Organization or Community-Based Outbreak? Responding to Cases of Meningitis Under Epidemiologic Uncertainty

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ABSTRACT

Six cases of serogroup C invasive meningococcal disease were identified in Treviso district, Veneto region, Italy between December 13 and 15, 2007. The afflicted patients were found to have attended the same Latin-dance clubs on the same nights, and chemoprophylaxis was provided to potentially exposed individuals. Despite these efforts, 2 cases caused by the same meningococcal strain subsequently occurred in the same area, without any apparent epidemiological correlation to the initial cases. This may have resulted from a failure to neutralize the meningococcal carrier/s. The root cause analysis method applied to public health emergency preparedness was used to analyze the response to this critical incident. The root cause analysis revealed a need to develop regional guidelines for the classification and management of a meningococcal outbreak and for developing risk-communication strategies that include the identification of appropriate channels of communication for differing segments of the population. (*Disaster Med Public Health Preparedness*. 2019;13:368-371)

Key Words: meningitis, root cause analysis, risk communication, epidemiological investigation, emergency response

Italy has low incidence of invasive meningococcal disease compared with Europe overall, ranging from 0.2 to 0.6/100.000.[1-4] In the Veneto region, the incidence of invasive meningococcal disease in 2007 was 0.44/100.000, the same as the average annual incidence between 1996 and 2006.[5] In this field report, we describe a meningococcal outbreak that occurred in 2007-2008 in Italy and the public health (PH) system response to the incident, including response challenges and root causes of such challenges.

Eight cases of serogroup C invasive meningococcal disease (ST-11/ET-37) were identified in the Veneto region between 2007 and 2008.[6] Of these, 6 cases (15-33 years of age), including 3 fatal cases, occurred between December 13 and 15 in the Treviso district. Epidemiological investigation started within 24 hours following each case diagnosis, as to establish the whereabouts of cases and trace all cases' potential contacts over the previous week. This investigation revealed that these 6 cases attended the same dance clubs on December 8 and 9, the majority of them (4 out of 6) were individuals from the Latin American community, and that only 2 of them were previous acquaintances. All 6 cases resided in towns under the jurisdictional authority of the Treviso district, which is divided into 3 local health units (LHUs).

In order to reach all potential carrier/s, all those who attended the clubs on December 8 and 9 were invited to receive chemoprophylaxis and vaccination: 1027 individuals were reached.

Multilingual posters, TV announcements, LHUs' websites and helplines were used to provide information to the public.

On December 20 and January 4, 2 additional cases were reported in the same region. The first occurred in the same municipality as the index case, and the second occurred ~19 miles from the previous 6, under the jurisdictional authority of the district of Venice. The regional laboratory confirmed these subsequent cases possessed the same meningococcal strain as the original 6, but no epidemiological link was established connecting the 2 new cases to each other or to the initial 6.

The only common factor between the case reported on December 20 and previous cases was geographic proximity.

The January 4 case was considered sporadic because it occurred beyond the incubation period, which is up to 10 days.

The LHU responding to the December 20 case offered chemoprophylaxis and vaccination to all contacts (350 people) and worked in conjunction with 2 LHUs

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operating in the Treviso district to offer mass vaccination to all 15-29-year-old residents, distributing a total of 69,000 doses of vaccine.

Despite the January 4 case's sporadic classification, the LHU offered chemoprophylaxis and vaccination to all contacts (91 people) and vaccination to all residents aged 15-29 upon request and without charge. No additional cases were reported.

Countermeasures were offered to all 15-29-year-old residents, and not solely close contacts, due to challenges regarding uncertainty in contact tracing and the inability to determine if the last 2 cases were sporadic or represented the onset of a *community-based outbreak*.

METHODS

The method used to analyze the response to this outbreak consisted of reviewing official reports, news and articles related to the incident, and subsequently conducting a series of semi-structured interviews with PH officials in key leadership positions during the outbreak. Interviews aimed to conduct a root cause analysis (RCA) of factors contributing to specific response challenges.[7,8] The interview guide included questions focused on epidemiological investigation and medical countermeasures, coordination across PH authorities and communication to the public, specifically asking: *What went well and why? What were the underlying problems? What changes in the public health system are required to improve the response?* Lessons learned were used to derive recommendations for improving the response to future incidents.[9]

RESULTS

Eleven PH officials were interviewed, of which 5 held leadership positions at the regional or local level and 6 worked in a laboratory, emergency department, epidemiology department or the mass media. The RCA identified response challenges and contributing factors related to the capabilities[10] described below and summarized in Figure 1.

Epidemiological investigation and management of medical countermeasures

Two hypotheses potentially explain how 2 new cases of the same meningococcal strain reoccurred in the 10 days following the identification of the first 6: (1) the initial epidemiological investigation failed to identify all exposed persons and, consequently, countermeasures failed to reach the carrier, or (2) the additional cases were sporadic, with no association to the initial 6.

The first hypothesis is supported by the fact that the epidemiologic investigation found attendance to the same dance clubs was the only common factor among the initial cases, and that only 2 of the 6 were previously acquainted. This makes defining who else was potentially in close contact, and therefore eligible for chemoprophylaxis, very difficult. In addition, health authorities lacked an effective mechanism to identify the dance club's clientele. Dance clubs are only open on weekends, limiting the usefulness of informational posters displayed therein. In addition, the risk-communication campaign targeted journals, TV and radio news which while frequently used by the general population, have an unknown popularity among Latino youths.

