Large ongoing measles outbreak in a religious community in the Netherlands since May 2013

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Despite vaccination coverage over 95%, a measles outbreak started in May 2013 in the Netherlands. As of 28 August, there were 1,226 reported cases, including 82 hospitalisations. It is anticipated that the outbreak will continue. Most cases were orthodox Protestants (n=1,087/1,186; 91.7%) and unvaccinated (n=1,174/1,217; 96.5%). A unique outbreak control intervention was implemented: a personal invitation for measles-mumps-rubella (MMR) vaccination was sent for all children aged 6–14 months living in municipalities with MMR vaccination coverage below 90%.

Outbreak description

The first two measles cases in this outbreak that were reported, occurred in an orthodox Protestant school in the Netherlands and were reported on 27 May 2013. As of 28 August, a total of 1,226 measles cases (incidence 73.1 per 1 million) who acquired infection in the Netherlands have been reported by 19 Municipal Health Services (Figure 1). The case with the earliest date of onset of exanthema in this outbreak had not travelled abroad and the source of infection remains unknown.

Case definition

The routine measles case definition is based on the presence of clinical measles symptoms (fever and maculopapular rash and cough, coryza or conjunctivitis) in combination with laboratory confirmation or an epidemiological link (contact in the previous three weeks) to a laboratory-confirmed case.

Laboratory confirmation is based on either measles-specific IgM serology for venous- or fingerstick-blood samples or specific detection of measles virus RNA by polymerase chain reaction (PCR) in throat swabs, oral fluid or urine specimens.

Of the 1,226 cases, 176 (14.4%) had complications including encephalitis (1 case), pneumonia (90 cases) and otitis media (66 cases) and 82 (6.7%) were admitted to hospital. (For a case description of the encephalitis case (in Dutch), see [1].) There were no deaths.

The median age of cases was 10 years (range: 0-54). Most cases were 4–12 years of age (n=717; 58.5%), while 200 (16.3%) were aged 13–15 years (Figure 2). Nearly all cases were unvaccinated (1,174; 96.5% of 1,217 with known vaccination status), 39 cases (3.2%) were vaccinated with one dose of a measles-containing vaccine and four cases (0.3%) were vaccinated with two doses.

Most cases were orthodox Protestant (1,087; 91.7% of 1,186 cases with information). Reasons for being unvaccinated were: 1,072 (93.6% of 1,145 cases with information) orthodox Protestantism, 3 (0.3%) anthroposophical, 30 (2.6%) parents' or own critical attitude towards vaccination, and 40 (3.5%) other. Most cases (719; 58.6%) occurred in municipalities with MMR vaccination coverage below 90% (Figure 3). Of the cases occurring in high-vaccination coverage (≥90%) areas, the majority (425; 86.4% of 492 cases with information) was also orthodox Protestant.

