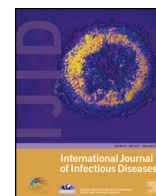




ELSEVIER

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Short Communication

Resurgence of measles in a country of elimination: interim assessment and current control measures in the Republic of Korea in early 2014

Tae Un Yang^a, Ju Whi Kim^a, Hye Eun Eom^a, Hyun-Kyung Oh^a, Eun Seong Kim^a, Hae Ji Kang^b, Jeong-Gu Nam^b, Ki Soon Kim^b, Sung Soon Kim^b, Chan Kyu Lee^c, Young-Joon Park^{a,*}, Ok Park^{a,*}^a Division of Vaccine-Preventable Diseases Control and National Immunization Program, Centers for Disease Prevention, Korea Center for Disease Control and Prevention, OHTAC, 200 Osongsaengmyeong 2-ro, Osong-eup, Cheongwon-gun, Chungcheongbuk-do, Republic of Korea 363-951^b Division of Respiratory Viruses, Centers for Infectious Diseases, Korea National Institute of Health, Republic of Korea^c Gyeonggi Provincial Government Bukbu Office, Gyeonggi-do, Republic of Korea

ARTICLE INFO

Article history:

Received 18 June 2014

Received in revised form 23 September 2014

Accepted 28 September 2014

Corresponding Editor: Eskild Petersen, Aarhus, Denmark

Keywords:

Measles
Diseases
Outbreaks
Epidemiology
Prevention
Control

SUMMARY

Since the beginning of 2014, the Republic of Korea has experienced a resurgence of measles cases. Among the 220 cases confirmed as measles during epidemiological weeks 1–20 (December 29, 2013 to May 17, 2014), 10 imported cases were identified. The predominant genotype was B3, which reflects the circulating measles virus in adjacent countries. Even with the verification of measles elimination in March 2014 by the World Health Organization, recent importation has been related to international travel. Targeted control measures have been implemented in addition to proper isolation and patient care. A vigilant surveillance system and high levels of vaccine coverage should be maintained to sustain the measles elimination status.

© 2014 The Authors. Published by Elsevier Ltd on behalf of International Society for Infectious Diseases. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/3.0/>).

1. Introduction

Measles was recently documented as eliminated in the Republic of Korea (ROK) as a result of a high-quality case-based surveillance system and population immunity, which was achieved by a high vaccination rate (>95.0% since 1996); this was verified using global standards.^{1,2} However, measles importation and limited transmission to local areas still occur. In early 2014, the highest number of measles cases was documented since a 2000–2001 nationwide Korean outbreak.³ Here, we describe our interim assessment of the current measles resurgence and recent targeted strategies.

2. Epidemiological and microbiological characteristics of outbreaks

During 2008–2013, the annual measles incidence in the ROK was 0.93 cases/1 000 000 people, with an average of 47.5 confirmed

annual measles cases (range 2–107). During epidemiological weeks 1–20 of 2014, the Korea Centers for Disease Control and Prevention (KCDC) received reports of 220 confirmed measles cases. Imported measles cases have been reported sporadically since January 2014, and subsequent transmission following imported virus cases without identified index cases has occurred in hospitalized children. In April and May, cases were reported in schools, without obvious international travel links (Figure 1).

During epidemiological weeks 1–20, the mean age of the 220 measles cases was 11.6 years (range 3 months to 47 years) with a bimodal distribution: one peak each for infants aged <1 year (26.4%) and adults aged 19–29 years (17.7%; Figure 2), reflecting nosocomial transmission among unvaccinated infants in children's hospitals and recent university outbreaks, respectively.

One hundred and eighty-four (80%) were import-associated cases, including 24 import-linked cases (10.9%), 150 imported virus cases (68.2%), and 10 imported cases (4.5%), of which six occurred in Korean residents returning from international travel and four in foreign visitors from the Philippines, Vietnam, China, and Singapore (Figure 1). Two of these resulted in secondary cases; one was transmitted to 22 cases associated with unvaccinated

* Corresponding author. Tel.: +82 43 719 6810; fax: +82 43 719 6859.
E-mail address: okpark8932@gmail.com (O. Park).

