Rate of *Clostridioides difficile* Culture Positivity Among Hospitalized Patients

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**ABSTRACT**

The rate of nosocomial *C. difficile* in Rhode Island is among the highest in the country. Colonization with *C. difficile* is uncommon but can lead to falsely identifying a patient as having *C. difficile* infection. Additionally, unrecognized *C. difficile* colonization may act as a reservoir in the hospital. During a 19-day period, rectal swabs obtained for routine VRE surveillance were cultured for *C. difficile*. Overall, 51 (7.9%) of 649 patients had *C. difficile* by culture. The majority (n=36, 71%) of patients from whom a rectal swab grew *C. difficile* did not have a sample sent to the clinical laboratory. Hence, at least 5.5% of the 649 patients were colonized. One patient was classified as having hospital-acquired *C. difficile* since the clinical specimen was sent to the clinical laboratory on hospital day 4. This patient was culture positive on admission and hence misclassified as having hospital-acquired *C. difficile*.

**KEYWORDS:** *Clostridioides difficile*, healthcare-associated infections, microbial colonization

**INTRODUCTION**

In January 2013, the Centers for Medicare and Medicaid Services (CMS) began requiring acute-care hospitals to submit any laboratory-identified (LabID) *Clostridioides difficile* cases to the Centers for Disease Control and Prevention’s surveillance system, the National Healthcare Safety Network. Data from the first quarter of 2013 demonstrated Rhode Island ranked 51st among the 50 states and the District of Columbia for *C. difficile* infection [CDI] were colonized on admission. For example, Gonzalez-Orta et al. reported that 14% of patients admitted to an acute care hospital were asymptomatic carriers of toxigenic *C. difficile* on admission and 9% of the carriers subsequently were diagnosed with healthcare-associated *C. difficile* versus only 1% of those with negative admission cultures. Such studies raise concern that patients with asymptomatic carriage on admission are often falsely diagnosed with *C. difficile* when they develop diarrhea for other reasons. However, most prior studies evaluating carriage on admission have been small studies often involving single wards. Therefore, we conducted an Infection Control quality improvement project to determine the frequency of *C. difficile* carriage at an acute care teaching hospital in Rhode Island.

**METHODS**

The study was conducted at The Miriam Hospital, a 247-bed teaching hospital in Providence, RI. Rectal swabs are obtained as part of the routine Infection Control surveillance for vancomycin-resistant enterococci [VRE] on hospital admission or admission/discharge from ICUs. For 19 consecutive days during 2014, the rectal swabs obtained for VRE culture were also cultured for *C. difficile*. The swabs were kept frozen at -80 until shipped on dry ice for *C. difficile* culture. The rectal swabs were plated directly onto selective media for culture of toxigenic *C. difficile* as previously described. After plating, the swabs were submersed in *C. difficile* brucella broth with thiglycarolic acid and 1-cystine (CDBB-TC) and incubated for up to 72 hours to identify low-level colonization. All *C. difficile* isolates were tested for in vitro cytotoxin production using *C. difficile* Tox A/B II (Wampole Laboratories) and isolates that did not produce toxin were excluded from the analysis. For a subset of isolates, polymerase chain reaction (PCR) analysis for the binary toxin gene cdtB and fluorescent PCR ribotyping was performed as previously described. For the directly plated swabs, the number of colonies recovered per swab was counted.

The percentage of directly plated swabs with greater than 25 colony-forming units (CFUs) per swab was calculated as this level of contamination has previously been associated with increased frequency of skin and/or environmental contamination in asymptomatic carriers.
RESULTS
A total of 754 swabs were cultured from 649 patients. 86 patients were cultured twice, 8 cultured 3 times and one patient was cultured 4 times during the 19 days. Patients were considered positive if they had one or more positive cultures. Overall, 51 (7.9%) patients had cultures positive for toxigenic C. difficile, including 28 (4.3%) on directly plated agar culture and 23 (3.5%) in broth culture only. (Figure 1)

Figure 1. C. difficile cultures and clinical laboratory testing.