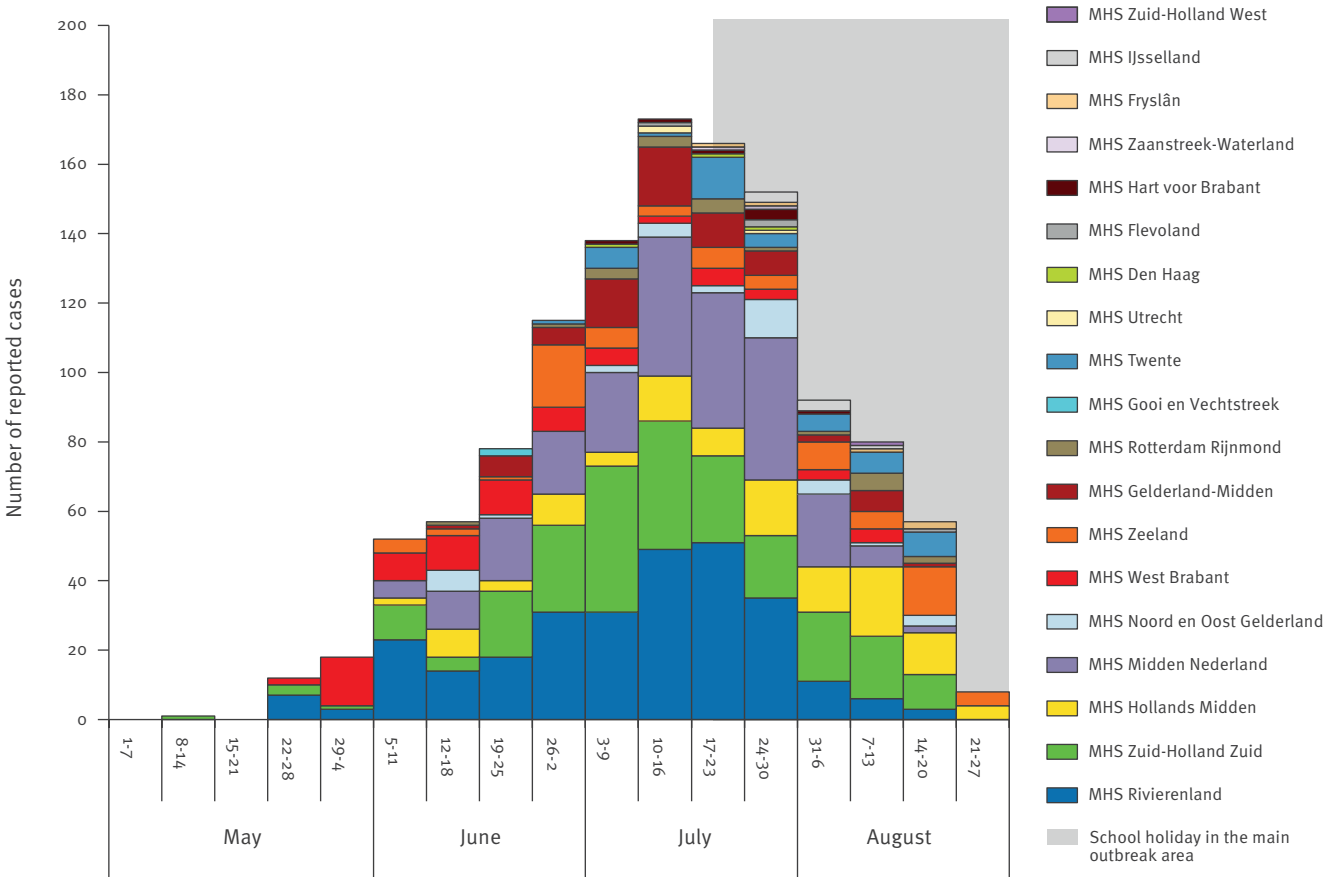
Of the 1,226 reported cases, 10 were healthcare workers who probably acquired the infection at their place of work. Nine were unvaccinated and one was vaccinated with two doses of measles-containing vaccine. Nosocomial transmission to patients has not been reported.

Laboratory confirmation and genotyping

Laboratory confirmation was obtained in 363 of 1,226 cases (29.6%); the other cases were notified on the basis of an epidemiological link with a laboratory-confirmed measles case. The vast majority of laboratory-confirmed cases are confirmed using PCR testing of oral fluid specimens from cases who were captured through exanthema surveillance, which had been implemented since 2003.

Figure 1

Reported measles cases by week of onset of exanthema and Municipal Health Service region, the Netherlands, 1 May–28 August 2013 (n=1,199)[a]

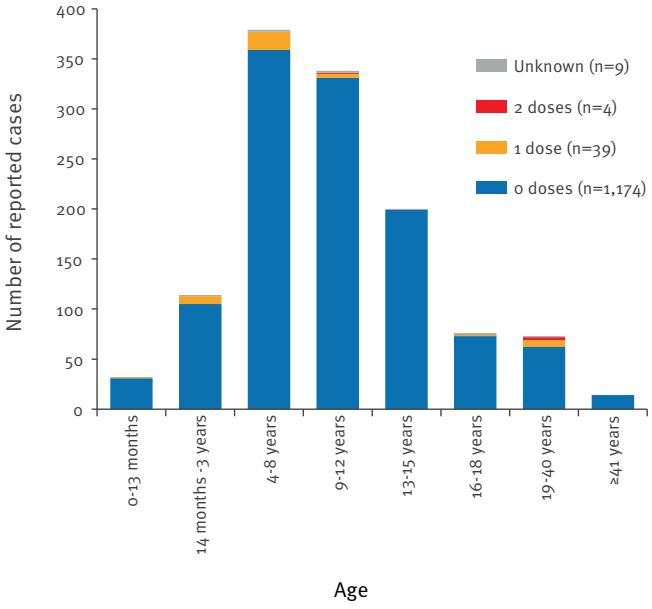


MHS: Municipal Health Service.

