Outbreak of *Clostridium difficile* Among Patients at a Kansas Hospital, November 2013

Background

On November 25, 2013 at 9:02 am, a hospital notified the Kansas Department of Health and Environment's Infectious Disease Epidemiology and Response section (KDHE) of a possible outbreak of *Clostridium difficile* among hospitalized patients. Beginning in early November, six patients had been diagnosed with infections caused by *C. difficile* that were likely acquired during hospitalization. The facility reported that the increase in cases was above their normal baseline rate for hospital-onset *C. difficile*. KDHE notified the local health department and an outbreak investigation was initiated on November 25 at 9:34 am by staff at KDHE to identify cases, characterize the scope of illnesses and to recommend appropriate prevention and control measures.

Methods

Epidemiological Investigation

A retrospective case study was conducted using a standardized questionnaire. Case-patients were interviewed to determine if illness was associated with risk factors known to be associated with outbreaks of *C. difficile*. In addition, records of patient admission, symptoms, procedures, medication history, unit/room movements, laboratory results, and infection control interventions were abstracted for patients diagnosed with hospital-onset of *C. difficile* from November 4, 2013 to December 23, 2013.

Cases were defined according to the Centers for Disease Control and Prevention's (CDC) National Healthcare Safety Network (NHSN) 2013 case definition of laboratory-identified hospital-onset *C. difficile* infection. A case was defined as an infection with *C. difficile* in a person admitted to the hospital between November 4 and December 23, 2013 with a positive laboratory result for *C. difficile* or toxins produced by the organism occurring more than three days after hospitalization.

Community-onset cases of *C. difficile*, those in which the disease was likely acquired outside of the hospital, were also assessed for their influence on the increased incidence of hospital-onset infections. Community-onset cases were defined using the CDC NHSN 2013 definition of community-onset *C. difficile* infection, using the same laboratory criteria. These persons have

onset either outside of the hospital and present to the hospital for treatment, or occur three or fewer days after hospitalization.

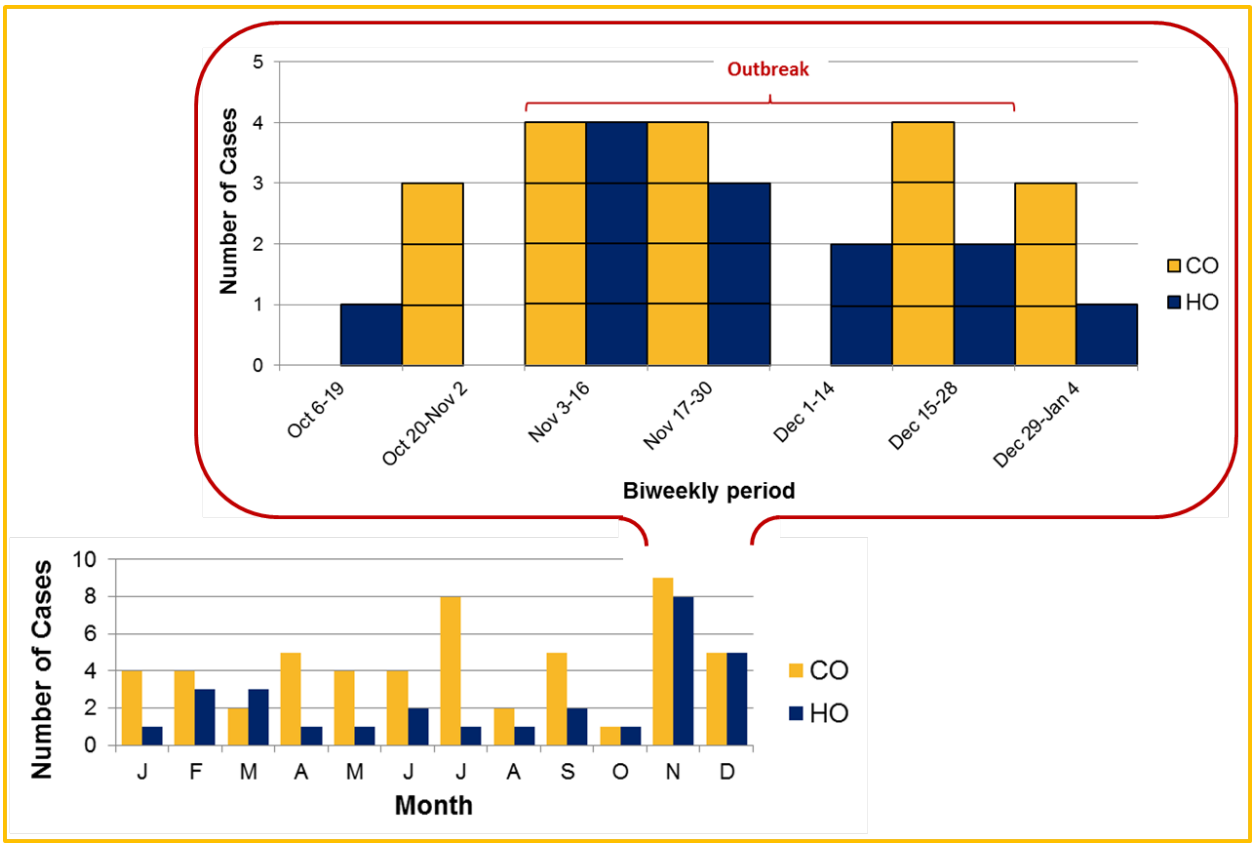
Descriptive analysis was conducted using Microsoft Excel 2007 and SAS®9.2. Incidence rate comparisons among outbreak cases and background cases (January – October, 2013) and total inpatient-days were performed using a Poisson test.

