State of Alaska Epidemiology Bulletin

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Increase in Detected Non-toxigenic Diphtheriae Cases in Alaska

Background

Diphtheria is a clinical syndrome that is caused by an exotoxin produced by the bacterium *Corynebacterium diphtheriae*. The disease primarily manifests as a respiratory infection that may result in death (respiratory diphtheria), but it may also present as an infection in a non-respiratory site (e.g., skin, wound, conjunctiva, ear, genital mucosa), otherwise known as cutaneous diphtheria. Both respiratory and non-respiratory infections caused by toxin-producing bacteria require public health follow-up.[1] Vaccination with diphtheria toxoid-containing vaccine prevents disease mediated by the diphtheria toxin, it does not prevent infection or colonization with either toxin-producing or non-toxin producing strains of the bacteria.

In 2019, the case definition used for diphtheria surveillance was revised to distinguish between disease caused by toxin and non-toxin producing bacteria from any anatomical site to better identify cases with public health implications.[2] This *Bulletin* summarizes diphtheria surveillance data in Alaska since 2019.

Methods

Diphtheria reports received by the Section of Epidemiology (SOE) during 2019–2021 were reviewed.

Results

During 2019–2021, 15 cases of non-toxigenic *C. diphtheriae* bacteria were reported to SOE; the median age was 47 years (range: 1–79 years). Of these, 10 (67%) were in males, 14 (93%) were in Alaska Native people and 1 (7%) was in a white person, 14 (93%) were in persons living in an urban area, 8 (53%) were in persons experiencing homelessness (PEH), and (87%) were in persons who were up to date on diphtheria toxoid-containing vaccination (Table). None had recent travel outside of the United States; one person was diagnosed while visiting another state.

Reported types of infection included wound abscess(es) 5 (33%), joint/pain swelling 2 (13%), and 1 (7%) each of the following: bacteremia, septic shock, altered mental status, altered mental status due to overdose, dermatitis, diabetic foot ulcer, endocarditis, osteomyelitis, and periorbital cellulitis. All persons had one or more underlying condition(s) reported; 2 (13%) died during their clinical syndrome.

Isolate sources included 3 respiratory (2 NP swabs, 1 tracheal aspirate), 4 blood cultures, and 8 wound/abscess cultures. All isolate identification was performed at the Alaska State Public Health Laboratory (ASPHL) using the Bruker Matrix Assisted Laser Desorption/Ionization-Time of Flight Mass Spectrometry (MALDI-TOF MS). All isolates were confirmed to be *C. diphtheriae* biovar gravis by the Centers for Disease Control and Prevention (CDC) in Atlanta, GA; none of the isolates produced diphtheria toxin in the Elek assay.

Table. Characteristics of Non-toxigenic *C. diphtheriae* Cases (n=15) — Alaska 2019–2021

Characteristics	Non-PEH*	PEH*
Demographic and Clinical		
Male	4	6
≤18 years	1	0
19-64 years	4	8
≥65 years	2	0
Anchorage resident	6	7
UTD Diphtheria toxoid vaccination	6	7
Underlying Conditions		
Alcohol misuse	1	7
Polysubstance abuse	1	5
Apparent wound	3	7
History of endocarditis or heart valve replacement	1	0

**PEH = Persons experiencing homelessness*

Discussion

Following the initial identification of two cases of non-toxigenic diphtheria in Alaska in 2012–2013, Alaska has seen an increasing number of identified cases. This started in 2019 and happened to coincide with the revision of the national disease surveillance case definition.[3] A similar increase has also been seen nationally and is likely largely (if not solely) due to the emerging use of MALDI-TOF MS for the identification of bacteria in clinical laboratories.[1,4] Current surveillance data may still underestimate the incidence of both toxigenic and non-toxigenic cutaneous infections because health care providers might not clinically suspect or test for diphtheria.

The main predisposing factors for colonization and infection with non-toxigenic *C. diphtheriae* are substance misuse (intravenous drug use, alcoholism), homelessness, underlying cardiac disease, and the presence of a heart valve prosthesis.[5,6]

Recommendations

1. Clinical specimens should be collected for bacterial culture testing if *C. diphtheriae* infection is suspected.
2. Isolates of *C. diphtheriae* identified from any anatomical site should be submitted to the ASPHL-Anchorage for Elek toxin testing at CDC. They are currently the only laboratory in the Nation that can test for toxin production.
3. Health care providers must notify the SOE of suspected respiratory or cutaneous diphtheria cases by calling 907-269-8000 during work hours or 1-800-478-0084 after hours to ensure that appropriate diagnostic testing (including culture and testing for toxin production) is performed and to facilitate prompt public health action.
4. Treat patients with a 14-day course of erythromycin or penicillin to eradicate *C. diphtheriae*, reduce symptoms of infection, and prevent transmission. Treatment with diphtheria antitoxin (DAT) is generally not recommended unless signs of systemic toxicity are present. DAT can be obtained if needed only after consultation with the SOE and a CDC diphtheria duty officer.[7]
5. Toxin-producing diphtheria infections warrant public health inventions to identify close contacts, and to determine if the infected person had recent travel to a country where diphtheria is endemic. Close contacts should be monitored for the development of respiratory or cutaneous illness for 7–10 days after their last exposure. For chemoprophylaxis, close contacts should receive a 7–10-day course of erythromycin or penicillin. Before antibiotics are administered, close contacts should have nasal and throat swabs collected for culture to test for *C. diphtheriae* carriage.
6. Persons recovering from diphtheria should begin or complete active immunization with diphtheria toxoid during convalescence if not fully up to date with vaccination. Close contacts should receive a booster dose, appropriate for age, if they are not up to date with diphtheria vaccination.[8]

References

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