



PATHOGEN SAFETY DATA GUIDE TRAINING MODULE CASE STUDY 4

CLOSTRIDIUM DIFFICILE IN A HEALTHCARE WORKER

TARGET AUDIENCE: Healthcare workers

How to use this case study

This case study is designed to be used as supplementary or as an alternative to Activities 3 and 4 in the NIEHS WTP's Pathogen Safety Data Guide Training Module.

Participants should work in small groups (4 – 8 people). Each group should select a recorder and reporter who will report back to entire class. Each small group should read through the case study. If time allows, the group should answer the questions in Activities 3 and 4 on the PSD Training Module Worksheet for the pathogen *Clostridium difficile* (*C. diff*). Then the group should work on the questions following the case study. If time is short, the questions may be divided among the group members or one or both activities may be omitted.

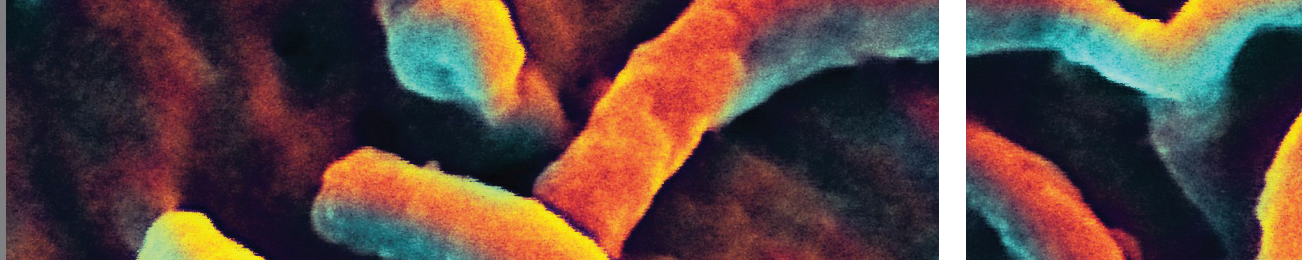
Case Study

A 24-year-old nurse was put on antibiotics during dental care and subsequently developed severe diarrhea that did not respond to initial treatment. This caused her to be out of work for two weeks. She experienced "Occupational *Clostridium difficile*". "With *C. diff* at epidemic levels, workers may acquire the bug from patients if they take antibiotics that wipe out the commensal bacteria in the gut and open a path for the pathogen."¹

"I think it would be a good idea for employee health to inform personnel about this risk if they are prescribed antibiotics," says Curtis Donskey, MD, an infectious disease physician at Louis Stokes Cleveland VA Medical Center. "I do that routinely if I prescribe antibiotics to someone working in a healthcare setting."¹

Because there is no active surveillance system for tracking occupational infections, it is likely that more cases are occurring than have been reported in the medical literature. "When I give presentations and comment on the risk to healthcare personnel taking antibiotics, it is common for a physician or nurse to come up afterwards and say that they or one of their coworkers got a *C. diff* infection while they were working," he says.¹

Researchers have reported on a case where a healthcare worker was infected when a patient developed symptomatic *C. diff* and vancomycin resistant *Enterococcus* (VRE) colonization after



taking clindamycin for another condition. Four additional reports documented *C. diff* infection in healthcare workers who were in good health and who were on antibiotic treatment or within two weeks after completing it. These cases demonstrated that workers may be at risk of *C. diff* infection after receiving antibiotics. Healthcare workers with immune disorders are at even greater risk of infection.

C. diff infections can cause lost work time. In our case study the nurse was initially furloughed for four days after taking clindamycin related to dental care. “Her *C. diff* infection did not respond to initial treatment with metronidazole, but she fully recovered when switched to vancomycin.”¹

“*C. diff* has become one of the most prevalent and deadly healthcare associated infections in the country, attributable for some 15,000 patient deaths annually, according to the Centers for Disease Control and Prevention (CDC). A confluence of events has led to the current *C. diff* epidemic, including the emergence of the highly virulent and toxigenic NAP1 strain in 2000, the misuse and overuse of antibiotics, and the difficulty of removing *C. diff* spores from contaminated surfaces and healthcare worker hands.”¹

Unfortunately, the type of *C. diff* circulating in the U.S. today produces such a powerful toxin that it can cause a truly deadly diarrhea,” says Michael Bell, MD, a medical epidemiologist in the CDC division of healthcare quality promotion. “[It’s an] intense illness that can include damage to the bowels so painful and severe that part of the colon needs to be surgically removed, a condition called megacolon.”¹

Proceed to answering the questions in Activities 3 and 4 on the PSD Worksheet if time allows. Then answer the following questions?

