Major article

Working relationships of infection prevention and control programs and environmental services and associations with antibiotic-resistant organisms in Canadian acute care hospitals

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Methicillin-resistant Staphylococcus aureus
Vancomycin-resistant Enterococcus
Clostridium difficile infection

Background: Environmental contamination in hospitals with antibiotic-resistant organisms (AROs) is associated with patient contraction of AROs. This study examined the working relationship of Infection Prevention and Control (IPAC) and Environmental Services and the impact of that relationship on ARO rates.

Methods: Lead infection control professionals completed an online survey that assessed the IPAC and Environmental Services working relationship in their acute care hospital in 2011. The survey assessed cleaning collaborations, staff training, hospital cleanliness, and nosocomial methicillin-resistant Staphylococcus aureus (MRSA) infection, vancomycin-resistant Enterococcus (VRE) infection, and Clostridium difficile infection (CDI).

Results: The survey was completed by 58.3% of hospitals (119 of 204). Two-thirds (65.8%; 77 of 117) of the respondents reported that their cleaners were adequately trained, and 62.4% (73 of 117) reported that their hospital was sufficiently clean. Greater cooperation between IPAC and Environmental Services was associated with lower rates of MRSA infection ($r = -0.22; P = .02$), and frequent collaboration regarding cleaning protocols was associated with lower rates of VRE infection ($r = -0.20; P = .03$) and CDI ($r = -0.31; P < .001$).

Conclusions: Canadian IPAC programs generally had collaborative working relationships with Environmental Services, and this was associated with lower rates of ARO. Deficits in the adequacy of cleaning staff training and hospital cleanliness were identified. The promotion of collaborative working relationships and additional training for Environmental Services workers would be expected to lower ARO rates.

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There is substantial evidence indicating that environmental contamination in hospitals with antibiotic-resistant organisms (AROs) is associated with patient contraction of AROs, and growing evidence that effective cleaning and disinfection of hospitals is associated with decreased ARO rates.1-9 Education and training on infection prevention and control for hospital cleaning staff has been associated with lower ARO rates.7-10 Close collaboration between Infection Prevention and Control (IPAC) programs and Environmental Services is associated with improved cleaning practices and decreased rates of AROs.2,8,9

The purpose of this national study was to examine the nature of the working relationships of IPAC and Environmental Services, and to determine whether educational and cleaning practices collaborations affected ARO levels in Canadian acute care hospitals. The study results can guide the development of strategies to improve the environmental cleaning of hospitals and reduce ARO rates.

METHODS

The infection control and prevention training and cleaning collaborations of IPAC programs and Environmental Services in medium to large-sized acute care hospitals in Canada were

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of IPAC programs informed Environmental Services managers of the latest scientific findings and advancements in environmental cleaning, and two-thirds (65.8%; 77 of 117) reported adequate training of Environmental Services cleaning staff in cleaning and disinfection standards.

Cooperation and collaboration between the services

The majority of respondents (61.5%; 72 of 117) reported that the extent of cooperation between the IPAC program with Environmental Services was excellent, and 28.2% (33 of 117) characterized cooperation as good (Table 1). Two-thirds of IPAC programs (69.2%; 81 of 117) had a designated infection control professional serving as a liaison with Environmental Services. IPAC programs were consulted regarding surface and finishing choices in patient care areas with respect to cleanability often or always in 73.5% of the hospitals (86 of 117) and in the choice of cleaning and disinfection products often or always in 80.3% (94 of 117). Most respondents (90.6%; 106 of 117) reported that Environmental Services used the appropriate cleaning products and equipment. More than three-quarters of IPAC programs (78.6%; 92 of 117) were consulted often or always before any changes to cleaning protocols. Second and third invitations to participate were mailed to nonresponders. Respondents were also contacted by e-mail when e-mail addresses were available. Simple regression was used to test associations between hospital bed classifications, cleaning collaborations, educational services, degree of cooperation, and respondents’ ratings of cleaning staff training and hospital cleanliness with MRSA, VRE, and CDI rates. Variables found to be associated at the \( P < 0.05 \) level were tested by multiple stepwise regression analysis with forward and backward selection for association with ARO rates. Separate multivariate models were developed for MRSA, VRE, and CDI rates. The forward selection procedure added variables if the probability of \( F \) to enter was \( < 0.05 \), and the backward elimination procedure subtracted variables if the probability of \( F \) to remove was \( > 0.05 \). Data analyses were performed with StatView version 5.0 (SAS Institute, Cary, NC).

RESULTS

Respondent hospital characteristics

The survey response rate was 58.3%; 117 surveys were completed, representing 119 of 204 facilities. One survey was received from a health organization representing 3 hospitals. The mean ± SD number of acute care beds per hospital was 232.5 ± 176.4, with a median of 172 and a range of 48-1,100. Many acute care hospitals had other types of beds, including mental health (75.2%), rehabilitation (52.1%), complex continuing care (47.9%), and long-term care beds (29.9%). The mean number of total beds per hospital was 315.6 ± 234.0, with a median of 247.0, a range of 54-1,510. The mean number of admissions was 12,376.9 ± 9,538.6, and the mean number of patient-days was 90,775.7 ± 67,330.7.