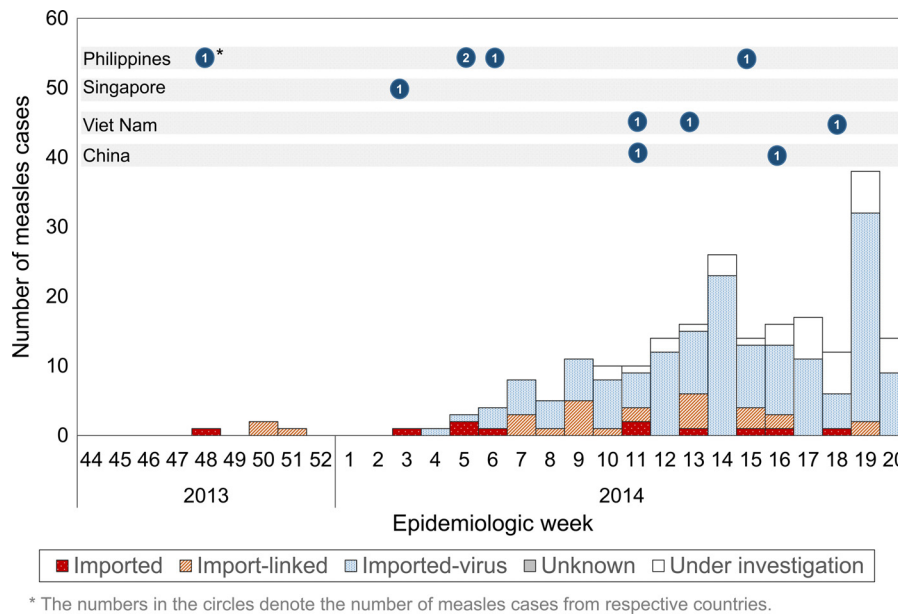


Figure 1. Numbers of measles cases by epidemiological week in the Republic of Korea between December 29, 2013 and May 17, 2014.

infants in a children’s hospital, the other with two workplace-related secondary cases.

Vaccination status was primarily unvaccinated ($n = 96/220$, 43.6%) or unknown ($n = 33/220$, 15.0%). Of the 76 patients aged 13–29 years in schools and universities, 49 (64.5%) had received a two-dose measles-containing vaccine (Figure 2). Of 105 hospitalized children who were on the same floor or in the same zone as one measles patient during the infectious period of the index case, only the unvaccinated patients were infected with measles (incidence in unvaccinated patients, 15.4%; 2/13).

Of the 210 patients with adequate information on clinical manifestations, 144 (68.6%) satisfied the original clinical measles case definition of fever, rash, and one of the 3 Cs (cough, coryza, or conjunctivitis). More unvaccinated patients (81.3%) met the case definition than vaccinated patients (56.1%).

Laboratory tests confirmed 216 cases, identified via viral RNA through PCR and/or positive IgM serology tests. PCR tests were performed in 167 (/216) cases, and measles genotype information was obtained from 91 specimens; the three genotypes identified (B3 94.5%, D8 4.4%, and H1 1.1%) are currently circulating in adjacent countries (e.g., the Philippines, Vietnam, and China).⁴

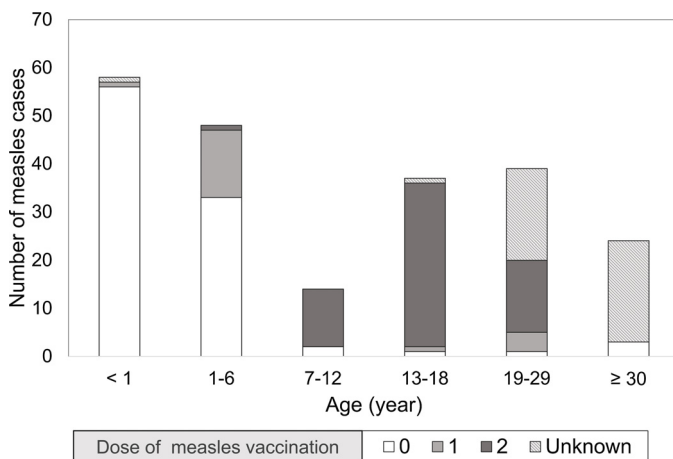


Figure 2. Numbers of measles cases by immunization status and age group in the Republic of Korea between December 29, 2013 and May 17, 2014.