1. What are the two major reservoirs of infection for *C. diff* in healthcare settings?

a) _____

b) _____

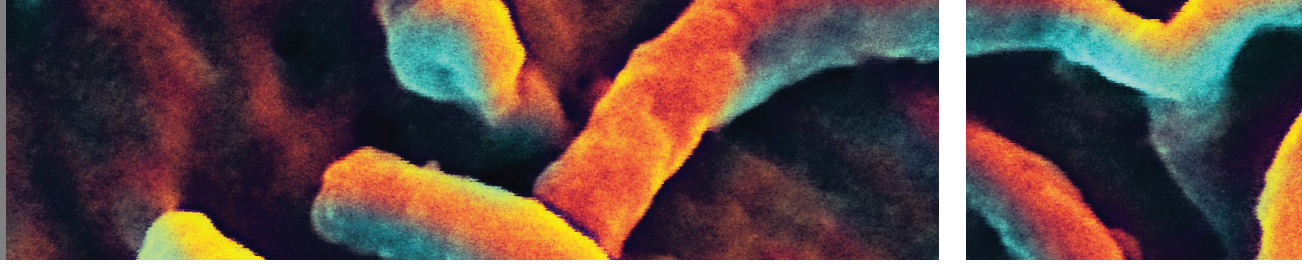
2. How long can the spores last in the environment?

3. Given a potential for exposure to *C. diff* by healthcare workers what type of precautions should be implemented? Check all that apply:

- Contact Droplet Airborne Aerosol transmissible

Explain

4. Why are most common hospital disinfectants ineffective for *C. diff*?



5. What disinfectants are effective?

6. What are the potential occupational health concerns for exposures to these disinfectants?

7. Based on the potential exposure routes identified in 2 above, what type of protective controls measures should be implemented?:

Engineering controls _____

Administrative controls _____

Personal protective equipment _____

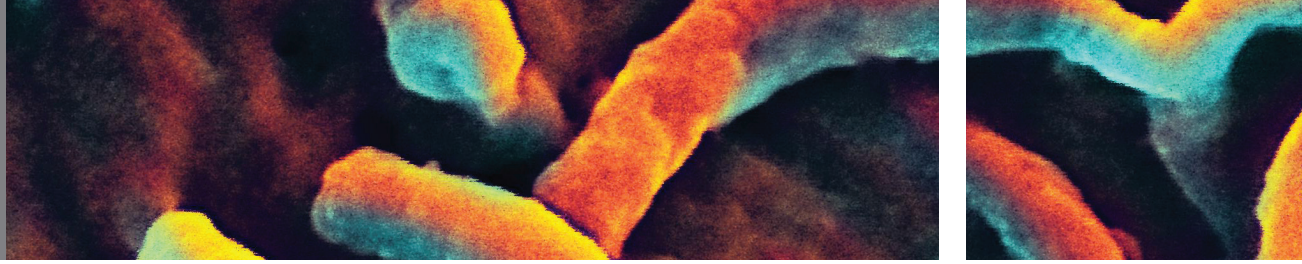
Respiratory protection _____

8. What steps should be taken to prepare for this type of event? Check all that apply:

- Written procedures
- Selection and purchase of PPE and respiratory equipment
- Worker training
- Cleaning and disinfection procedures
- Signage and information
- Other? _____

9. Why are healthcare workers who are on antibiotics or recently completed use of antibiotics at increased risk of infection?

10. Based on what you learned in this case study, are there potential improvements that should be made at your place of employment? Yes No If yes, please explain and list any potential action steps:

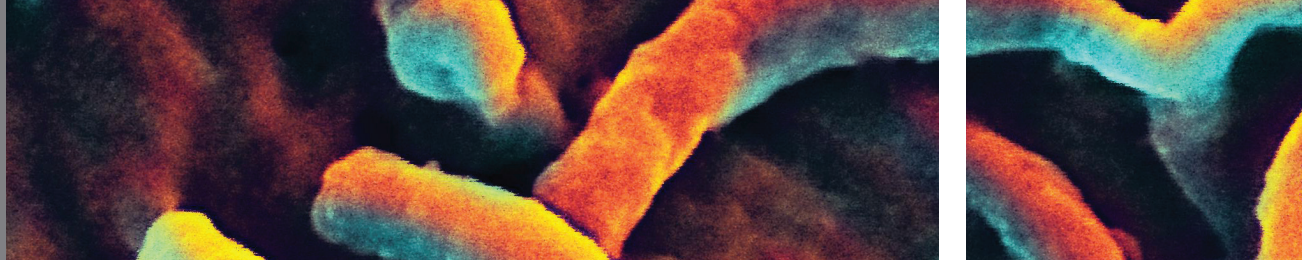


References:

