INSIDE:

Bedpan processing methods: making an informed choice

Wound dressing quality improvement

CSF shunt-associated infections surveillance, CNISP


**ABSTRACT**

**Background**

Effective management of bedpans is a key component of hospital infection control. Several technologies are presently available to managers of health care facilities.

**Objectives**

To summarize current issues arising from the use of reusable bedpan washers, disposable bedpan macerators, and disposable hygienic bags, particularly regarding safety and effectiveness, work organization, costs and environmental impact.

**Methods**

Published studies were identified through PubMed (MEDLINE) and The Cochrane Library; other relevant documents (grey literature) were found using Internet search engines. Interviews were carried out with infection prevention and control staff in Quebec hospitals, and a cost analysis was performed.

**Results**

The scientific data on bedpan processing methods are limited. Guidelines and technical standards do not provide a consensus on the optimal technology. The use of washers (without sterilization) would be the least effective method when considering control of heat-resistant micro-organisms (e.g. *C. difficile*). The interviews highlighted issues related to safe transport of soiled bedpans, processing bedpan supports when using macerators, implementation of procedures, and trade-offs between patient/staff safety and environmental impact, and between staff time and equipment purchasing costs.

**Conclusions**

Based on the available evidence, a single particular bedpan processing method cannot be recommended. The classification of bedpans as non-critical devices requiring low-level disinfection is questionable. To better prevent nosocomial *C. difficile* infections, sterilization of bedpans after patient discharge or use of disposable bedpans or hygienic bags should be considered. Context-specific cost and effectiveness estimates using complete field information are necessary to inform the choice of a single or multi-solution processing method.

**KEY WORDS:**

bedpan, washer, washer-disinfector, macerator, hygienic bags, infection control

**Acknowledgements:**

We thank the interviewed experts for their valuable contribution to this study. We also thank our colleagues at INESSS for their collaboration.

**INTRODUCTION**

In assuring the quality of hospital services, infection control is fundamental and effective processing of reusable medical devices is a key component. Processing involves cleaning, disinfecting and/or sterilizing soiled devices to make their reuse safe; the alternative to processing is to use disposable items. Bedpans are used in hospitals to collect the excreta of bedridden patients, and can be a source of nosocomial infection. The most frequent types of machines used in bedpan processing are washers (also known as washer-disinfectors) and macerators: the former process reusable plastic and stainless steel bedpans while the latter destroy disposable pulp bedpans, but require the use of reusable plastic bedpan supports. Disposable, oxo-biodegradable hygienic bags are relatively new devices that are being adopted by hospitals in some North American regions.
including Quebec, as an alternative to conventional bedpans.

Bedpans are classified in Canadian and international practice guidelines as non-critical devices, that only come in contact with a patient’s intact skin. According to this classification, the reuse of bedpans requires meticulous cleaning and low-level disinfection (1), although the safety of this processing approach has been questioned (2, 3). The Canadian Decontamination of Reusable Medical Devices standard CSA Z314.0-08 (4) simply states that waste containers should be emptied and rinsed at the point of use before they are transported to a designated processing area. According to the international standard ISO 15883-1, thermal disinfection at 80°C for one minute is the acceptable minimum for decontaminating non-critical devices that are not likely to contain high numbers of heat-resistant micro-organisms (5, 6). This international standard was adopted in Canada in 2009 (7, 8).

The present paper arises from a health technology assessment (HTA) prepared by the former Quebec Agency for Health Services and Technology Assessment (AETMIS, now INESSS) for the provincial Ministry of Health (9). HTA, which aims primarily to inform health care decision-makers, is a multidisciplinary process that examines the introduction, acquisition and use of medical devices, equipment, therapeutic and diagnostic procedures and methods of delivering and organizing services. The objective of this paper is to inform health care facilities about current issues arising from the use of the two main bedpan processing technologies, particularly regarding safety and effectiveness, work organization, costs and environmental impact. Hygienic bags are also briefly examined.