[a] Information on date of exanthema onset was missing for 27 cases.

Figure 2

Reported measles cases by age group and measles vaccination status, the Netherlands, 1 May–28 August 2013 (n=1,226)



The cases that have been genotyped (n=150) were all genotype D8 and all had the same sequence type (MVi/DenHaag.NLD/8.13/1, WHO/MEANS ID 32423). As of January 2013, genotype D8 has been reported for the majority of measles cases within the World Health Organization (WHO) European Region and the Dutch sequence is identical to what is currently referred to as the Taunton sequence-type of D8 (K. Brown, Public Health England, personal communication, 5 April 2013 and M. Mulders, World Health Organization, personal communication 12 June 2013).

Background

A single dose of monovalent measles vaccine was included in the Dutch national immunisation programme in 1976 for children aged 14 months. Since 1987, children have been offered vaccination against measles, mumps and rubella in a two-dose schedule, at 14 months and nine years of age. Vaccination coverage is generally high in the Netherlands. In 2012, the MMR coverage was 96% for the first dose and 93% for the second dose (birth cohorts 2010 and 2002, respectively). However, vaccination uptake is low in some specific groups, for religious reasons (orthodox Protestantism), anthroposophic reasons, and in those

with a critical attitude towards vaccination. While the last two groups are spread throughout the Netherlands, orthodox Protestants are a close-knit community of 250,000 persons, mostly living in an area that stretches from the south-west to the north-east of the country, the so-called Bible belt. Vaccination coverage in general among orthodox Protestants was assessed in 2006-2008 as about 60% [2]. Predestination is an important theme in their beliefs: refusal of vaccination is based on the idea that people should not interfere with divine providence [3]. Since they intensively share educational, social, cultural and religious activities, they do not benefit from herd immunity that protects unvaccinated individuals living elsewhere in the Netherlands [4].

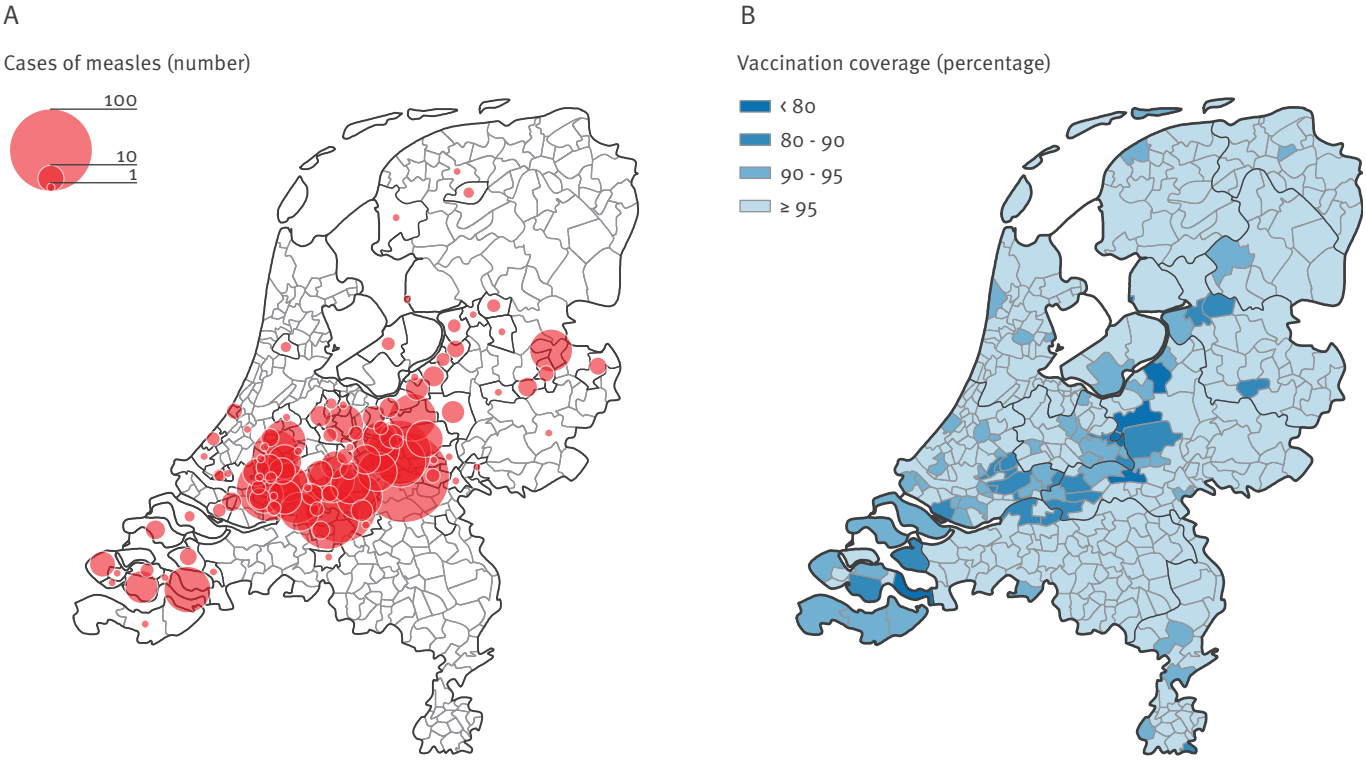
Measles has been a notifiable disease in the Netherlands since 1976. Since introduction of measles vaccination, outbreaks among unvaccinated individuals occurred every four to seven years, e.g. a small outbreak among anthroposophists occurred in 2008 [5, 6]. The most recent large outbreak in the Bible belt occurred in 1999–2000, with more than 3,200 reported cases, 3 deaths and an estimated 150 hospitalisations [7, 8]. In the Bible belt, there are 29 municipalities with a vaccination coverage for the first dose of MMR of less than 90%, in which approximately 5% of the Dutch population lives [9]. As measles is a highly contagious disease, in these 29 municipalities, all non-immune individuals – orthodox Protestant as well as others – are considered to be at risk of contracting measles during an outbreak.

