Crossing the quality chasm for *Clostridium difficile* infection prevention

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Clostridium difficile, a spore-forming organism, causes as many as 25% of cases of healthcare-associated diarrhoea.[1–4] In many developed countries, *C. difficile* infection (CDI) is now the most important healthcare-associated infection (HAI), suggesting an urgent need of strategies for effective containment.[5] Recent studies on the impact of antimicrobial stewardship initiatives and CDI prevention 'bundles' have reported variable reductions in CDI rates.[6–10] For example, a recent meta-analysis found that implementing an antimicrobial stewardship programme was associated with a 50% reduction in CDI rates, particularly if it utilised restrictive over persuasive policies.[11] Following declines in other types of HAI such as central line (CL)-associated bloodstream infection and catheter-associated urinary tract infection with the use of a checklist of recommended practices and bundled interventions, many healthcare institutions have adopted a similar approach to reducing CDI.[12–14]

This is easier said than done. The complex, incompletely understood pathogenesis of CDI, large reservoirs in the environment and in asymptomatically colonised patients, multiple pathways for spread of the organism, lack of a readily removable 'device' to target, uncertain relative roles of antibiotic stewardship versus infection control practices, and a relatively sparse evidence base for prevention all combine to make *C. difficile* containment extremely challenging in comparison to device-related HAI.

Daneman *et al*[15] report the findings of a survey conducted in 2011 with the goal of determining acute-care hospital prevention practices for *C. difficile* prevention in Ontario, Canada. Unlike many other descriptive surveys, the authors achieved a 100% response rate and took a welcome step further by correlating hospital-level self-reported prevention practices with patient-level information on risk factors and outcomes of CDI gathered from administrative databases. The authors chose to focus on a few particular CDI prevention practices selected by a hospitalist and an infectious diseases specialist as both being important to CDI prevention and having a high likelihood that respondents would accurately gauge the practice along with sufficient expected variability across sites.

Overall, they found patient-level risk factors, particularly comorbid illnesses, were predictive of CDI and that none of the six hospital prevention practices they examined were associated with a statistically significant reduction in the risk of CDI. At first glance, this may seem counter-intuitive. However, several findings from their study merit mention and may explain the conclusions. First, the authors identified low self-reported implementation of most CDI prevention practices, with only 27% of facilities reporting isolation of all patients at onset of diarrhoea, and 16% reporting auditing of antibiotic stewardship practices. Low adherence rates for these two practices in particular are concerning because prompt institution of contact precautions is necessary to reduce nosocomial transmission of *C. difficile*. And antimicrobial stewardship is at least as important as infection prevention practices, if not more so, for reducing CDI.

Moreover, low adherence to evidence-based practices has been shown to adversely affect infection rates for other types of HAIs. For example, in a cross-sectional study of 250 National Healthcare Safety Network (NHSN) hospitals, 49% reported having a written CL bundle policy. However, of those that monitored compliance, only 38% reported very high compliance with the bundle. CL-associated

bloodstream infection rates decreased only when an ICU achieved ≥95% compliance.[12]

In this Ontario-based study by Daneman *et al*,[15] the other practices that were examined included auditing of cleaning practices, which were reported by 72% of facilities, on-site diagnostic testing (47%), using vancomycin as first line treatment (15%), and reporting rates to senior leadership (33%). The latter three practices have less evidence to support their use as core CDI prevention practices, and thus low adherence rates to these measures may reflect hospitals' unwillingness to adopt them for lack of evidence. It is encouraging that all or nearly all facilities reported emphasis on hand hygiene, but the choice of hand hygiene agent and compliance rates—which would have been of interest—were not assessed.

Given the overall low levels of CDI-focused prevention processes reported in Ontario, it is possible that lack of association between process and outcome at the facility level might represent lack of coordinated efforts at the regional level. Widespread, regional control efforts have been shown to be critical for controlling multidrug-resistant bacteria such as vancomycin-resistant enterococcus and carbapenem-resistant Enterobacteriaceae.[16 17] Thus, the lessons to be learned from this report may rather be that low levels of regional commitment to CDI prevention in acute-care hospitals are not enough: increased adoption of proven measures such as antimicrobial stewardship and isolation on diarrhoea onset along with comparable measures in long-term care facilities will be necessary.

This study also highlights the importance of implementation science research to tackle the vexing yet pervasive problem of low and variable adherence to evidence-based interventions for reducing HAI, including CDI. The scope of this study did not extend to exploring barriers to implementation or an in-depth assessment of the self-reported practices that may help inform implementation strategies to increase uptake of proven practices.

The study's results should be interpreted in the context of its limitations. First, the survey was conducted in 2011 and it is possible that the responses do not reflect current practices given the increasing interest in prevention of CDI. Second, prevention practices were self-reported and other complementary methods of data collection such as direct observations were not employed to verify self-reported practices. Third, social desirability bias in a survey of infection prevention practices must be considered, and may result in overestimation of adherence to prevention practices. Finally, it is possible that the selected prevention practices included in the survey did not accurately or completely capture the intended scope of the activities, for example, auditing of stewardship practices versus specific antibiotic restriction practices.

These limitations notwithstanding, the findings of this study are important and should serve as a wake-up call for institutions to participate actively in assessing and evaluating implementation of and adherence to CDI prevention practices. Mixed-methods approaches to further our understanding of barriers to implementation may be particularly useful in this regard. Last, increasing the evidence base for preventing CDI by undertaking pragmatic randomised controlled trials of novel interventions incorporating efficacy and effectiveness is essential to successfully bridge the quality chasm that currently exists in CDI prevention.

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