**METHODS**

The published scientific literature was searched using PubMed (MEDLINE) and The Cochrane Library in April 2008 and July 2010, with the following key words: bedpan, washer, washer-disinfector, washer-sterilizer, decontaminator, and macerator. Given the present scant literature, any type of study published since 1980 in English or French and addressing the two main technologies or their comparison was retrieved. Bibliographies of articles were also screened for relevant studies. Grey literature, which included clinical practice guidelines and technical standards, was identified in Nosobase (a database specializing in hospital hygiene and nosocomial infections) and on the Web, in April 2008 and March 2009. Manufacturers’ websites were visited to identify different models and their characteristics (washers and macerators) and an alternative bedpan management option (hygienic bags).

A convenience sample of infection prevention and control practitioners at all sites were interviewed: these represent different hospital settings of Quebec, including acute care facilities in rural regions (population density <400 persons/km²) and university hospitals in metropolitan areas. The objective of the survey was to obtain a clearer picture of the practical issues associated with the use of bedpans in health care facilities, excluding any evaluation of procedures or staff. The interviewed experts were asked to describe their daily experiences and to discuss the following: former and present bedpan processing technology used and reason(s) for any change; processing procedures; their appraisal of available technologies; issues related to safety, work organization, costs and environmental impact; reasons for not selecting alternative processing methods; and any general comments on the use of bedpans. A written questionnaire was sent to participants who could not be interviewed on-site because of geographic distance.

Finally, a comparative cost analysis of bedpan washers, macerators and hygienic bags was performed using data provided by the interviewed experts or available from equipment specifications on manufacturers’ websites. A partial analysis was applied to a hypothetical 400-bed hospital. Bedpans were assumed to be used by one-third of in-patients, at a rate of 4 bedpans daily per patient.

**RESULTS**

**Literature review**

The search strategy resulted in a small number of studies (n=9) generally of poor quality, and most at least a decade old. There were no comparative observational studies of washers and macerators presenting quantitative analysis (with respect to safety, for example). Two expert opinions and two surveys, which discussed issues related to the two main technologies, were published between 1980 and 1991 (10-13) but raised some points still relevant today. Two publications about washers included an industry-funded study of the effectiveness of a particular machine (14) and a letter to an editor (15).

Hereafter, we summarize the three most objective studies, providing useful and comparative data about the effectiveness of washer methods or describing the role of macerators in an infection control initiative in Ontario, Canada. This section ends with a summary of our findings from recent clinical practice guidelines and technical standards.

In 1983, Nyström and colleagues demonstrated that bedpan washer disinfection was effective in eliminating virtually all micro-organisms (enterobacteria, enterococci and *Staphylococcus aureus*) from bedpans when the final rinse water temperature was above 85°C rather than below 70°C (16). The principal bacteria that survived in fairly large numbers were *Staphylococcus epidermidis* and Gram-positive (spore-forming) rods.

Alfa and colleagues (17) recently evaluated the efficacy of two hospital bedpan washer-disinfectors (WD) in inactivating *C. difficile* spores inoculated onto artificial test soils. The standard cleaning cycle of one WD, located on a ward, consisted of three short warm or cold-water washes and disinfection at 80°C for one minute, the latter being typical for a ward WD. The other WD, located in the Central Processing Department (CPD) had a longer cycle consisting of two hot-water washes for two minutes each, a rinse, a one-minute disinfection at 82°C, a final rinse and a drying phase for seven minutes at 116°C. *C. difficile* remained on plastic and stainless steel bedpans after the low-level disinfection on the ward whereas none was detected after the CPD process. Further investigation attributed the differential performance to the cumulative effect of multiple factors...
associated with the CPD machine (hot-water rinsing, disinfection temperature, drying).

In 2005, a growing number of C. difficile–associated diarrhoea (CDAD) cases led the infection prevention and control service of a Toronto hospital to implement a multifaceted strategy, including the purchase and installation of a macerator system (18). The infection control team believed that using a spray wand to manually clean bedpans was a major contributing factor to the increase in cases of infection. As a result of the initiatives (including enhanced cleaning in rooms containing a patient diagnosed with CDAD), a gradual return to the baseline level of cases was observed. The authors did not explain why macerators were chosen rather than bedpan washers.