Control measures

An outbreak management team was convened on 17 June 2013 to provide scientific advice on control measures. The team defined infants between 6 and 14 months of age living in municipalities with MMR vaccination coverage below 90% as the main risk group for developing measles complications. This age group is at relatively high risk since most mothers are currently vaccinated against measles, which leads to lower levels of maternal antibodies than does natural infection [10]. The team advised that children in this age group should be targeted for an additional (for children aged 6–12 months) or early (for children aged 12–14 months) MMR vaccination. Parents of children in this age group living in municipalities with vaccination coverage below 90% received a personal invitation by post through the routine vaccination programme register. The Netherlands has a very complete national vaccination registration, which allows direct targeting of additional vaccination to risk groups [11].

Figure 3

Reported measles cases by municipality, 1 May–28 August 2013 (panel A, n=1,226) and vaccination coverage of first MMR vaccine dose by municipality[a] for birth cohort 2010 at the age of two years (panel B, n=184,230), the Netherlands



MMR: measles-mumps-rubella.

[a] There are 30 municipalities with MMR-1 vaccination coverage below 90%, of which 29 are within the 'Bible belt'. The other municipality is Vaals, in the far south-east of the Netherlands. A considerable number of the infants living in Vaals receive their vaccinations in Germany and are therefore not registered in the Dutch vaccination registration, which explains the low vaccination coverage (84.3%).

Although previous research and practical experience have shown low acceptance of catch- up vaccination among orthodox Protestants during outbreaks [4], the team advised offering MMR vaccination to all unvaccinated orthodox Protestant children from six months to 19 years of age, even if they were living in municipalities with high vaccination coverage. The aim was to provide individual protection and increase vaccine coverage. As a person's religion is not registered, this offer was publicised through media focusing on the orthodox Protestant community.

In addition, all unvaccinated individuals aged 14 months up to 19 years were invited for catch-up vaccination through the general media.

Post-exposure guidelines [12] recommend vaccination of contacts of a case of measles when they are unprotected and aged six months or older. For younger infants who have had contact with a measles case passive immunisation with immunoglobulin, or MMR vaccination when aged four months or older, could be considered, depending on the time since exposure and the measles immune status of the mother.

National recommendations to reduce the risk of measles in healthcare workers were recently finalised [13]. These suggest that healthcare workers born after 1965 should actively check their vaccination or measles infection status and complete their MMR vaccination schedule if needed. Healthcare workers born before 1965 and those vaccinated twice are considered immune. All hospitals in the Netherlands have been approached and encouraged to comply with these recommendations. The effects of the control measures will be evaluated.