- 1) Healthcare workers on antibiotics at risk of Clostridium difficile, Employee health should inform workers of infection risk, AHC Media, 11/9/15
- 2) Clostridium difficile Infection in a Health Care Worker, Clinical Infectious Diseases 2009; 48:1329, 2009 by the Infectious Diseases Society of America.
- 3) Laboratory-Acquired Clostridium difficile Polymerase Chain Reaction Ribotype 027: A New Risk for Laboratory Workers? Clinical Infectious Diseases 2008:47 (1 December) by the Infectious Diseases Society of America. • Correspondence

Supplemental Reading Material:

- 1) Guide to Preventing Clostridium difficile Infections, APIC Implementation Guide, Copyright © 2013 by the Association for Professionals in Infection Control and Epidemiology, Inc. (APIC)
- 2) Clostridium difficile Infection among Health Care Workers Receiving Antibiotic Therapy, Clinical Infectious Diseases 2005 by the Infectious Diseases Society of America. 40 (1 May) • Correspondence
- 3) Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings
<http://www.cdc.gov/hicpac/pdf/Isolation/Isolation2007.pdf>
- 4) Burden of Clostridium difficile Infection in the United States, N Engl J Med 015;372:825-34. Fernanda C. Lessa, M.D., M.P.H., et al.



PATHOGEN SAFETY DATA GUIDE TRAINING MODULE CASE STUDY 3

EXPOSURE TO MIDDLE EAST RESPIRATORY SYNDROME CORONAVIRUS (MERS-COV) BY TRANSPORTATION AND HEALTHCARE WORKERS

TARGET AUDIENCE: Transportation workers including airline, airport, transit, shipping, and cargo workers and healthcare workers

How to use this case study

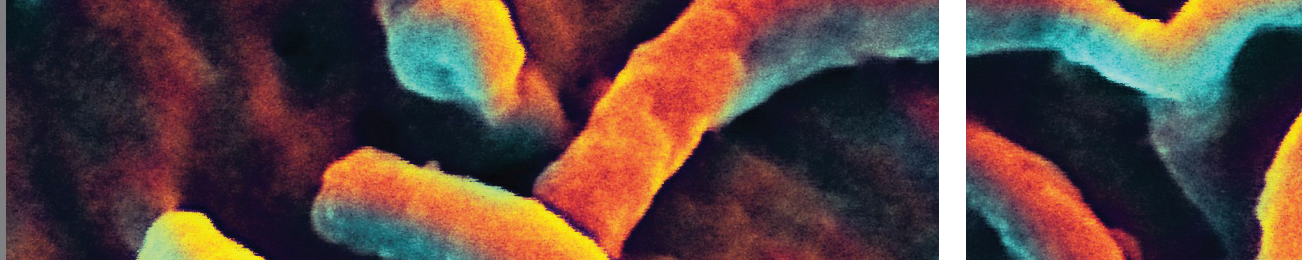
This case study is designed to be used as supplementary or as an alternative to Activities 3 and 4 in the NIEHS WTP's Pathogen Safety Data Guide Training Module.

Participants should work in small groups (4 – 8 people). Each group should select a recorder and reporter who will report back to entire class. Each small group should read through the case study. If time allows, the group should answer the questions in Activities 3 and 4 on the PSD Training Module Worksheet for the pathogen Middle East Respiratory Syndrome Coronavirus (MERS-CoV). Then the group should work on the questions following the case study. If time is short, the questions may be divided among the group members or one or both activities may be omitted.

Case Study

Mr. Smith, a 28-year-old U.S. citizen, was returning home after spending 6 weeks in Saudi Arabia as part of his college study exchange program. While in Jeddah, Saudi Arabia, he had visited numerous hospitals and medical campgrounds for his project about the local healthcare system. During his leisure time, he enjoyed activities in the Arabian Peninsula including camel rides in the Arabian Desert. Four days prior to leaving Saudi Arabia, he began feeling ill and developed a low-grade fever. Not thinking much of it, he departed Riyadh and boarded his flight to London, England. After a 6-hour layover, he continued to Chicago, Illinois. He then took a 70-minute greyhound bus from Chicago to his residence in Indiana. During this time, Mr. Smith continued to feel ill and experienced symptoms of nausea, muscles aches and a cough.