3. Control measures

Transmission following international measles importation, nosocomial transmission among unvaccinated infants in children’s hospitals, school outbreaks among vaccinees (assumed to be related to extensive measles virus exposure), and a pocket population have contributed to recent outbreaks in the ROK. Targeted countermeasures, proper isolation, and patient care have been implemented.

To prevent importation, the KCDC recommended immunization prior to travel to measles endemic countries, via the press, mass media, and travel agencies. To minimize local transmission, measles-related education for primary care physicians was conducted through medical conference presentations and leaflets to increase awareness. Prompt reporting of laboratory work-up was intensified and re-verified by a recent World Health Organization accreditation (April 14, 2014). Vigorous contact tracing was conducted. Vaccination was encouraged by reminder text messages for unvaccinated people who were identified from the data of the Administrative Registry of the Ministry of Security and Administration and the National Immunization Registry.

4. Discussion

The rapid increase in measles cases in early 2014 in the ROK appears to be related to recent, large outbreaks in adjacent countries, similar to situations reported in other countries, including the USA and Japan.^{4–6}

Given the very low measles incidence in the ROK, newly trained healthcare professionals are less aware of and have less experience with measles; furthermore, the vaccine-modified clinical presentation hampers clinical diagnosis.⁷ Also, identifying the chain of transmission is challenging in dense urban areas. Misdiagnosed measles cases come into prolonged, close contact with school or work colleagues, without adequate precautions or isolation, potentially resulting in secondary vaccine failure related with waning immunity.⁸ We are preparing the application of a policy targeted at pocket populations, defined according to data from a previous seroprevalence study and the National Immunization Registry as adolescents and young adults born between 1994 and

1996.⁹ Further vaccine failure investigations are also in preparation.

With the reliable National Immunization Program and high-quality case-based surveillance system in the ROK, the measles outbreak should soon subside. However, measles importation constantly challenges the country's herd immunity, emphasizing the importance of maintaining a vigilant surveillance system and high vaccine coverage. With this early-2014 resurgence of measles, we have re-enforced a strategic plan for measles outbreaks, and our experience will prevent similar situations.

Conflict of interest: None.

References

1. Four Western Pacific countries and areas are the first in their Region to be measles-free. News release. World Health Organization Western Pacific Region; 2014. Available at: <http://www.wpro.who.int/mediacentre/releases/2014/20140320/en/> (accessed June 17, 2014).
2. Progress toward measles elimination in the Republic of Korea 2008–2013 Sep. Republic of Korea: Korea Centers for Disease Control and Prevention; 2013.
3. Elimination of measles in the Republic of Korea, 2001–2006. *Wkly Epidemiol Rec* 2007;**82**:118–24.
4. Measles–rubella bulletin. Manila, Philippines: World Health Organization Western Pacific Regional Office; 2014.
5. Takahashi T, Arima Y, Kinoshita H, Kanou K, Saitoh T, Sunagawa T, et al. Ongoing increase in measles cases following importations, Japan, March 2014: times of challenge and opportunity. *Western Pac Surveill Response J* 2014;**5**:31–3.
6. Zipprich J, Hacke JK, Murray EL, Xia D, Harriman K, Glase C. Notes from the field: measles—California, January 1–April 18, 2014. *MMWR Morb Mortal Wkly Rep* 2014;**63**:362–3.
7. Choe YJ, Hu JK, Song KM, Cho H, Yoon HS, Kim ST, et al. Evaluation of an expanded case definition for vaccine-modified measles in a school outbreak in South Korea in 2010. *Jpn J Infect Dis* 2012;**65**:371–5.
8. Hickman CJ, Hyde TB, Sowers SB, Mercader S, McGrew M, Williams NJ, et al. Laboratory characterization of measles virus infection in previously vaccinated and unvaccinated individuals. *J Infect Dis* 2011;**204**:S549–58.
9. Kim ES, Choe YJ, Cho HY, Kim YJ, Yoon HS, Yang JS, et al. Seroprevalence of measles among children affected by national measles elimination program in Korea, 2010. *Vaccine* 2012;**30**:3355–9.