Discussion

Recently, a review of measles susceptibility of infants below the age of the first MMR vaccine dose was published [14]. This listed four European countries where early MMR vaccination (from the age of six months) was recommended during outbreaks (Greece, Italy, Romania, Spain). To our knowledge, the current vaccination campaign in the Netherlands is unique in that it is implemented using the national vaccination register, which allows a personal invitation to be sent to parents of children in the target population to have their child vaccinated. The uptake of the vaccination among the vaccine accepting population is therefore likely to be much higher than when there was only a recommendation for vaccination [15-18]. The number of MMR vaccinations administered before the age of 14 months was ten times higher in July 2013 compared with July 2012, indicating that parents adhere to the invitation. However, exact vaccination coverage is not known yet. Measles vaccination at 6–9 months of age results in suboptimal humoral immunity, which may not be completely repaired by repeated vaccination [19]. The clinical and immunological impact of the vaccination campaign will be assessed in dedicated studies.

The current outbreak was anticipated because of the large percentage of susceptible orthodox Protestant children (more than 40%) based on serological data from 2006-2007 [20]. The current percentage of susceptible individuals is estimated to be larger than prior to the 1999–2000 outbreak [21], due to the lack of natural immunity as measles virus did not circulate in this community since 2000. Therefore, we expect that the number of measles cases in the current outbreak will be higher than in the 1999–2000 outbreak, in which more than 3,200 cases were reported [7]. The current epicurve of the outbreak (Figure 1) indicates a clear decrease in the number of measles cases in the last 5–6 weeks. This is most probably due to the summer holidays, i.e. the closing of the schools, which are one of the main sources of transmission. As in the 1999–2000 outbreak, we expect the number of cases to increase again after the summer holidays. School closure or exclusion may be effective to control small local outbreaks of measles [22]. Considering that the current outbreak started in a large number of susceptibles living in a widespread area, these interventions may not be feasible or effective: it is likely that they would delay rather than stop the outbreak.

The number of reported cases in the outbreak is probably a large underestimation of the actual number of measles cases because not all patients consult a physician and not all patients seeking consultation are reported. In the 1999–2000 outbreak, it was estimated that only 9% of all measles cases were reported [7]. If we assume the same degree of under-reporting applies to the current outbreak, the actual number of cases would currently be over 13,000.

Until now, cases were mainly orthodox Protestants (92%). Based on the proportion of orthodox Protestants in the Netherlands and the vaccination coverage among these groups [23], it is estimated that only 15% of the individuals who refuse vaccination are orthodox Protestants. There is therefore a risk that the outbreak might spread to individuals who refuse vaccination because of reasons other than religion, including anthroposophists and those with a critical attitude towards vaccination, or to people who are too young or ill to be vaccinated. However, these individuals are more dispersed over the country and are therefore better protected by herd immunity. Nevertheless, it remains important to monitor the spread of the outbreak outside the orthodox Protestant community.

On 15 August 2013 the Dutch National Institute for Public Health and the Environment (RIVM) received an alert from Canadian public health authorities regarding a Dutch citizen who developed measles whilst in Canada. The strain isolated from this case was indistinguishable from the Dutch outbreak strain, consistent with his epidemiological link to two cases in the Dutch orthodox community (L. Sherrard, Public Health Agency of Canada, personal communication, 3 September 2013). Onward transmission from this Dutch

case in Canada has not been reported. For all large outbreaks of vaccine preventable diseases that occurred in the Dutch orthodox reformed community since the 1990s spread to Canada, and occasionally the US, has been documented [24]. Spread to neighbouring countries where pockets of unvaccinated people and areas with lower MMR coverage exist, such as Germany and the United Kingdom, could also occur, but there is no specific contact between the orthodox Protestant community in the Netherlands and unvaccinated people in neighbouring as is the case with Canada.

Since the 1999–2000 outbreak, the incidence of measles notifications in the Netherlands has been below the WHO European Region threshold for measles elimination (1 per 1 million population per year [25]) for all years except 2008 and 2011. However, because of the unique social and geographical clustering of religious communities with low vaccination coverage, the risk of large outbreaks remains in the Netherlands, as illustrated by the current outbreak.

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Conflict of interest

None declared.

Authors' contributions

AU, RB and MW contributed to acquisition of data. MK, ES, LM and SH analysed and interpreted the data. MK, AU and SH drafted the manuscript. ES, LM, WR, RB, MW, HM and AT critically revised the manuscript. All authors approved the final version of the manuscript.

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