



## Review

# A global perspective of vaccination of healthcare personnel against measles: Systematic review



Amy Parker Fiebelkorn<sup>a,\*</sup>, Jane F. Seward<sup>a</sup>, Walter A. Orenstein<sup>b</sup>

<sup>a</sup> National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, Atlanta, GA, USA

<sup>b</sup> Emory Vaccine Center, Emory University, Atlanta, GA, USA

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## ABSTRACT

Measles transmission has been well documented in healthcare facilities. Healthcare personnel who are unvaccinated and who lack other evidence of measles immunity put themselves and their patients at risk for measles. We conducted a systematic literature review of measles vaccination policies and their implementation in healthcare personnel, measles seroprevalence among healthcare personnel, measles transmission and disease burden in healthcare settings, and impact/costs incurred by healthcare facilities for healthcare-associated measles transmission. Five database searches yielded 135 relevant articles; 47 additional articles were found through cross-referencing. The risk of acquiring measles is estimated to be 2 to 19 times higher for susceptible healthcare personnel than for the general population. Fifty-three articles published worldwide during 1989–2013 reported measles transmission from patients to healthcare personnel; many of the healthcare personnel were unvaccinated or had unknown vaccination status. Eighteen articles published worldwide during 1982–2013 described examples of transmission from healthcare personnel to patients or to other healthcare personnel. Half of European countries have no measles vaccine policies for healthcare personnel. There is no global policy recommendation for the vaccination of healthcare personnel against measles. Even in countries such as the United States or Finland that have national policies, the recommendations are not uniformly implemented in healthcare facilities. Measles serosusceptibility in healthcare personnel varied widely across studies (median 6.5%, range 0–46%) but was consistently higher among younger healthcare personnel. Deficiencies in documentation of two doses of measles vaccination or other evidence of immunity among healthcare personnel presents challenges in responding to measles exposures in healthcare settings. Evaluating and containing exposures and outbreaks in healthcare settings can be disruptive and costly. Establishing policies for measles vaccination for healthcare personnel is an important strategy towards achieving measles elimination and should be a high priority for global policy setting groups, governments, and hospitals.

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\* Corresponding author at: 1600 Clifton Rd, MS A-34, Atlanta, GA 30333, USA.

E-mail address: [afiebelkorn@cdc.gov](mailto:afiebelkorn@cdc.gov) (A.P. Fiebelkorn).

## 1. Introduction

Measles, a highly infectious viral disease characterized by a febrile respiratory prodrome and a generalized maculopapular rash, can lead to severe complications and death [1]. In 1980, before widespread measles vaccine use globally, an estimated 2.6 million measles-associated deaths occurred worldwide [2]. With implementation of routine measles immunization policies globally, there have been dramatic reductions in measles morbidity and mortality [1].

The World Health Organization (WHO) has established global measles goals focusing on reduction of measles mortality ( $\geq 95\%$  compared with 2000 levels) and achievement of regional measles elimination [3].<sup>1</sup> Achieving these goals will pave the way for a variety of achievements including reducing childhood mortality by two-thirds between 1990 and 2015 (i.e., the Millennium Development Goal #4) [4], establishing a target date for global measles eradication [4,5], and ultimately, accomplishing the vision of “achieving and maintaining a world without measles” [3]. Measles was eliminated from WHO’s Region of the Americas in 2003 [6,7] and the Pan American Health Organization is currently certifying measles and rubella elimination for every country in the Region [8]. Elimination goals for 2015 have been established for four other WHO regions in the world [9,10]. Nonetheless, measles remains endemic in Europe, Asia, Africa, and the Middle East [11] leading to measles importations and outbreaks in many countries that have achieved elimination [12–16].

The majority of measles cases occur in the community but due to the severity of measles, ill persons are likely to seek medical care in primary healthcare facilities, emergency departments, or hospitals resulting in nosocomial/healthcare-associated transmission. The high potential for transmission of measles poses considerable challenges in healthcare facilities, particularly because the illness may not be recognized immediately resulting in a failure to implement appropriate isolation precautions [17–19]. Patients can be highly contagious in the prodromal phase prior to rash onset [1]. Healthcare personnel, including students in healthcare fields who have clinical rotations and volunteers in medical facilities, should be protected against measles either through vaccination or other acceptable evidence of measles immunity [20,21]. However, measles outbreaks occurring over the last decade have continued to document the problem of healthcare personnel acquiring and transmitting measles, suggesting deficiencies in establishing or implementing measles vaccine policies for this occupational group [18,22–24].

