

Diphtheria in a congregate setting — facilitators and barriers to an effective Public Health response

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Abstract

Presentation

Diphtheria has high outbreak potential in settings with low vaccination coverage, such as International Protection Accommodation Services (IPAS) and Beneficiaries of Temporary Protection (BOTP) settings. This report describes a case of diphtheria in such a setting, with unknown toxigenic status.

Diagnosis

Ultimately the isolate was non-toxigenic. This report examines the facilitators and barriers to the public health response.

Treatment

On the basis of the clinical and microbiological evidence, a decision was taken to assume the presence of toxigenic *Corynebacterium diphtheria*, while awaiting definitive toxin gene status.

Discussion

Despite the isolate ultimately being non-toxigenic, this incident was managed appropriately as a case of toxigenic diphtheria, while awaiting toxin status testing. This allowed us to exercise a response to a high-priority vaccine-preventable disease in an IPAS setting, and identify facilitators and barriers to the response. These learnings have allowed better preparedness for future infectious diseases incidents in high-risk settings.

Case report

The Microbiologist notified isolation of *Corynebacterium diphtheriae* in a throat swab culture (toxin status undetermined) from a 19-year-old East African male. He had arrived in Ireland two years previously, and resided in an IPAS setting. The case had presented to his General Practitioner three days earlier with a two-day history of unilateral throat pain with a classic pseudomembrane.¹ Following discussion with the Infectious Diseases consultant, the patient was admitted to hospital for diphtheria anti-toxin and IV antibiotics. A Public Health Incident Management Team (IMT) was established.

Admissions to the IPAS facility were restricted and anyone with respiratory or cutaneous symptoms were isolated. This centre housed 198 residents in crowded conditions, from many countries worldwide, with multiple languages. A rapid Public Health assessment found the facility to be non-compliant with standard Infection Prevention Control (IPC) guidelines. Translated information on Diphtheria was provided to residents. The “concentric circle” approach to identifying contacts was used, assessing contacts closest to the case first and gradually extending to more casual contacts.

To protect the residents, a vaccination clinic was established at the facility three days after notification. Sixty-six of the 198 residents consented to, and received, vaccination. A site visit to the patient’s workplace was planned in order to identify potential sources of infection for the index case, and other undetected chains of transmission.

Three days after notification, the Bacteriology Reference Department in Colindale, UK, reported the *C. diphtheriae* isolate as non-toxigenic. As only diphtheria infection with toxin-producing *C. diphtheriae* is notifiable in Ireland,² the IMT was stood down.

Table 1: Concentric circle approach to identify and assess contacts				
Reason	Number	Number swabbed	Swab results for diphtheria	Other actions
Close contact (Same room as index)	5	5	All not detected	Isolated within a dedicated isolation facility Provided with prophylactic antibiotics
Close contacts (Extended family)	3	3	All not detected	Isolated in situ Provided with prophylactic antibiotics

Other symptomatic residents (all mild flu-like symptoms)	9	9	All not detected	Isolated in situ if clinically suspicious illness
Recent arrival to Ireland	3	2	All not detected	None

Table 2: Facilitators and barriers to the response

Component of response	Facilitators	Barriers
Risk Assessment and Initial response	Ability to stand up a multi-disciplinary national Incident Management Team within 24 hours of notification.	Diphtheria is on the list of immediate preliminary notifiable diseases. However, the case was first notified upon laboratory confirmation, despite clinical suspicion of diphtheria.
		Inability to determine toxin status of the isolate in Ireland, resulted in a 6-day interval between swabbing and non-toxigenic status confirmation.
Contact tracing	Local surge capacity to carry out on-site risk assessment.	“Zero-hour contract” employment terms in Ireland penalise or do not facilitate employees in taking leave for self-isolation and quarantine. ⁸
Site visit	Regional public health departments in Ireland have teams based at locations throughout their large catchment areas, making an on-site response readily achievable.	
Communications	Pre-prepared translated material was available to be distributed.	There were some delays in accessing translators and adapting translated materials to certain languages.
Workplace	Pre-existing procedure to engage National Ambulance Service’s (NAS) Emerging Threats Team in swabbing close contacts. NAS	Difficult to initiate communication with large corporations at a local level. There was no clear point of contact to manage this type of incident.

