

vative figure in our calculations. We also recognize that the general inflation factor used may be an underestimate for “medical” inflation.

With increasing rates of travel and medical tourism, more patients are receiving OCMC. Although this point-prevalence study did not identify any CRE-colonized patients, ongoing surveillance and stringent infection control practices will be critical for identifying and limiting the spread of CRE among hospitalized patients in Canada. A preemptive isolation strategy has significant resource implications and is not economically practical at this time in our setting given the low prevalence of CRE colonization.

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Establishing Surveillance for Carbapenem-Resistant Enterobacteriaceae in Minnesota, 2012

To the Editor—Carbapenem-resistant Enterobacteriaceae (CRE) have emerged as a public health threat; Enterobacteriaceae harboring carbapenemase-encoded genes often carry resistance to multiple antibiotic classes, rendering the bacteria resistant to almost all available antibiotics. Invasive CRE infections are associated with a high mortality rate (38%–48%),^{1–3} and intra- and interfacility spread in a variety of healthcare settings has occurred.^{4,5} A standardized approach to CRE surveillance and a clearer description of the evolving epidemiology are needed to understand the health burden and evaluate the impact of control measures.

In 2009, the Minnesota Department of Health (MDH) Public Health Laboratory (PHL) first confirmed *Klebsiella pneumoniae* carbapenemase in a clinical Enterobacteriaceae isolate. The MDH immediately initiated statewide voluntary reporting of CRE with isolate submission to the PHL (clinical cultures from all sources and Enterobacteriaceae species). In collaboration with the Centers for Disease Control and Prevention (CDC) Emerging Infections Program (EIP) Multi-site resistant Gram-negative Surveillance Initiative (MuGSI),

the MDH began active, laboratory-based surveillance in Minnesota's 2 most populous counties, Hennepin and Ramsey, using a standardized case definition. The CRE definition includes the species *Enterobacter cloacae*, *Enterobacter aerogenes*, *Escherichia coli*, *K. pneumoniae*, and *Klebsiella oxytoca*; culture specimens from sterile sites and urine; and intermediate resistance to all tested third-generation cephalosporins.⁶ Data from 2012 represent the first full year of MuGSI surveillance.

Antibiotic susceptibility testing (AST) results from automated testing instruments (ATIs) and results of additional testing (eg, modified Hodge test) performed by the submitting laboratory are sent to the PHL with isolates, and minimum inhibitory concentrations reviewed by MDH staff to confirm case status, because variable interpretive criteria are used by clinical laboratories. Isolates submitted to the PHL are tested by polymerase chain reaction for the *bla*_{KPC} and *bla*_{NDM} genes. Medical records of CRE cases meeting MuGSI criteria are reviewed.

During 2012, the PHL received and tested 154 Enterobacteriaceae, including isolates not meeting the MuGSI definition, from 151 unique patients (multiple species in a single patient are reported). Isolates were submitted by 20 clinical laboratories statewide, including 115 (75%) from 9 of 11 clinical laboratories participating in active surveillance. Submitted isolates included *Enterobacter* species (75 isolates), *Klebsiella* species (32), *E. coli* (23), *Citrobacter* species (15), *Serratia marcescens* (4), *Proteus mirabilis* (3), and *Providencia rettgeri* (2). Thirty-six (23%) of the isolates were *bla*_{KPC} positive, and 3 (2%) were *bla*_{NDM} positive. Species of *bla*_{KPC}-positive isolates were *Klebsiella* species (20), *Enterobacter* species (15), and *E. coli* (1). Notably, 2 (6%) of the *bla*_{KPC}-positive isolates were resistant to ertapenem only and therefore did not meet the established CRE definition; both had a positive modified Hodge test result reported by the submitting laboratory. Additional characterization of the isolates may provide insight into why these isolates carry the *bla*_{KPC} gene but had test results that indicated susceptibility to imipenem and/or meropenem. The *bla*_{NDM}-positive isolates included 2 *K. pneumoniae* and 1 *E. coli* from 2 patients (1 patient with 2 species); both patients had previous healthcare exposure outside of the United States.

Thirty-two cases that met the MuGSI CRE definition were identified during 2012. Isolates for 5 of the 32 cases were not available or were repeat isolates from the same patient. Twenty-seven isolates were submitted to the CDC for additional testing; 12 were unexpectedly susceptible to all carbapenems (excluding ertapenem) when tested by broth microdilution at the CDC. Of note, all 12 isolates (9 *E. aerogenes* and 3 *E. coli*) were negative for *bla*_{KPC} and *bla*_{NDM}. The 5 cases without isolate testing at the CDC and 12 cases whose isolates had test results indicating susceptibility at the CDC were excluded from further review. Of the remaining 15 cases, 10 (67%) were *bla*_{KPC} positive; species are reported in Table 1. The source for all 15 CRE isolates was urine samples. Ten case patients were hospitalized at the time of or within 30

TABLE 1. Multi-site resistant Gram-negative Surveillance Initiative (MuGSI) Carbapenem-Resistant Enterobacteriaceae (CRE) Isolates by Species and *bla*_{KPC} Polymerase Chain Reaction Results, Minnesota, 2012

CRE species	No. of isolates	No. (%) of <i>bla</i> _{KPC} -positive isolates
<i>Enterobacter cloacae</i>	7	6 (86)
<i>Klebsiella pneumoniae</i>	4	3 (75)
<i>Escherichia coli</i>	2	1 (50)
<i>Enterobacter aerogenes</i>	2	0 (0)
Total	15	10 (67)

days of culture specimen collection. Three others were in an outpatient setting at the time of culture specimen collection, and 1 each were in a long-term care facility and a long-term acute care hospital. Two cases had recurrent isolates submitted within 30 days of initial culture.

CRE control can be impacted by early detection and implementation of appropriate infection prevention measures and communication of CRE status when a patient is transferred.⁷ Similar to other reports, we found that CRE cases came from healthcare facilities across the continuum of care.⁸ Regional evaluation of CRE and a coordinated approach to CRE prevention is recommended by the CDC and has been fundamental to controlling CRE in areas with a high prevalence of CRE infection.^{9,10} Although many states are establishing CRE surveillance, defining CRE has been difficult because of the nuances of CRE detection methods used in clinical laboratories, including variations and complexities of ATIs and differences in the interpretation criteria used. The emergence of novel resistance mechanisms (eg, OXA-48) adds to the challenge of developing a standardized definition. Additional study is needed to evaluate the discrepancy in AST results that we observed with different methods and in different laboratories. Despite these challenges, it remains important to establish a common national CRE definition.

We found this surveillance useful, because it highlights that it is possible to detect carbapenemase-producing organisms even in regions with a low incidence of infection, like Minnesota. This provides an opportunity to control the spread and proliferation of CRE through infection prevention activities and antimicrobial stewardship. Detection of *bla*_{NDM}-positive isolates serves as a reminder that these organisms may return with travelers who receive health care in countries where these resistance mechanisms are endemic.

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