Three days after safely reaching home, Mr. Smith went to the post office to ship a package and



realized he was getting sicker. His fever increased to a temperature of 101° F and he developed respiratory symptoms including runny nose, increased coughing, and shortness of breath. One day later, he went to the emergency department of a hospital near his home and was admitted. A chest x-ray revealed he had a right lower lobe infiltrate. A lower lobe infiltrate is a medical situation where an x-ray of the lungs shows a gray shadow on either the left or right lower lobe of the lung. The shadow can be several things, including a buildup of fluid or a bacterial infection.

The patient required supplemental oxygen immediately. Further testing revealed he was positive for infection with MERS-CoV. Mr. Smith received supportive treatment and was placed in quarantine. After 10 days, he was found no longer symptomatic, tested negative for MERS-CoV and considered to be fully recovered. He was subsequently discharged from the hospital.

During the time Mr. Smith was symptomatic and potentially contagious, public health officials determined that he may have exposed 59 airport and security workers in Saudi Arabia, 108 passengers and 10 crew members during his flight from Saudi Arabia to London, England; 58 passengers and 12 crew members during his flight from London to Chicago; 18 passengers on the greyhound bus from Chicago to Indiana and; 9 individuals at the local post office in Indiana. Before implementation of infection control precautions at the hospital in Indiana, 53 healthcare personnel had unprotected close contact with Mr. Smith and were potentially exposed to his illness. Close contact is defined as a) being within approximately 6 feet (2 meters), or b) within the room or care area, of a confirmed MERS-CoV case for a prolonged period. None of potentially exposed passengers, crew members, and healthcare personnel became symptomatic with MERS-CoV.

Discussion Questions:

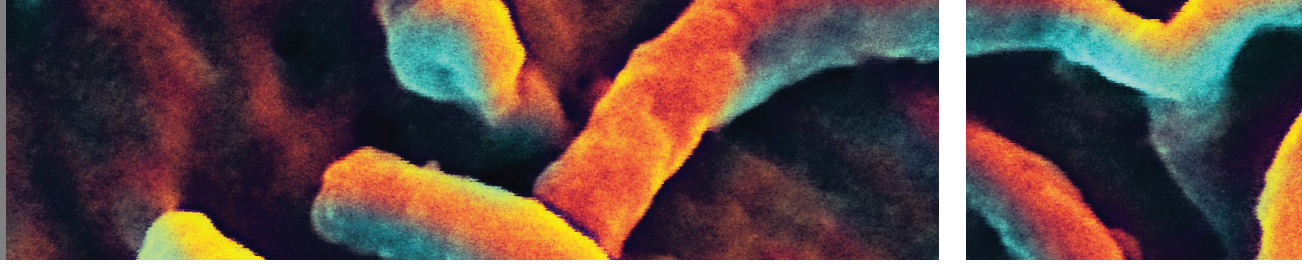
1. In the circumstances in this case study, was it possible to know what the pathogen was when the exposures took place? Yes No

Explain

2. Given the symptoms of fever, coughing, runny nose, and shortness of breath what type of precautions should be implemented? Check all that apply:

Contact Droplet Airborne Aerosol transmissible

Explain



3. Based on the potential exposure routes identified in 2. above, what type of protective controls measures should be implemented:

Engineering controls _____

Administrative controls _____

Personal protective equipment _____

Respiratory protection _____

4. What steps should be taken to prepare for this type of event? Check all that apply:

- Written procedures
- Selection and purchase of necessary equipment
- Worker training
- Equipping airplanes, transit vehicles, and related operations
- Post exposure procedures
- Other? _____

5. Based on what you learned in this case study, are there potential improvements that should be made at your place of employment? Yes No

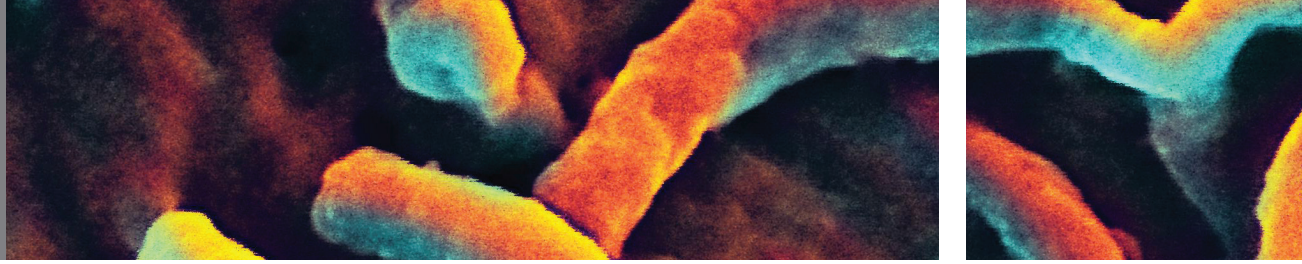
If yes, please explain and list any potential action steps:

