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Major Article

Cross-sectional study on factors hampering implementation of measles pre- and postexposure measures in Dutch hospitals during the 2013-2014 measles outbreak

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Background: This study examined adherence to national recommendations on measles pre- and postexposure measures, including immunization of health care workers (HCWs) in Dutch hospitals, during a national outbreak of measles in The Netherlands. This study also investigated which hospital characteristics and organizational issues hamper implementation.

Methods: This was a cross-sectional survey among all general and academic hospitals in The Netherlands. An online structured questionnaire (48 questions) was administered. Analysis was performed using descriptive statistics and logistic regression.

Results: Of 88 hospitals, 70 (79.5%) were included. Of 68 hospitals, 48 (70.6%) assessed susceptibility to measles in HCWs. Of 70 hospitals, 61 (87.1%) offered vaccination to susceptible HCWs. Of 63 hospitals, 42 (66.7%) had postexposure policies consistent with national recommendations. Of 62 hospitals, 30 (48.4%) implemented all these measures, which is the minimum set of measures considered necessary to adequately prevent measles in HCWs. Logistic regression suggests that hospitals with several locations, hospitals with more employees, and hospitals where infectious disease experts designed infection prevention policies while occupational health experts implemented the policy less often implemented this minimum set of measures ($P < .001$, $P < .01$, and $P < .001$, respectively).

Conclusions: During a national measles outbreak, most hospitals took measures to prevent measles in HCWs, but less than half implemented the minimum set of measures required. Implementation strategies in hospitals need to be improved, especially in large-sized hospitals and hospitals with several locations, and with respect to the assignment of responsibilities for infection prevention policies.

Measles is a highly infectious viral disease transmitted through airborne respiratory droplets, or by direct contact with nasal and throat secretions of infected individuals. Symptoms include fever and maculopapular rash. Common complications are otitis media and pneumonia. A less frequent but serious complication is encephalitis, which occurs in approximately 0.1% of measles patients.

Measles is preventable by vaccination, providing lifelong immunity. In the national immunization program of The Netherlands, children born in 1976 and 1977 were offered a single monovalent measles vaccine, and children born from 1978 onward were offered 2 measles-containing vaccines (monovalent measles vaccine or measles mumps rubella [MMR] vaccine). Prior to the introduction of measles vaccination in the national immunization program, measles was highly endemic in The Netherlands; therefore, all adults born before 1965 are considered to be immune after natural infection.[1]

Despite an overall vaccination coverage in The Netherlands of >95%,[2] a national measles epidemic took place between May 2013 until the end of March 2014 because of regional clustering of unvaccinated persons and unvaccinated children attending the same

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schools. During this epidemic, 2,700 cases were notified to the National Institute for Public Health and the Environment (RIVM); 181 children were hospitalized, and 1 child died of complications.[3] The number of patients reported is probably an underestimation because not all symptomatic persons seek medical attention.[4] Most patients were unvaccinated Orthodox Protestant children, who were not vaccinated for religious reasons. The Orthodox Protestants minority consists of 220,000 persons, mostly living in the Bible Belt,[5] a geographic area stretching southwest to northeast within The Netherlands. In 29 municipalities in the Bible Belt, MMR vaccination coverage for 2-year-old children is <90%.[6]

In hospitals, measles patients are treated with isolation precautions,[7] but health care workers (HCWs) can unknowingly be exposed to measles because patients are infectious before onset of rash, and early symptoms may not be recognized. Even when timely and adequate isolation and hygiene measures are taken, susceptible HCWs can become infected.[8] Nosocomial measles transmission may account for 14%-45% of cases identified during epidemics in countries where measles has been declared to be eliminated.[9] The risk of contracting measles is estimated to be 2-19 times higher for susceptible HCWs than for the general population.[10] Some HCWs are potentially at high risk for severe measles infection, for example pregnant or immunocompromised HCWs.[11] Furthermore, transmission of measles from infected HCWs to patients can lead to severe complications because of the patient's prior medical condition.[12]