	team was mobilised within 24 hours, as per existing protocol.	Lack of awareness of Medical Officer of Health Legislation in the index case's workplace, which led to an initial reluctance to cooperate with Public Health.
Immunisation	Ability to offer vaccine to residents within 3 days, with 66 of 198 availing (33% uptake).	Many residents in this facility were unvaccinated or unsure of vaccination status. The catch-up vaccination service had not yet visited this facility.

Discussion

At the time of the incident, while *C. diphtheriae* could be detected in laboratories in Ireland, there was no facility to determine its toxigenic status. It is the Diphtheria toxin that causes classical systemic diphtheria.¹ Therefore, only toxin-producing *C. diphtheriae* is notifiable². As the necessary PCR capabilities for toxin detection were not available in Ireland at the time, the isolate was sent to the Bacteriology Reference Department laboratory for analysis.

Despite the isolate being non-toxigenic, this incident was managed appropriately as a case of presumed toxigenic diphtheria, while awaiting toxin status testing. This allowed us to exercise a response to a high-priority vaccine-preventable disease in an IPAS setting. After this incident, we conducted a series of post-outbreak meetings with Public Health stakeholders to identify facilitators and barriers to the response, which are described in Table 2. These learnings have allowed better preparedness for future infectious diseases incidents in high-risk settings.

Specifically, a notable facilitator for future responses is that the facility to rapidly determine the toxigenic status of *C. diphtheriae* isolates by PCR in Ireland has since been introduced at the Public Health Laboratory, Dublin for investigative purposes and to enhance the facility's capability to act as centralised laboratory for the screening of close contacts. This incident highlighted the importance of the development of regional and national Public Health Laboratories to respond to emerging health threats. Similarly, local urgent vaccination response protocols have now been developed for IPAS/BOTP settings for use in the case of future outbreaks.

The ability to rapidly establish a temporary vaccine clinic, which vaccinated 33% of residents was encouraging. Full vaccination, consisting of three doses of a Diphtheria-containing vaccine, is 87% effective in preventing symptomatic disease amongst close contacts in

outbreak settings, while vaccination with 1 or 2 doses is approximately 70% effective². It was determined that baseline vaccine coverage in this facility was likely low, as migrants seeking International Protection are often under-immunised.³ Additionally, the rollout of catch-up vaccinations in this setting had not yet occurred.⁴

On a site visit, this facility was found to be overcrowded, with multiple individuals sharing bedrooms, bathrooms and dining space. Residential facilities, such as this, are required to comply with pre-existing IPC standards.⁵ The responsibility for ensuring the site remains acceptable, maintained, and not overcrowded lies with both site management and IPAS.⁶

One symptomatic close contact of the case did not comply with isolation advice. This non-compliance was driven by a 'zero-hour contract' of employment. To protect the public from infectious diseases, it is paramount that government policy and social welfare supports ensure that adherence to public health directions does not place undue financial pressure on cases and contacts.

Workplaces often have an inadequate understanding of their obligations under Medical Officer of Health (MOH) Legislation, when an infectious disease is a threat to their staff, patrons or the public. This was the case in this situation, and delayed our response somewhat. Providing the workplace with information on the MOH Legislation enabled use to resolve the issue.⁷

Communications with a vulnerable population in a setting where multiple languages are spoken was a challenge. Informal communication channels often exist in IPAS and BOTP settings. In this case it was a residents' and management Whatsapp group, which was used to provide information. Having pre-translated materials available also facilitated the dissemination of information.

In summary, this report describes a case of *C.diphtheriae* infection that was managed presumptively as a toxin-producing strain, while awaiting definitive toxin results. The facilitators and barriers to the response are also described.

Declarations of Conflicts of Interest:

None declared.

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