References:

- 1) Centers for Disease Control and Prevention (CDC). MERS in the U.S. <http://www.cdc.gov/coronavirus/mers/us.html#indiana> Accessed October 21, 2016.
- 2) Morbidity and Mortality Weekly Report (MMWR). First Confirmed Cases of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Infection in the United States, Updated Information on the Epidemiology of MERS-CoV, and Guidance for the Public, Clinicians and Public Health Authorities – May 2014.

Supplemental Reading Material:

- 1) Alhakeem R et al. Exposures among MERS Case-Patients, Saudi-Arabia, January-February 2016. Emerging Infectious Diseases. Volume 22, No. 11. November 2016.
- 2) El Bushra H et al. An outbreak of Middle East Respiratory Syndrome (MERS) due to coronavirus in Al-Ahssa Region, Saudia Arabia, 2015. Eastern Mediterranean Health Journal. Volume 22, No. 7. 2016.
- 3) Gao H et al. From SARS to MERS: evidence and speculation. Front. Med. DOI 10.1007/s11684-016-0466-7.



PATHOGEN SAFETY DATA GUIDE TRAINING MODULE CASE STUDY 2

POTENTIAL EBOLA VIRUS EXPOSURE TO NON-HOSPITAL ENVIRONMENTAL SERVICE WORKERS

TARGET AUDIENCE: Environmental Service Workers

How to use this case study

This case study is designed to be used as supplementary or as an alternative to Activities 3 and 4 in the NIEHS WTP's Pathogen Safety Data Guide Training Module.

Participants should work in small groups (4 – 8 people). Each group should select a recorder and reporter who will report back to entire class. Each small group should read through the case study. If time allows, the group should answer the questions in Activities 3 and 4 on the PSD Training Module Worksheet for the pathogen Ebola Virus. Then the group should work on the questions following the case study. If time is short, the questions may be divided among the group members or one or both activities may be omitted.

Case Study

In December of 2014, the Occupational Safety & Health Administration (OSHA) issued a citation and notification of penalty after conducting an inspection in response to a complaint from an environmental services worker who was assigned by his employer to work activities including cleaning and disinfecting surfaces and objects potentially contaminated with bloodborne pathogens, including the Ebola Virus.

In this case, environmental service workers were assigned to clean and decontaminate the apartment of the first Ebola patient in New York City. The firm described itself as a Crime Scene Clean-up and Blood Clean-up company. The OSHA violations included:

- 1) The OSHA Personal Protective Equipment (PPE) Standard 29 CFR 1910.132. The employer did not verify that the required workplace hazard assessment had been performed to select the proper PPE for this job.
- 2) The OSHA Respiratory Protection Standard 29 CFR 1910.134. The employer did not provide training for employees who were assigned to wear a full face negative pressure respirator during the cleanup and decontamination of the apartment. Additionally, the employer failed



to evaluate the workplace to ensure that the type of respirator used was effective for the type of contaminants anticipated at the worksite. The employer also failed to provide workers with a medical evaluation and a fit test before assigning them to use a respirator.

- 3) The OSHA Bloodborne Pathogens Standard 29 CFR 1910.1030. The employer failed to provide hepatitis B vaccinations to employees potentially exposed to blood and other potentially infectious material. Additionally, the employer failed to develop the required written exposure control plan and related training.
- 4) The OSHA Hazardous Waste Operations and Emergency Response Standard 29 CFR 1910.120. The employer did not provide the workers who did the clean-up and decontamination with the required training and medical surveillance.

These violations were classified as serious and willful. Serious indicates that the violation could potentially result in death or serious physical harm to exposed workers. Willful is when the employer either knowingly failed to comply with a legal requirement or acted with plain indifference to employee safety. The total proposed penalties were \$78,400.

Proceed to answering the questions in Activities 3 and 4 on the PSD Worksheet if time allows. Then answer the following questions?