Vaccination of HCWs is effective in preventing measles in health care facilities,[12] and susceptible HCWs should be encouraged to be vaccinated. However, during the Dutch epidemic in 2013-2014, 16 out of 19 HCWs notified to the RIVM were not or were incompletely vaccinated against measles—and probably were infected with measles during their work.[3]

This is in line with the generally low measles vaccination coverage among HCWs found in studies in Europe,[13,14] and with low influenza vaccination coverage among HCWs in Dutch hospitals.[15] An Australian study demonstrated the crucial role of policy implementation to enhance vaccination coverage in HCWs. In that study, only 24% (65/272) of HCWs reported being fully vaccinated 1 year after introduction of an HCW vaccination policy, despite 96% (260/272) indicating a willingness to update their vaccination status.[16]

As part of the response to the Dutch epidemic in 2013-2014, the RIVM issued guidance on pre- and postexposure measures, including immunization of HCWs in hospitals and other health care facilities.[17] This study investigates adherence to these recommendations in Dutch hospitals, and which hospital characteristics and organizational issues hamper implementation of measles prevention policies. Insight in these factors is needed to further tailor guidance for hospitals to improve compliance to national recommendations during epidemics to protect HCWs and their patients from vaccine-preventable diseases. This is particularly relevant in light of the current upsurge of measles in various countries in Europe.[18,19]

METHODS

Data collection

A cross-sectional study was undertaken among all general and academic hospitals in The Netherlands.[20] In 2013, there were 131 hospital locations clustered in 88 organizations, of which 8 were academic.[20] The board of directors of each organization was approached by letter (n = 88) and asked to invite professionals responsible for (implementing) policies regarding measles vaccination for HCWs to complete an online questionnaire. Three and 5 weeks later reminders were sent. Data collection was done between April and June 2014, immediately after the measles epidemic had officially ended.

Online questionnaire

The structured questionnaire consisted of 48 questions, divided into 6 domains: characteristics of the hospital, responsibilities for design and implementation of infection prevention policies, occurrence of measles in patients and HCWs, assessment of susceptibility to measles of HCWs and measles pre- and postexposure measures in place. The questions in the domains of assessment of susceptibility and pre- and postexposure measures were based on the national recommendations issued by the RIVM in June 2013.[17]

Short description of national recommendations

The recommendations issued by the RIVM in June 2013 focused on 3 pillars. The first was about how to assess susceptibility to measles in HCWs. It was recommended that all adults born before 1965, and persons born between 1965 and 1975 with a positive history of measles, could be considered as immune after natural infection. Also, persons born after 1978 who said to be fully vaccinated within the national immunization program (2 times for a measles or MMR vaccination) could be considered protected against measles. In uncertain situations, either the vaccination certificate or serologic testing to detect measles antibodies was recommended. The second pillar of the recommendations was offering MMR vaccination to susceptible HCWs. The third regarded postexposure procedures: MMR vaccination as soon as possible and prohibition to work from 5-18 days after last exposure if no antibodies could be detected in serum.

Guidance was targeted at HCWs in so-called risk departments: departments where HCWs are prone to be exposed to measles or departments where patients are particularly at risk for complications because of measles. These include the following: department of obstetrics and maternity, department of neonatology, department of pediatrics, department of internal medicine, intensive care unit, and emergency department.[17]

Adequate implementation of measles pre- and postexposure measures

Implementation of measles pre- and postexposure measures was categorized as adequate in case the minimum set of measures considered necessary to adequately prevent measles in HCWs was implemented (Box 1).

Box 1. Minimum set of measures

1. Assessing susceptibility to measles in HCWs
2. Offering MMR vaccination to susceptible HCWs
3. Postexposure procedures consistent with national recommendations
   a) MMR vaccination as soon as possible
   b) Serology to measure antibody titer
   c) Prohibition to work from 5-18 days after (last) exposure if no antibodies could be detected

HCW, health care worker; *MMR*, measles mumps rubella.