The Canadian practice guidelines identified in our literature search did not explicitly favour a specific bedpan processing technology (19, 20), although disposable bedpans were strongly recommended by a provincial body for the control of C. difficile infections (21). Among guidelines and technical standards from other countries, there is a lack of consensus about processing methods (22-27).

**Experiences and perspectives of infection control practitioners in Quebec hospitals**

Staff from seven Quebec hospitals were invited to participate in the survey and all agreed. The present bedpan processing methods differed across hospitals: conventional method (i.e., cleaning and disinfecting bedpans using a spray wand) at two sites, bedpan washers (two sites), macerators (one site), and hygienic bags (two sites).

The interviewed experts pointed out that the optimal use of washer-disinfectors would require more bedpans per patient and minimizing the pile-up of soiled bedpans between disinfection cycles. The ideal washer would be easy to operate by patient-care attendants, rapid, located near patient rooms, quiet and easily accessible. Interviewees believed washers should not be installed in patient rooms due to lack of alternatives in case of machine failure and inconvenience of maintenance. Many questioned the capability of washers to meet high disinfection standards, considering recent research findings.

Several challenges were raised about the use of macerators: safe transport of soiled disposable bedpans outside patient rooms, processing bedpan supports, need for increased storage space, machine failure caused by non-macerable items, and recurrent drain blockages or backflow due to the build-up of waste.

At one hospital, the fact that the central processing department did not have the capability to process bedpan supports was an additional argument in favour of washers rather than macerators. Cost of disposable supplies and environmental issues were also mentioned.

Concerning disposable hygienic bags, the main disadvantages raised by the interviewed practitioners were recurring costs and impact of waste on the environment. Some believed, however, that the extra nursing time freed by

<table>
<thead>
<tr>
<th>Issues</th>
<th>Characteristics</th>
<th>Manual washing</th>
<th>Washers</th>
<th>Macerators</th>
<th>Hygienic bags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety and effectiveness</td>
<td>Requires handling of soiled bedpans</td>
<td>Yes</td>
<td>Limited</td>
<td>Limited</td>
<td>Limited</td>
</tr>
<tr>
<td></td>
<td>Risk of cross-contamination between patients</td>
<td>Yes</td>
<td>Yes</td>
<td>Limited (risk applies only to bedpan supports)</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Risk of aerosol production and contamination of workplace</td>
<td>Yes</td>
<td>Limited</td>
<td>Limited</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Risk of mechanical failure</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Effective against heat-resistant micro-organisms</td>
<td>No</td>
<td>No</td>
<td>Yes for disposable bedpans but bedpan supports require processing</td>
<td>Yes</td>
</tr>
<tr>
<td>Work organization</td>
<td>Complex process</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Time saving overall (staff implications + processing time)</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Easy to implement in general</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Environmental impact</td>
<td>Use of water and energy during processing</td>
<td>Limited</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Use of chemicals during processing</td>
<td>Possibly</td>
<td>Yes</td>
<td>Limited</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Use of energy to manufacture disposable items</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Large volume of waste produced</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

N/A: not applicable
using bags and the non-use of water or chemicals would greatly offset their purchasing costs. Although clearly aware of environmental issues, users of hygienic bags considered patient and staff safety as their primary concerns. They also believed the bags afford better control of the hazards of spore contamination and that spread of infection is minimal compared to a disposable pulp bedpan system. Finally, the need for training patient-care attendants on appropriate reprocessing procedures in general was highlighted.

In Table 1, we summarize the results gathered from the interviews and our literature review (including the expert opinions and surveys), in order to compare the characteristics of the three bedpan processing methods under review as well as conventional manual cleaning (with spray wands).

Cost analysis
This analysis was based on the assumption that an infection control team at a 400-bed hospital needed an initial overview of the acquisition and operating costs related to the three waste management methods before deciding on a system. The results (Table 2) indicate that the use of hygienic bags would generate the highest total annual costs, while washers would be the least expensive option. We also considered the cost savings associated with preventing nosocomial infections. The estimated average cost related to C. difficile-associated disease acquired during a hospital stay is $16,717 CAD (28). Macerators would thus need to prevent roughly eight additional hospital-acquired infections at the 400-bed facility, in our scenario, to justify their additional expenditure compared with the use of bedpan washers. This benefit would have to increase to 11 prevented cases of infection if hygienic bags were used.