We conducted a systematic review of literature regarding measles vaccine policies for healthcare personnel, measles seroprevalence, disease burden and transmission in healthcare personnel and impact/costs incurred by healthcare facilities for healthcare-associated measles transmission. This information is intended to help policy makers make, implement, and evaluate policies to prevent measles transmission to and from healthcare personnel.

## 2. Methods

We reviewed the following databases from the dates indicated through January 2013: PubMed (June 1973), CINAHL (June 1990), Web of Science (1982), Embase (1988), and Ovid Medline/Ovid OLDMedline (1946). We used the following search terms: (“measles” or “MMR vaccine” or “measles transmission” or “measles vaccine policy”) and (“healthcare

workers” or “health-care workers” or “health care workers” or “healthcare personnel” or “health-care personnel” or “health care personnel”). We included articles written in English. We also cross-referenced articles referenced in the above searches that were not captured in the online database searches. Additionally, we conducted a Google search of governmental health agencies (e.g., Public Health Agency of Canada, Public Health England), as well as international health agencies (e.g., WHO), to search for measles vaccine policies and measles evidence of immunity requirements. For calculating summary statistics (mean, median, interquartile range) for percent of healthcare personnel who were measles seronegative by region, we excluded studies that reported on a non-representative sample (i.e., those reporting only on persons without evidence of measles immunity).

## 3. Results

### 3.1. Literature search findings

The database searches yielded 135 relevant articles out of 931 potential articles retrieved, and an additional 47 articles were found through cross-referencing, for a total of 182 relevant articles. Of these, we included 125 articles in the results section of the review. The remaining 57 articles had outdated findings on vaccine coverage, were previous versions of articles that had subsequently been updated, did not have results broken down by antigen, had serosurvey results based on vaccination rather than titers, were review articles that included references we had already cited, or were commentaries that provided no new information.

### 3.2. Vaccination policies and their implementation in healthcare personnel

Globally, the WHO recommends measles vaccination for susceptible adults but there is no specific WHO policy recommending measles vaccination or evidence of measles immunity for healthcare personnel [25]. The United States was the first country to establish a measles vaccine policy for healthcare personnel in 1987 [26] though measles vaccine had been recommended for eligible persons of all ages who were considered “susceptible” since 1977 [27]. A number of other countries have policies for measles vaccination of healthcare personnel including Canada, Australia, countries of the Caribbean and some countries in Europe [28–31]. As of 2011, Maltezou et al. reviewed vaccination policies for healthcare personnel in acute healthcare facilities in Europe through surveying infection control or occupational health providers in all 27 European Union member states, as well as Norway, Russia and Switzerland. Of the 30 countries, 15 had no measles vaccination recommendations for healthcare personnel, 12 countries (i.e., Belgium, Cyprus, Germany, Ireland, Italy, Lithuania, Luxembourg, Malta, Russia, Spain, Switzerland and the United Kingdom [UK]) recommend measles vaccination for all healthcare personnel, France recommends vaccination for healthcare personnel in direct patient care, Austria recommends vaccination for pediatricians only, and Finland has a policy for mandatory measles vaccination of healthcare personnel [32]. In France, measles is one of 4 vaccines that is recommended for healthcare personnel (as well as influenza, pertussis, and varicella), in contrast to 5 other vaccines (diphtheria, tetanus, poliomyelitis, hepatitis B virus, and tuberculosis) which are mandated for healthcare personnel [33]. A study in Japan in 2008 reported that vaccination of medical students in Japan was not mandatory [34].

To support implementation of vaccine policy, the United States defined criteria for “evidence of measles immunity” in 1978 [35]. Since a number of children and the majority of adults in the

<sup>1</sup> Absence of circulation of measles virus >12 months.

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