Coordination and communication (within the PH emergency preparedness system) and emergency risk communication (with the public)

In Veneto, LHUs are responsible for PH responses inside their jurisdictions, while regional authorities are responsible for developing guidelines and supervising and coordinating LHUs. In 2007, no regional or national protocols on responding to meningococcal outbreaks had been developed, nor had agreements to follow specific protocols been established. The 4 LHUs among which the 8 cases were distributed handled the distribution of chemoprophylaxis differently. Due to concerns regarding potential harms and side effects of chemoprophylaxis, 2 LHUs took a more conservative approach, offering chemoprophylaxis only to those potentially exposed to cases. However, 2 LHUs responding to public concern, offered chemoprophylaxis to anyone requesting it. The age categories used to determine who should receive vaccination also differed across units, with 1 LHU extending vaccination to those aged 3-5 years in addition to those aged 15-29 years. In total, 0-2-year olds were already covered by routine meningococcal C vaccine, official policy in Veneto since 2005.

Risk communication represented a response challenge, as the dance clubs' majority clientele were from the Latino community, raising concerns regarding language barriers, how to best reach this population segment, and the risk of stigmatization stemming from excessive communication (Figure 1).

Interviewees reported that, regarding information sharing and coordination across partners, the biggest challenge was that primary care physicians offered chemoprophylaxis and vaccination to patients without informing the PH departments.

Lessons learned from this analysis, displayed in Figure 1, have been used to develop 5 recommendations for practice, agreed upon by 7 out of 9 PH officials interviewed during this incident analysis.[9]

DISCUSSION

This report from the field is the second example of using the critical incident analysis methodology based on RCA[7,8] to evaluate an incident that occurred in Europe. The first example was published in 2015, focusing on the response to the H1N1 pandemic in the Emilia Romagna region, in Italy.[11] The major response challenge identified in our analysis was the difficulty in contact tracing during the epidemiological investigation followed by the disease spreading from a delimitated (*organization based*[12-15]) outbreak to the community. High demand for medical countermeasures

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FIGURE 1

Root Cause Analysis of the meningococcal outbreak occurred in the Veneto region, Italy in 2007.

Timeline Subsequently to enlarged chemoprophylaxis after the first six menigococcal cases together with high risk perception among general population and high chemoprophylaxis attendance, two subsequent cases with same meningococcal strain occurred. The cases occurred in four bordering Local Health Units (LHUs). Spread of meningococcal outbreak to the community has been faced up with chemoprophylaxis offered to the close contacts and the mass vaccination strategy applied to all 15-29 years old residents in all LHUs while one LHU added vaccinoprophylaxis also to 3-5 years old.

Lessons Learned & Adaptations	WHY did the sub-cause occur?	WHY did the system have difficulty?	The public health system had difficulty with….	Objective
	Root Cause	Sub-Cause	Challenge	The public health system was trying to…
There is a need for developing national guidelines for management of meningococcal outbreaks, indicating also the actions in situation when contacts are not traceable. *There is a need for developing risk-communication strategies directed to segments of the population at risk without incurring into population panic and/or stigmatization.* *There is need for developing coordination and communication strategy between LHUs and public health partners identifying in advance different roles and mutual agreements.*	*There is lack of Italian guideline on management of meningococcal outbreaks and inconsistency in available international guidelines and in literature on application of medical countermeasures during a meningococcal outbreaks.* *Lack of knowledge on how to reach the Latino youth through appropriate channels and trusted sources.* *Lack of a coordinated communication strategy across LHUs and with public health partners as GPs*	*Absence of a reliable mechanism to identify potential contacts in an environment such as dance clubs.* *Concerns about the risk of stigmatization of the Latino community during the risk-communication campaign.* *Impossibility of determining if the any of the two additional cases were related to the initial six.* *It was decided a priori to coordinate strategic decisions between LHUs and to leave*	*Conducting the epidemiological investigation and tracking contacts.* *Controlling the high demand of chemoprophylaxis and vaccination from an over-concerned public.* *Achieving consistency in operations across local health units (LHUs).* *Information sharing and coordination with public health partners as GPs.*	*Control meningococcal outbreak through application of medical countermeasures and risk communication to public.*

from a concerned public explains public health authorities' decision to extend chemoprophylaxis beyond close contacts and offer vaccination to all residents aged 15-29. It remains unclear if the Veneto Public Health System effectively prevented this outbreak from progressing into a *community-based outbreak* through mass distribution of medical countermeasures, or if this constituted overtreatment, which would be true if the subsequent cases were indeed sporadic.

CONCLUSIONS

From this critical incident analysis, we identified a need to strengthen coordination and communication across LHUs and with PH partners, a need which has now been partially met in Veneto through the development of the *Preparedness and Response to Public Health Emergencies Regional Plan*.

Our analysis underlines the need for regional protocols to respond to meningococcal outbreaks and the necessity of developing risk-communication strategies and messages that support the identification of potential contacts and avoid general panic.

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