1. Given a potential for exposure to Ebola Virus by environmental service workers what type of precautions should be implemented? Check all that apply:

- Contact Droplet Airborne Aerosol transmissible

Explain

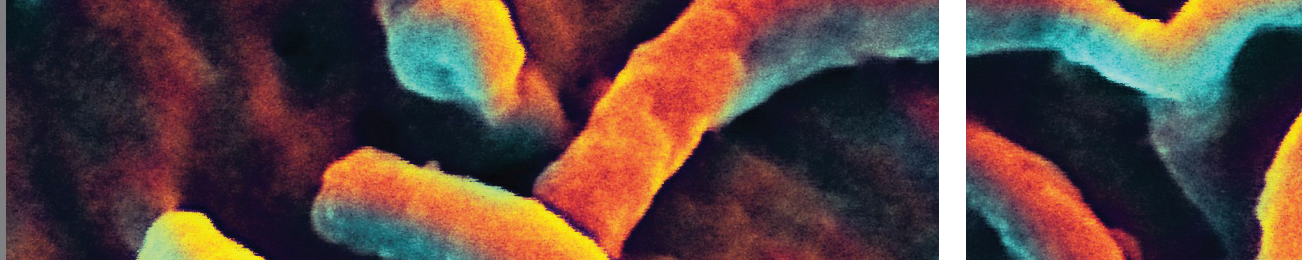
2. Based on the potential exposure routes identified in 2. above, what type of protective controls measures should be implemented:

Engineering controls _____

Administrative controls _____

Personal protective equipment _____

Respiratory protection _____



3. *What steps should be taken to prepare for this type of event? Check all that apply:*

- Written procedures
- Selection and purchase of PPE and respiratory equipment
- Worker training
- Equipping vehicles
- Decontamination procedures
- Post exposure procedures
- Other? _____

4. *In planning a clean-up involving Ebola Virus which OSHA standards apply? _____.*

5. *Based on what you learned in this case study, are there potential improvements that should be made at your place of employment?* Yes No

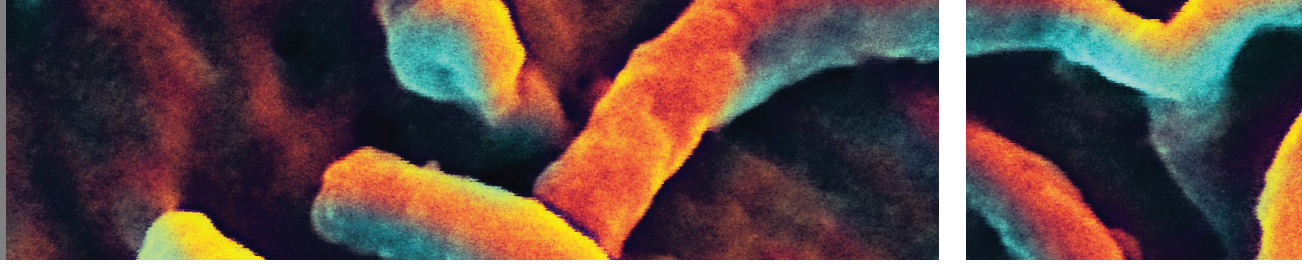
If yes, please explain and list any potential action steps:

References:

- 1) OSHA Violation Detail https://www.osha.gov/pls/imis/establishment.inspection_detail?id=1011654.015

Supplemental Reading Material:

- 1) CDC Ebola Website <https://www.cdc.gov/vhf/ebola/>
- 2) CDC, Interim Guidance for Environmental Infection Control in Hospitals for Ebola Virus, <http://www.cdc.gov/vhf/ebola/healthcare-us/cleaning/hospitals.html>
- 3) OSHA standards: <https://www.osha.gov/law-regs.html>



PATHOGEN SAFETY DATA GUIDE TRAINING MODULE CASE STUDY 1

N. MENINGITIDIS TRANSMISSION TO A POLICE OFFICER AND RESPIRATORY THERAPIST

TARGET AUDIENCE: Emergency Medical Service, First Responders, Security, Police, Healthcare Workers

How to use this case study

This case study is designed to be used as supplementary or as an alternative to Activities 3 and 4 in the NIEHS WTP's Pathogen Safety Data Guide Training Module.