Education and training provided to Environmental Services

The vast majority of IPAC programs (91.3%; 105 of 115) provided education and training in infection prevention and control to Environmental Services staff. Among the IPAC programs that provided education and training, the majority (86.8%; 92 of 106) reported that it was well received and taken seriously by Environmental Services staff (Table 1). Three-quarters (76.9%; 90 of 117)
independently associated with VRE rates; frequent consultation with IPAC programs before changes to cleaning protocols was associated with lower VRE rates ($r = -0.20; P = .03$). Two factors were identified on multiple stepwise regression analysis as independently associated with CDI rates. The number of acute care beds was associated with higher CDI rates ($r = 0.39; P < .001$), and frequently consultation with IPAC programs being before changes to cleaning protocols was associated with lower CDI rates ($r = -0.31; P < .001$).

**DISCUSSION**

A substantial majority of IPAC programs in Canadian acute care hospitals reported having considerable interdepartmental cooperation and collaboration with Environmental Services regarding environmental cleaning methods. Of note, however, in one-fifth of hospitals, IPAC programs and Environmental Services did not frequently collaborate on cleaning protocols. A good working relationship, indicated by greater cooperation and collaboration between the 2 services, was associated with lower ARO rates. Greater cooperation between IPAC programs and Environmental Services was associated with lower rates of MRSA, and hospitals greater cooperation between IPAC programs and Environmental Services did not demonstrate any influence of infection prevention and control purposes. This study identifies the need for Canadian hospitals to improve hospital cleanliness, and the evidence indicates that if this was accomplished, then ARO rates would decline.1-9

Most IPAC programs provide education and training in infection prevention and control directly to Environmental Services staff, and most respondents reported that the education and training is well received. One-third of the respondents did not rate their hospital’s Environmental Services cleaning staff as adequately trained to do a good cleaning and disinfection job in the hospital. Environmental Services uses the appropriate cleaning products and the necessary equipment to do a good cleaning and disinfection job in the hospital ($r = 0.20; P < .001$), and frequently consultation with IPAC (n = 117) and Environmental Services regarding cleaning practices, and this is associated with lower ARO rates.7-10

Based on the survey responses, the cleanliness of Canadian hospitals can be characterized as less than optimal. Nearly 40% of the IPAC respondents did not judge their hospital to be sufficiently clean for infection prevention and control purposes. This study identifies the need for Canadian hospitals to improve hospital cleanliness, and the evidence indicates that if this was accomplished, then ARO rates would decline.1-9

One limitation of the present study is the evaluation of the working relationship of IPAC programs and Environmental Services solely from the perspective of IPAC managers. The viewpoint of Environmental Services managers regarding the nature of the working relationship between the services was examined concurrently in a separate survey, in which cooperation and collaboration were characterized as extensive and excellent.11 This perspective is currently in a separate survey, in which cooperation and collaboration were characterized as extensive and excellent.11 The present study is correlational in nature, and although the results have been interpreted such that a good working relationship between the IPAC program and Environmental Services leads to a lower ARO rate, the possibility exists that a lower ARO rate leads to a better working relationship between the departments.

In general, IPAC programs in Canadian acute care hospitals report positive, collaborative working relationships with Environmental Services regarding cleaning practices, and this is associated

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**Table 1**

IPAC collaborations with and ratings of aspects of Environmental Services

<table>
<thead>
<tr>
<th>Survey item</th>
<th>Survey responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPAC has input into the choices of surfaces and finishes in patient care areas with respect to cleanliness (n = 117)</td>
<td>Never, n (%)</td>
</tr>
<tr>
<td>Cleaning and disinfection products used in the hospital are chosen in consultation with IPAC (n = 117)</td>
<td>0</td>
</tr>
<tr>
<td>IPAC consulted before changes to cleaning and disinfection procedures and technologies (n = 117)</td>
<td>0</td>
</tr>
<tr>
<td>IPAC informs Environmental Services managers about the latest scientific findings and advancements in cleaning and disinfection (n = 117)</td>
<td>1 (0.9)</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Extent of cooperation between IPAC and Environmental Services (n = 117)</th>
<th>Poor, n (%)</th>
<th>Some, n (%)</th>
<th>Moderate, n (%)</th>
<th>Good, n (%)</th>
<th>Excellent, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Services uses the appropriate cleaning products and the necessary equipment to do a good cleaning and disinfection job in the hospital (n = 117)</td>
<td>1 (0.9)</td>
<td>2 (1.7)</td>
<td>8 (6.8)</td>
<td>55 (47.0)</td>
<td>51 (43.6)</td>
</tr>
<tr>
<td>Infection prevention and control education provided to Environmental Services staff is well received and taken seriously (n = 106)</td>
<td>0</td>
<td>4 (3.8)</td>
<td>10 (9.4)</td>
<td>50 (47.2)</td>
<td>42 (39.6)</td>
</tr>
<tr>
<td>Environmental Services cleaning staff are adequately trained to do a good cleaning and disinfection job (n = 117)</td>
<td>2 (1.7)</td>
<td>17 (14.5)</td>
<td>21 (17.9)</td>
<td>59 (50.4)</td>
<td>18 (15.4)</td>
</tr>
<tr>
<td>Hospital environment is sufficiently clean for the purposes of infection prevention and control (n = 117)</td>
<td>5 (4.3)</td>
<td>20 (17.1)</td>
<td>19 (16.2)</td>
<td>58 (49.6)</td>
<td>15 (12.8)</td>
</tr>
</tbody>
</table>
with lower ARO rates. Most IPAC programs provide well-received infection prevention and control education to Environmental Services staff. Deficits in the adequacy of Environmental Services workers’ training and hospital cleanliness were identified. The promotion of collaborative working relationships between the services, along with additional education and training in infection prevention and control for Environmental Services staff, would help ameliorate these training and cleanliness deficits in our hospitals and result in lower ARO rates.

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