Laboratory analysis
Thirteen stool specimens from eleven individuals were collected and tested by the hospital.

Results

Epidemiological Investigation
Eleven patients met the case definition of having hospital-onset *C. difficile*. Onset of illness ranged from November 4 to December 23, Figure 1.

Figure 1. Community (CO) and Hospital Onset (HO) Cases of *C. difficile* from Admissions at Hospital A, biweekly, October 6, 2013 through January 4, 2014.



Medical record reviews were performed for all 11 patients. Six (55%) of the patients were female and 5 (45%) of the patients were male. The patients ranged from 48 to 85 years (median: 66 years). All of the patients were diagnosed with colitis. The most common symptoms were diarrhea, which was experienced by 10 (91%) patients and leukocytosis before onset of diarrhea was experience by 7 (64%) patients.

Prior to this outbreak, between January and October, 2013, the incidence rate of hospital-onset *C. difficile* was 4.3 per 10,000 patient-days and community-onset rate was 10.8 per 10,000 patient-days (Figure 1). In November and December, 2013, the hospital experienced significant increases in hospital-onset *C. difficile* with a rate of 16.3 per 10,000 patient-days (p=0.0007) and community-onset *C. difficile* with a rate of 17.6 per 10,000 patient-days (p=0.1021).

From admission to hospital-onset of *C. difficile*, cases were in the hospital from 4 to 24 days (median=8 days). Prior to onset of symptoms, 10 patients (91%) stayed in a unit where a patient with *C. difficile* had stayed in the previous 10 days. These patients developed onset of symptoms within 2 to 9 days (median = 5.5 days) of admission to the unit.

All patients had medical procedures performed during hospitalization and seven (64%) had gastrointestinal procedures while hospitalized. All patients were prescribed antibiotics during their hospitalization before onset of symptoms. Seven (64%) received broad spectrum cephalosporins, clindamycin, or fluoroquinolones. Eight (73%) were taking proton pump inhibitors.

At the facility, infection prevention staff worked with environmental service staff to implement CDC's terminal cleaning checklist in the affected units and begin use of an EPA-approved spore-killing disinfectants in rooms where a patient with *C. difficile* had stayed. In mid-December, environmental services discontinued use of the spore-killing disinfectant due to complaints from staff about the smell of the product. Within one week, two additional cases occurred. Infection prevention staff worked with environmental service staff to reenforce the need to use a spore-killing disinfectant, investigated alternative EPA-approved products and re-implemented it into their cleaning processes. Additional education was provided to clinical staff on infection prevention practices throughout the outbreak. The hospital also enhanced patient isolation to 48 hours after symptom resolution.

Laboratory analysis

Eight (62%) stool specimens tested positive for *C. difficile* by polymerase chain reaction. Five (38%) stool specimens tested positive by a toxin assay.

Discussion

This was an outbreak of *Clostridium difficile* with hospital-onset, associated with a hospital in Kansas. An increase in patients diagnosed with community-onset *C. difficile* at the hospital likely contributed to an increase in transmission and patients diagnosed with hospital-onset *C. difficile*. To decrease the risk of transmission, it is recommended that the hospital maintain vigilant adherence to adequate environmental cleaning, improve hand hygiene compliance and assess antimicrobial stewardship program activities at their facility for opportunities to make improvements.