Our analysis is limited because it did not consider some internal cost items, such as human resources, set-up and maintenance of infrastructure (e.g. plumbing, electricity, storage space), use of water, transport of bedpans or supports to processing machines or sterilization of reusable bedpans, and excluded external items (e.g. energy required to manufacture devices, waste management). A recent cost analysis (29) performed in Quebec used the model and data from our AETMIS report (9) to compare bedpan washers and hygienic bags in the context of a future academic hospital. This facility will have 770 beds in 29 wards and two bedpan washers per ward (thus, 48 additional machines compared to our scenario). The authors also estimated patient-care attendant time to carry bedpans from patient rooms to washers, and included sterilization of reusable bedpans and waste recycling costs. The estimated total annual costs associated with washers would be higher than with hygienic bags ($413,136 versus $319,481 CAD), mainly due to staff time (two minutes transport/bedpan/day, amounting to $297,406 CAD).

DISCUSSION
At present, the scientific evidence on bedpan processing methods is extremely limited, generally of poor quality and quite old. The relevance of older information is debatable given ongoing technological developments. However, our review also considered several recent studies, current clinical practice guidelines and technical standards, as well as a qualitative study of issues raised in Quebec hospital settings and a partial cost analysis. Although the survey included only seven sites and the cost analysis was limited to a medium-size hospital, this mixed methods approach allows us to make several relevant conclusions applicable to contemporary hospital infection control.

Historically, bedpans have been classified as non-critical devices requiring only low-level disinfection. Given the increasing importance of preventing and controlling nosocomial infections, the identification of bedpans as major sources of C. difficile contamination and more recent data and guidelines (2, 17, 30), a higher level of processing to eliminate bacterial spores seems to be required. It is estimated that one to three percent of adults are C. difficile carriers (31), and this percentage could rise to 25% among hospital in-patients (32). Bedpans dedicated to each patient and bedpan sterilization after patient discharge should therefore be considered, although we did not find any mandatory obligation of this practice in existing standards. To prevent C. difficile outbreaks, macerators for disposable bedpans or, better yet, disposable hygienic bags for all patients are safer methods, in principle, for limiting the risk of transmission by asymptomatic carriers compared to bedpan washers.

The use of washers or macerators in bedpan waste management poses a risk of workplace contamination. The problem of bedpan transport could be solved by installing modular bedpan-washer units or macerators in patient rooms. However, the current infrastructure of some health care facilities does not allow for this approach because of the limited number of single rooms, general lack of space, and the extent of retrofitting that would be required. In comparison, hygienic bags that are disposed in situ require little or no infrastructure, facilitating their implementation.

In general, a decision concerning infection prevention and control in hospitals must be based on minimizing risk. This involves limiting the handling, transport and processing delays of soiled supplies. Based on the current scientific literature, a single, particular bedpan processing method cannot be recommended. Several factors need to be considered, notably bedpan use requirements, underlying risk of infection and potential outbreaks, staff availability, possibility of infrastructure redesign, budget and environmental impact. Hospital decision-makers could contemplate multi-solution waste management scenarios that would allow a reasonable compromise among safety, work organization, costs and environmental issues.

We have aimed to present the most comprehensive contemporary analysis of bedpan-associated technologies and their role in infection prevention and control. A first set of conclusions deals with bedpan processing practice:

- Reusable bedpans must be disinfected after each use; soiled bedpans should not be collected on counters or allowed to dry.
- Manual bedpan cleaning and spray wands should not be used due to the
associated high risk of infection.

- To better prevent *C. difficile* infection, sterilization of bedpans between patients must be considered.
- Installation of modular bedpan-washer units or macerators in the washrooms of isolation rooms and in close proximity to other types of patient rooms should be considered to minimize workplace contamination and to facilitate monitoring of highly contaminated bedpans.
- Preventive maintenance and verification of the equipment’s operational settings must be carried out on a regular basis.

