt of a dose of measles vaccine, and virtually none had received two doses. More than half were "routinely" eligible for vaccination (ie, born after 1956, without medical contraindication or exemption to vaccination). Two hundred thirty healthcare workers reported with measles (29%) were born before 1957, a group that Advisory Committee on Immunization Practices (ACIP) recommendations state should not be considered "routinely" eligible for measles vaccination.⁵ The "1957 Rule," as it is sometimes called, was first included in an ACIP measles statement in 1978. Prior to this, the recommendation had been more generic—that adults "usually" were

From the National Immunization Program, Centers for Disease Control and Prevention, Atlanta, Georgia.
Address reprint requests to William L. Atkinson, MD, MPH, National Immunization Program, Mailstop E-61, Centers for Disease Control and Prevention, Atlanta, GA 30333.
93-ED-166. Atkinson WL. Measles and healthcare workers. *Infect Control Hosp Epidemiol* 1994;15:5-7.

immune to measles and did not require vaccination. The choice of 1957 as the cutoff for routine vaccination was based on the observed seroprevalence of measles antibody among adults in the prevaccine era (ie, seroprevalence of $\geq 90\%$ by age 15) and the programmatic need for an upper age limit for vaccination. This age cutoff was, and still is, acceptable for adults at low risk of exposure to measles. However, healthcare workers are at higher risk of measles than the average adult, and the 1957 Rule may not be appropriate for this group. For instance, nurses and physicians have been estimated to be two and eight times, respectively, more likely to acquire measles than adults who are not healthcare workers.⁴

Measles among healthcare workers is more than just an infection control problem. Except for otitis media, complication rates of measles are as high for adults as for preschool-aged children.⁶ Complications are frequently reported in healthcare workers with measles, including pneumonia, encephalopathy, and occasionally death. Twenty-six percent of healthcare workers who acquired measles required hospitalization, for an average of seven days. In addition, these infected healthcare workers were responsible for transmitting the virus to patients, other healthcare workers, and family members.

Two studies in this issue of *Infection Control and Hospital Epidemiology* report the seroprevalence of measles antibody among healthcare workers.^{1,2} The investigators observed that 6% to 10% of new or current medical personnel lack antibody against measles virus and are presumably susceptible to infection. These seronegativity rates are similar to other measles seroprevalence studies among American healthcare workers in the last few years. In both studies, seronegativity to measles antibody increased with decreasing age. Wright and Carlquist¹ reported that 19% of employees born between 1960 and 1979 were considered nonimmune to measles. This high apparent seronegativity rate may be due in part to the relative insensitivity of the enzyme immunoassay used to screen the sera. However, many of these individuals were probably truly susceptible to measles, due at least in part to lack of vaccination.

Another important observation from these seroprevalence data is that birth before 1957 does not absolutely predict measles immunity. These two studies, as well as virtually every other measles antibody seroprevalence study published, have found a small (2% to 5%) but significant proportion of older workers to be susceptible to measles. Any susceptible person, regardless of age, may contract measles if exposed.

Willy et al² at the National Institutes of Health report the results of measles vaccination of seronegative workers. While seroconversion rates are lower

than those reported for children, it is reassuring that 85% of seronegative employees responded to a single dose of vaccine. Among their first dose vaccine failures, 81% developed detectable antibody following a second dose. Thus, following a program of screening and vaccination of seronegative employees with two doses of measles vaccine, the authors achieved an estimated measles antibody seroprevalence of more than 99% in their population. While a very small number of workers may remain susceptible to measles virus infection after two doses of vaccine, the overall risk of measles among staff members should be greatly reduced.

Stover et al³ from Louisville report on the costs associated with two approaches to measles vaccination of hospital personnel during a measles outbreak—"blind" vaccination with two doses of measles-mumps-rubella (MMR) vaccine for employees without documented vaccination, compared with targeted vaccination of seronegative persons after serologic screening. Their study, which reports lower costs when vaccination is targeted only to seronegative employees, is consistent with other studies that have examined this issue.⁷⁻⁹ A targeted approach to measles vaccination makes sense because more than 90% of adults can be expected to be immune to measles, either from previous vaccination or disease, and vaccination of immune persons is of no benefit. However, three important points should be kept in mind when considering a systematic measles immunity policy for a healthcare facility. First, if a screen-and-vaccinate approach is chosen, the facility must develop a recall system that can assure that seronegative persons are vaccinated. Second, the cost savings from a screen-and-vaccinate program are dependent on the cost of the screening test, cost of the vaccine, and expected seroprevalence of measles antibody.^{8,9} Since both expected seroprevalence of measles antibody (90% to 95%) and vaccine cost (\$15 to \$25 per dose) are relatively constant, the key variable is the cost of screening. In-house testing is usually inexpensive but sera sent to outside reference laboratories may be so expensive as to remove any economic advantage to this approach. Third, a screen-and-vaccinate approach does not consider immunity to rubella and mumps. While hospital outbreaks of rubella and mumps are reported less frequently than for measles, a recent study among U.S. Army recruits suggests that as many as 16% to 18% of young adults may be susceptible.¹⁰ Considering the potential impact of these diseases, particularly the devastating effect of rubella infection of a pregnant woman, the opportunity to assure immunity to these viruses should not be overlooked. The additional cost of screening for immunity to rubella and mumps would probably

eliminate the cost savings of a screen-and-vaccinate approach and would favor an MMR vaccination program of employees without documented prior vaccination.

Measles will continue to be an occupational hazard for healthcare workers until the disease is eradicated. Global measles eradication likely will not occur for many years. Until that time, systematic efforts to achieve universal measles immunity with employee measles vaccination programs virtually should eliminate this dangerous disease in this high-risk population.

REFERENCES

1. Wright IJ, Carlquist JE Measles immunity in employees of a multihospital healthcare provider. *Infect Control Hosp Epidemiol* 1994;15:8-11.
2. Willy ME, Koziol DE, Fleisher T, et al. Measles immunity in a population of healthcare workers. *Infect Control Hosp Epidemiol* 1994;15:12-17.
3. Stover BH, Adams G, Kuebler CA, Cost KM, Rabalais GP. Measles-mumps-rubella immunization of susceptible hospital employees during a community measles outbreak: cost-effectiveness and protective efficacy. *Infect Control Hosp Epidemiol* 1994;15:18-21.
4. Atkinson WL, Markowitz LE, Adams NC, Seastrom GR. Transmission of measles in medical settings-United States, 1985-1989. *Am J Med* 1991;91(suppl 3B):320S-324S.
5. Centers for Disease Control. Measles prevention: recommendations of the Immunization Practices Advisory Committee (ACIP). *MMWR* 1989;38(no. S-9):10.
6. Atkinson WL, Markowitz LE. Measles and measles vaccine. *Sem Ped Infect Dis* 1991;2:100-107.
7. Sellick J, Longbine D, Schiffeling R, Mylotte J. Screening hospital employees for measles is more cost-effective than blind immunization. *Ann Intern Med* 1992;116:982-984.
8. Subbarao EK, Amin S, Kumar ML. Prevacination serologic screening for measles in health care workers. *J Infect Dis* 1991;163:876-878.
9. Grabowsky M, Markowitz L. Serologic screening, mass immunization, and implications for immunization programs. *J Infect Dis* 1991;164:1237-1238.
10. Kelley PW, Petrucelli BP, Stehr-Green P, Erickson RL, Mason CJ. The susceptibility of young adult Americans to vaccine-preventable infections. *JAMA* 1991;266:2724-2729.