There were several limitations in this investigation. Logistically it was not feasible to acquire stool specimens to conduct additional molecular testing that could have potentially described the relatedness of each case. Many cases had exposure to broad spectrum antibiotics that have been highly associated with acquisition of *C. difficile* infections. As well, many cases had

exposure to proton pump inhibiting medications, used to reduce gastric acid production. Unfortunately it was impractical to assess, longitudinally, the use of these medications across all patient experiences within the facility, and to assess whether or not these medications were clinically indicated for each of the case patients. Therefore, it was not possible to assess whether or not medication prescription practices were associated with the outbreak. Additionally, it was difficult to assess past cleaning practices and compare those with practices implemented after identification of the outbreak. This may have allowed for assessment of inadequate cleaning practices, or cleaning practices associated with limiting the transmission of the organism.

C. difficile, an anaerobic, Gram-positive, spore-forming bacillus, is the leading cause of antibiotic-associated diarrhea and is a highly problematic healthcare-associated infection.[1] Toxin-producing strains of *C. difficile* can cause illness ranging from mild or moderate diarrhea to pseudomembranous colitis (an inflammatory condition of the colon that develops in response to toxins produced by the organism), which can lead to toxic dilation of the colon (megacolon), sepsis, and death. *C. difficile* is the primary cause of pseudomembranous colitis in patients treated with antibiotics. [2,3]

The development of *C. difficile* infection most commonly has two essential requirements: (1) exposure to antibiotics, which disrupts the normal microbiota of the intestinal tract and (2) new acquisition of *C. difficile*, which occurs by ingestion of spores. The acquisition of the organism may occur as a result of contamination of the patient environment, of shared equipment, or via the hands of healthcare personnel (HCP). [4,5]

Additionally, people can be colonized (asymptomatic) with *C. difficile* and still shed the organism. The ability to rid an environment of *C. difficile* is made even more difficult by the organisms ability to produce spores that can persist in the environment for many months and are highly resistant to cleaning and disinfection measures.[6,7] Alcohol-based hand sanitizer are not effective in killing *C. difficile* spores, requiring healthcare personnel to exclusively wash their hands when caring for patients with known *C. difficile* infections.[8]

There has also been a dramatic change in the epidemiology of *C. difficile* in recent years, with increased incidence and severity being reported in the United States, Canada, and Europe. [9-12] This change has also involved the emergence of *C. difficile* infections in populations previously thought to be at low risk, including severe cases among healthy peripartum women. There are also increasing reports of *C. difficile* infections in children and normally healthy people who have had minimal or no recent exposure to healthcare settings.[13] Part of the change in *C. difficile* epidemiology has also been attributed to the emergence of a hypervirulent epidemic strain with mutations leading to higher toxin production, increased resistance to certain antibiotics, and possibly more severe disease. [14-16]

Conclusion

This outbreak of hospital-onset *C. difficile* likely had multiple contributing factors. The hospital experienced an increase in admissions from community-onset *C. difficile*, increasing the opportunity for transmission within the facility. Ten of eleven individuals who acquired *C. difficile*

in the hospital stayed in a unit where a patient with *C. difficile* had stayed in the previous 10 days, inadequate environmental cleaning and possible issues with hand hygiene compliance were suspected as potential contributing factors. Recent turnover in the environmental services department supported this conclusion. Because *C. difficile* can be shed in stool after resolution of diarrheal symptoms and published rationale exists for facilities to consider extended isolation of *C. difficile* patients, a lack of a policy for isolation of confirmed *C. difficile* patients after symptom resolution may also have contributed to the start of the outbreak. This policy was, however, adopted early upon identification of the outbreak. Antimicrobial stewardship programs and staff education on *C. difficile* have been shown to be effective activities in the prevention of hospital-onset *C. difficile*. Because all individuals with confirmed hospital-onset *C. difficile* received antibiotics while hospitalized, seven of which received broad-spectrum antibiotics, and eight received proton pump inhibitors, assessment and continued development of antimicrobial stewardship programs and staff education may provide opportunities for making on-going improvements. Continued follow-up with the facility confirmed the outbreak did resolve and indicated that improvement activities in areas where recommendations had been provided were occurring.

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