A chart review of the 51 culture positive patients demonstrated that 15 had a clinical laboratory test for C. difficile; 12 were positive and 3 were negative. The three negative test results from the clinical laboratory test were 2 days prior to the positive culture, 10 days after the culture and 11 days after the culture. Twenty-eight patients (54.9%) had positive cultures on agar culture plates and 23 (45.1%) patients had low-level carriage only detected by broth enrichment cultures. Culture positivity by the broth method only occurred more frequently (53%) among patients who did not have a specimen sent to the clinical laboratory and 23 (45.1%) patients had positive PCR tests for toxigenic C. difficile. Of these 12 patients, 11 (91.7%) had positive tests during the first 3 days of admission and were classified as community-acquired cases. The three negative clinical laboratory results were 2 days prior and 10–11 days after the positive culture. As the cultures and clinical laboratory C. difficile tests were several days apart, it is possible that these patients cleared colonization during their hospital stay. Factors such as receipt of antibiotics with inhibitory activity against C. difficile may contribute to clearance of colonization.13

One patient was colonized with C. difficile on admission and subsequently was diagnosed with hospital-acquired C. difficile, using National Healthcare Safety Network (LabID) criteria, based on a stool specimen submitted to the clinical laboratory on hospital day 4. As noted previously, positive tests in patients colonized on admission could result in a false-positive diagnosis of C. difficile if factors such as laxatives are the cause of diarrhea.

In summary, this quality improvement project was undertaken to determine the rate of colonization with C. difficile in an acute care hospital in Rhode Island. At least 5.5% and possibly 6.0% of patients are colonized with C. difficile, a rate consistent with previous studies.13 Although a minority of new admissions were colonized, these patients could potentially be a source of transmission as they are not isolated and inappropriate testing could result in false-positive diagnosis of C. difficile.

DISCUSSION
We found that 51 (7.9%) of 649 patients admitted to The Miriam Hospital were culture-positive for toxigenic C. difficile. Most of these culture-positive patients (71%) did not have a specimen sent to the clinical laboratory for C. difficile testing suggesting that they were colonized rather than infected. Fifteen of 51 (29%) patients with a positive culture had a specimen sent to the clinical laboratory and 12 (80%) had positive PCR tests for toxigenic C. difficile. Of these 12 patients, 11 (91.7%) had positive tests during the first 3 days of admission and were classified as community-acquired cases. The three negative clinical laboratory results were 2 days prior and 10–11 days after the positive culture. As noted previously, positive tests in patients colonized on admission could result in a false-positive diagnosis of C. difficile if factors such as laxatives are the cause of diarrhea.

In summary, this quality improvement project was undertaken to determine the rate of colonization with C. difficile in an acute care hospital in Rhode Island. At least 5.5% and possibly 6.0% of patients are colonized with C. difficile, a rate consistent with previous studies.13 Although a minority of new admissions were colonized, these patients could potentially be a source of transmission as they are not isolated and inappropriate testing could result in false-positive diagnosis of C. difficile.

Table 1. Recovery of toxigenic Clostridioides difficile on agar culture plates versus only in broth enrichment cultures, stratified by clinical laboratory testing results.

<table>
<thead>
<tr>
<th>Clinical Lab</th>
<th>Agar Number (%)</th>
<th>Broth Only Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not tested</td>
<td>17 (47)</td>
<td>19 (53)</td>
</tr>
<tr>
<td>Positive test</td>
<td>9 (75)</td>
<td>3 (25)</td>
</tr>
<tr>
<td>Negative test</td>
<td>2 (66)</td>
<td>1 (33)</td>
</tr>
</tbody>
</table>

There was one patient among the 51 culture positive patients who was classified as having hospital-acquired C. difficile since the clinical specimen was sent to the clinical laboratory on hospital day 4. This patient was culture positive by directly plated agar on admission and hence misclassified as having hospital-acquired C. difficile.

References


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