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## SHORT REPORT

# Emergence and disappearance of W135 meningococcal disease

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### SUMMARY

W135 meningococcal disease was imported into Singapore in 2000 via Hajj pilgrims. Previous studies have showed sustained carriage of W135 with the potential for further transmission within communities. We therefore set out to determine whether W135 meningococcal disease would become endemic in Singapore after its introduction in 2000. Cases occurred until 2003, but no further cases have been reported since 2004.

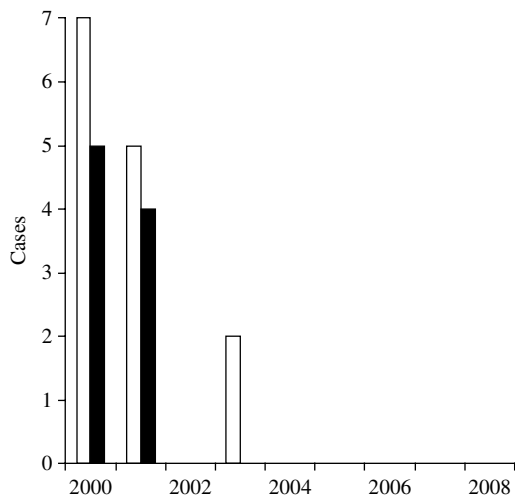
**Key words:** Hajj pilgrims, household contacts, importation, non-Hajj related

An outbreak of meningococcal disease due to serogroup W135 occurred during the Hajj pilgrimage in the years 2000 and 2001 [1]. This outbreak generated particular interest as W135 had previously not been reported to be associated with outbreaks [2]. Thus, the Hajj-associated outbreak was the first major outbreak due to a previously rare strain, serogroup W135 of the electrophoretic type 37, which led to secondary clusters in Moslem communities around the world via pilgrims returning to their countries of origin [2–4], including a large outbreak of W135 meningococcal disease in Burkina Faso in 2002 [5]. The mechanism of spread was probably due to nasopharyngeal carriage as pilgrims were reported to have acquired W135 carriage during the Hajj [4]. High acquisition rate of W135 carriage associated with transmission from pilgrims to their household contacts upon return was documented in 2001 [6], associated with sustained carriage [7]. The public health concern therefore was

that this outbreak not only affected pilgrims and their household contacts but also the general community, with a potential for future non-Hajj-related W135 epidemics.

Singapore is an industrialized island state in Asia with a population of about 4 million people. Fifteen percent of the population are Malay Muslim, and about 4000–5000 pilgrims travel annually for the Hajj pilgrimage. In Singapore, meningococcal disease is a notifiable disease. Prior to 2000, no cases of W135 meningococcal diseases had been reported to the Ministry of Health. W135 emerged for the first time in Singapore during 2000, imported via Hajj pilgrims [6]. Pulsed-field gel electrophoresis (PFGE) of W135 isolates from returning pilgrims in 2001 showed them to be of clonal origin [6]. Given the long duration of W135 carriage in Singaporean pilgrims and contacts with the potential to disseminate into the general community [8], we were concerned that W135 may rapidly spread in Singapore and become endemic. We therefore set out to investigate the national epidemiology of W135 meningococcal disease after its importation into Singapore in 2000.

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**Fig. 1.** Cases of W135 meningococcal diseases [total (□) and Hajj-related only (■)] in Singapore between 2000 and 2008.

Information on confirmed cases of W135 meningococcal disease from January 2000 until December 2008 was retrieved from the Ministry of Health Singapore. Medical records were reviewed and face-to-face interviews conducted to obtain information on age, gender, race, history of recent Hajj pilgrimage or household contact with a Hajj returnee, temporal relationship between onset of symptoms and return from the Hajj, other travel history, as well as clinical outcome.

In total, between 2000 and 2008, there were 14 cases of W135 meningococcal disease, seven of which occurred in 2000, five in 2001 and two in 2003 (Fig. 1). Nine of the 14 cases (64%) were related to the Hajj (pilgrims, contacts of pilgrims, laboratory worker during the Hajj). Twelve of the 14 cases (85%) occurred in 2000 and 2001 in temporal association with the Hajj outbreaks, e.g. within 2 months after the end of the Hajj. Of the nine Hajj-associated cases, seven (78%) were contacts of pilgrims (five household contacts, two non-household contacts), and two were directly related to the Hajj (one pilgrim, one laboratory worker in Mecca). Of the five non-Hajj-associated cases, one was a traveller from Africa (Morocco) who arrived in Singapore with signs and symptoms of meningitis [9], and four were Singaporeans (three of Chinese origin and one of Indian ethnicity) – none with known contact with Hajj pilgrims or mosques. Four out of the total 14 cases died – the case-fatality rate was therefore 29%. There was a marked decline in cases of W135 meningococcal disease after 2001,

but non-Hajj-related cases occurred until 2003. Unfortunately, the isolates from 2003 were not available for PFGE for comparison with the 2001 isolates. No further cases were reported between 2004 and 2008.

W135 meningococcal disease newly emerged in Singapore in 2000 and 2001, introduced via pilgrims who had acquired the disease or carriage during the Hajj of 2000 and 2001. In Singapore, the Ministry of Health introduced tetravalent polysaccharide meningococcal vaccine (covering A/C/Y/W135) for the 2001 Hajj, and this public health intervention would explain the absence of further cases of W135 meningococcal disease in Singaporean Hajj pilgrims in 2001. However, polysaccharide meningococcal vaccines do not prevent acquisition of meningococcal carriage [10]. Despite vaccination, in 2001, pilgrims acquired W135 meningococcal carriage and transmitted carriage to their household contacts [6]. Based on our national epidemiological data, the attack rate in household contacts for 2000 and 2001 was estimated to be 18/100 000 and 28/100 000, respectively [8]. To protect household contacts of returning pilgrims, eradication of carriage by administration of antibiotics to the Singaporean pilgrims at the point of return to their country of origin was considered for the 2002 Hajj. However, as the Ministry of Health in Saudi Arabia introduced tetravalent meningococcal vaccination as a visa requirement for the 2002 Hajj, we decided to wait for the impact of this public health intervention. Indeed, in 2002, no further outbreak of W135 meningococcal disease occurred during the Hajj, and no cases were seen in Singapore either. This was probably due to a combination of factors. (1) Although polysaccharide meningococcal vaccine does not reduce carriage, the new visa requirement would have resulted in an almost complete vaccine coverage of 2 million pilgrims against W135 thereby resulting in a decline of clinical cases of W135 disease, with a consequently reduced pool of circulating W135 isolates associated with reduced carriage rates [11, 12]. (2) The Kingdom of Saudi Arabia reinforced antibiotics to pilgrims from African countries which would also have led to a reduction of carriage rates. (3) Natural changes in carriage rates occur over time combined with the unpredictability of evolution of outbreaks.

No further Hajj-associated cases occurred from 2002 to 2008. Two cases of W135 disease occurred in 2003 that were non-Hajj-related. These cases may have been exposed to W135 as carriage of W135 in

pilgrims has been shown to persist for a lengthy period thus putting the general community at risk [7].

In conclusion, W135 meningococcal disease emerged for the first time in Singapore in 2000, imported via Hajj pilgrims, and caused clusters of disease mainly in Moslem communities. However, our study showed that W135 did not become endemic in Singapore in subsequent years. W135 meningococcal disease in Singapore was effectively controlled probably due to the fact that this disease was kept under control during the Hajj in Saudi Arabia.

#### DECLARATION OF INTEREST

None.

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