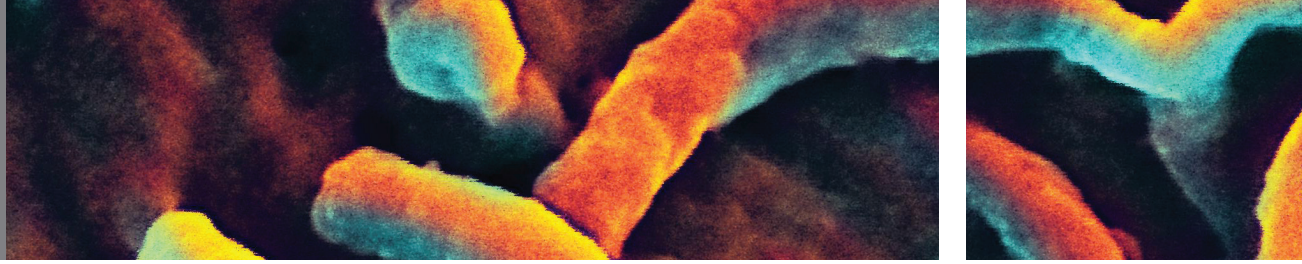
Participants should work in small groups (4 – 8 people). Each group should select a recorder and reporter who will report back to entire class. Each small group should read through the case study. If time allows, the group should answer the questions in Activities 3 and 4 on the PSD Training Module Worksheet for the pathogen *N meningitidis*. Then the group should work on the questions following the case study. If time is short, the questions may be divided among the group members or one or both activities may be omitted.

Case Study

This case study is based on the first CAL/OSHA enforcement of its Aerosol Transmissible Disease Standard. A case report about this exposure was also published in the CDC's Mortality & Morbidity Weekly Report, "Occupational Transmission of *Neisseria meningitidis* — California, 2009, MMWR, November 19, 2010 / Vol. 59 / No. 45."

A 36-year-old man was found unconscious at home by four police officers who had been asked by the patient's family to check on him. The patient was on lying on his back on his bed, and his airway was partially obstructed by vomit. Vomit and feces were on the patient's body and clothing. While positioned near the patient's head, one of the police officers (PO1) turned the patient to one side and adjusted his head to aid breathing. Immediately afterward, PO1 left the patient's room, reentering only to check on the patient from a distance. After firefighters and paramedics arrived, PO1 left the scene. Firefighters measured the patient's blood pressure and heart rate, and paramedics placed an intravenous line, performed airway suctioning, placed an oropharyngeal airway, administered oxygen, and transported the patient by ambulance to hospital A.

In the hospital emergency department (ED), the patient's airway was suctioned, and an endotracheal tube was placed. Blood was drawn for culture in the ED and the patient was



treated with ceftriaxone. The patient was transferred to the intensive-care unit, and the treating provider considered meningococcal disease, 2009 pandemic influenza A (H1N1), or community-acquired pneumonia as possible causes of his illness. In the ICU, cerebrospinal fluid (CSF) was collected for gram stain and culture and the patient was treated with additional antibiotics.

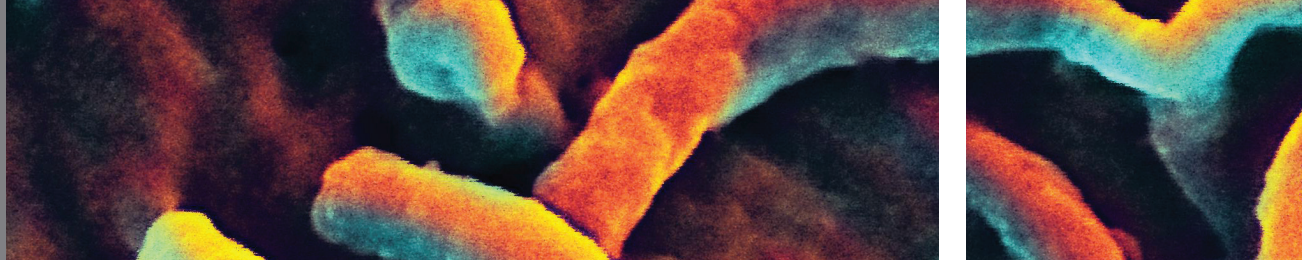
The diagnosis of laboratory-confirmed meningococcal disease was made 3 days after the incident and confirmed by blood culture. The patient was hospitalized for 20 days and then discharged to a rehabilitation facility.

Two days after the incident, the 30-year-old PO1 experienced sore throat and nausea that progressed to muscle pain with fever and vomiting. Six days after exposure, PO1 went to see his family physician. While at the physician's office, PO1 received a phone call from a coworker who informed him of the original patient's diagnosis of meningococcal disease. The primary-care physician advised him to go directly to the ED, and he was admitted to the hospital. PO1 was hospitalized for 5 days, and then discharged to his home.