Finally, the following conclusions apply to the choice of bedpan processing methods:

- The use of bedpan washers would be the least effective method (in the absence of additional bedpan sterilization) to control heat-resistant micro-organisms.
- Bedpan washers are energy-intensive, while both macerators and particularly hygienic bags produce large amounts of waste.

### REFERENCES


### TABLE 2: Acquisition and operating costs by method for a hypothetical 400-bed hospital*

<table>
<thead>
<tr>
<th>Reusable item</th>
<th>Washers†</th>
<th>Macerators§</th>
<th>Hygienic bags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machines (n=10 of each)</td>
<td>6,667</td>
<td>6,667</td>
<td>0</td>
</tr>
<tr>
<td>Reusable bedpans</td>
<td>1,584</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Reusable supports for disposable bedpans</td>
<td>0</td>
<td>106</td>
<td>0</td>
</tr>
<tr>
<td><strong>Subtotals – acquisition costs</strong></td>
<td><strong>8,251</strong></td>
<td><strong>6,773</strong></td>
<td><strong>0</strong></td>
</tr>
<tr>
<td>Operating costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>5,000</td>
<td>5,000</td>
<td>0</td>
</tr>
<tr>
<td>Disposable bedpans</td>
<td>0</td>
<td>113,705</td>
<td>0</td>
</tr>
<tr>
<td>Disposable protective covers</td>
<td>0</td>
<td>21,199</td>
<td>0</td>
</tr>
<tr>
<td>Hygienic bags</td>
<td>0</td>
<td>0</td>
<td>154,176</td>
</tr>
<tr>
<td>Disposable supports for hygienic bags</td>
<td>0</td>
<td>0</td>
<td>48,180</td>
</tr>
<tr>
<td>Electricity to run machines</td>
<td>894</td>
<td>236</td>
<td>0</td>
</tr>
<tr>
<td>Detergent</td>
<td>7,747</td>
<td>249</td>
<td>0</td>
</tr>
<tr>
<td>Rinse agent and descaler</td>
<td>2,708</td>
<td>86</td>
<td>0</td>
</tr>
<tr>
<td>Cleanser-deodorizer</td>
<td>0</td>
<td>4,818</td>
<td>0</td>
</tr>
<tr>
<td><strong>Subtotals – operating costs</strong></td>
<td><strong>16,349</strong></td>
<td><strong>145,293</strong></td>
<td><strong>202,356</strong></td>
</tr>
</tbody>
</table>

**TOTAL ANNUAL COSTS** | **24,600** | **152,066** | **202,356**

* Assuming that one-third of patients each use four bedpans daily.
† Costs were divided over the life span (assumed to be 15 years) of the equipment.
§ Costs for sterilizing reusable bedpans were not included.
§§ Acquisition and operating costs for one washer used to process disposable bedpan supports were included.
15, with Canadian deviations). Mississauga, ON: CSA; 2009.


11. Hickman B. To dispose or re-use? An evaluation of sluice room equipment.


VASCULAR IMAGING IN A WHOLE NEW LIGHT

VeinViewer can help the clinician find the optimal venipuncture site and avoid potential complications by:
- Viewing veins up to 10mm deep not readily located through traditional methods of site and touch
- Locating valves and bifurcations
- Helping unsuccessful IV access leading to an unnecessary PICC
- Reducing pain and stress from multiple sticks
- Avoiding treatment delays through improved peripheral venous access

The exclusive ASSESS™ imaging suite with four distinctive visualization modes:
- Universal, Fine Detail, Inverse, and Resize

Only AVIN™ (Active Vascular Imaging Navigation) provides a real-time digital image

* Clint Welch, RN, CRM, Nurse Manager, Vascular Access and Sharps Safety

Hundreds of facilities around the world now use the VeinViewer imaging system to help improve peripheral vascular access, reduce costs, and provide the best possible care. Anne Arundel Medical Center in Annapolis, Maryland used VeinViewer to help avoid unnecessary central lines. *"Once the 50th patient was done, I notified the [financial department] that just one of the machines paid for both in savings. *"