Five days after the incident, a 47-year-old respiratory therapist who had been present during airway suctioning and assisted with endotracheal tube placement, began experiencing weakness, chills, and fatigue. Seven days after that exposure, he was transported by ambulance from his home to a hospital. He was hospitalized for 11 days and then discharged to his home.

Contact tracing and post exposure follow-up of workers already had been initiated by the local health authorities and affected employers. Exposure was defined as being less than 3 feet from the original case. A total of 23 workers, including 4 police officers, 3 firefighters, 2 paramedics, and 14 healthcare workers, were involved in the patient's care. Among the 23 workers, 10 were reported to have been ≤ 3 feet from the patient while providing care. Among these, PO1 wore only gloves, two firefighters and two paramedics donned N95 respirators, and one of five hospital health-care workers wore a surgical mask. Lack of PPE availability in the field and lack of knowledge regarding where respirators and surgical masks were kept in the ED were cited as two reasons why appropriate PPE was not worn by health-care workers. In total, 16 workers were offered post exposure prophylaxis by their employers 4–8 days post exposure.

The infected police officer and respiratory therapist did not use N95 respirators or surgical masks; both did use gloves. The officer reported no direct contact with respiratory secretions. However, he reported that he heard hacking or gurgling sounds when he turned the patient, but he could not remember feeling droplets on his skin or face. The therapist assisted with intubation and airway suctioning of the patient. In both cases, unprotected exposure to respiratory aerosols or secretions might have resulted in transmission of *N. meningitidis*.



Proceed to answering the questions in Activities 3 and 4 on the PSD Worksheet if time allows. Then answer the following questions?

1. In the circumstances in this case study, was it possible to know what the pathogen was during the immediate response? Yes No

Explain

2. Given the symptoms of fever, vomiting, and diarrhea what type of precautions should be implemented? Check all that apply:

Contact Droplet Airborne Aerosol transmissible

Explain

3. Based on the potential exposure routes identified in 2. above, what type of protective controls measures should be implemented:

Engineering controls _____

Administrative controls _____

Personal protective equipment _____

Respiratory protection _____

4. What steps should be taken to prepare for this type of event? Check all that apply:

Written procedures

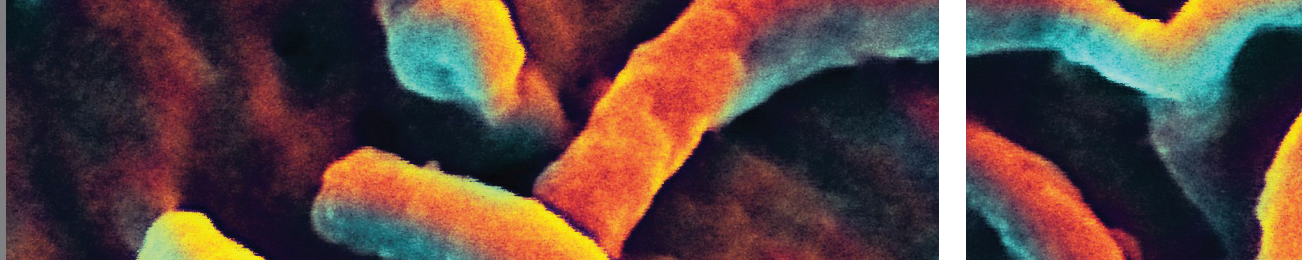
Selection and purchase of necessary equipment

Worker training

Equipping ambulances, police vehicles, and hospital emergency rooms

Post exposure procedures

Other? _____



5. Based on what you learned in this case study, are there potential improvements that should be made at your place of employment? Yes No

If yes, please explain and list any potential action steps:

References:

- 1) Occupational Transmission of *Neisseria meningitidis* — California, 2009, MMWR, November 19, 2010 / Vol. 59 / No. 45 <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5945a2.htm>
- 2) CALOSHA Reporter, CALOSHA Issues First ATD Citations in Meningitis Exposure Case, 2010 Providence Publications, LLC. <http://www.cal-osh.com/Cal-OSHA-Issues-First-ATD-Citations-in-Meningitis-Exposure-Case.aspx>

Supplemental Reading Material:

- 1) CALOSHA Aerosol Transmissible Disease Standard <http://www.dir.ca.gov/title8/5199.HTML>
- 2) CDC Meningococcal Disease website: <https://www.cdc.gov/meningococcal/>
- 3) Public Health Agency of Canada, NEISSERIA MENINGITIDIS, PATHOGEN SAFETY DATA SHEET - INFECTIOUS SUBSTANCES, <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/neisseria-men-eng.php>