Single-use: an interesting alternative to bedpan washers

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ABSTRACT

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The risk of spreading resistant bacteria (RB) and emerging highly resistant bacteria and the risk of a *Clostridium difficile* outbreak in our hospitals led us to check the validity of the procedures used to discard excreta. Currently, the preferred device for the safe management of excreta is the bedpan washer. However, the literature does show that some failures and insufficiencies are possible, notably concerning the elimination of *C. difficile* spores. To change a process, one must establish the cost of change and compare it to the alternatives which, as well as being ergonomic and comfortable, need to meet hospital hygiene requirements. The biomedical engineers responsible for the management of the 32 bedpan washers used in the Haguenau Hospital have established the financial cost of one bedpan-washer cycle: consumables, human cost, investment and amortization, preventive and curative maintenance. The total cost of one washing cycle is €1.68 before tax; integrated meters give an estimated 70,000 washing cycles launched per year in the entire hospital. The quest for an alternate solution involving the systematic resort to single-use bags fitted on adapted supports is under way. The advantage of such a system is that this form of excreta management remains within the privacy of the bedroom, and reduces staff workload and movements. The excreta are immediately confined without further manipulation, which should reduce spreading and cross-transmission risks.

KEYWORDS

Bedpan washer – Excreta – Disposable equipment – Multi-drug-resistant bacteria – Emerging resistant bacteria – Clostridium difficile

The emergence and spread of multi-antibiotic-resistant bacteria (MARB) as well as emerging extensively drug-resistant bacteria (eXDR) is a public health issue in France and around the world. While MARB infection leads to problems in selecting antibiotic treatments from an arsenal that is by definition restricted, when people are colonized, the spread of these bacteria must be prevented either directly by the actions of healthcare providers, or indirectly via contaminated inert surfaces, medical devices used, or during management of excreta. The stool of carriers (known or not) constitutes major microbial reservoirs for these MARBs and eXDRs. All stakeholders should be informed and conscious of the risk involved in manipulating fecal matter. The latter is also a reservoir for *Clostridium difficile* and enteroviruses in the event of diarrhea caused by these micro-organisms.

Instructions given to operational hygiene teams (OHTs) are clear, but are restrictive, or perceived as such, by health professionals in charge of patients. The procedures recommend, insofar as is possible, the use of bedpan washers to eliminate excreta, with receptacles (pans and urinals) cleaned and disinfected in a single wash cycle. The specifications for the choice of bedpan washer are established per the EN ISO 15883-3 standard, and recommend exclusive use of thermal disinfection devices. The bedpan with its cover in place is transported with gloved hands [2] from the patient's room to the dedicated washing room. Some additional hand hygiene manipulations are performed before the bedpan emptying-cleaning-disinfection cycle is started. After a wash phase, the drying cycle (80°C for 1 min or 90°C for at least 6 s) ensures a certain degree of disinfection. This complex procedure is not particularly realistic in current practice.

The bedpan washer wash cycle takes a few minutes, meaning that other bedpans sit idle pending their treatment. That wait period is conducive to drying and encrustation of organic matter and limits the subsequent effectiveness of disinfection. In the event of an outage or malfunction, elimination of excreta becomes problematic. Such situations are conducive to misuse including emptying of bedpans into toilets, manual cleaning of bedpans, and the risk of splashing and microbial dispersion into the environment.

Mindful of these difficulties, we studied an alternative method for elimination of stool and urine of bedpan-dependent patients. Lowering the risk of contamination of caregivers, the environment and other patients by excreta demands reduced manipulation and transportation and shorter soiled-material treatment times [3]: ideally, a simple, realistic, effective procedure with no risk of bacterial dispersion. Single-use bags with an absorbent on a lightweight, individual personal support appears to us to be a worthwhile solution. It is appropriate, however, to have users evaluate the system and validate the change in practice economically. Other indicators, such as patient comfort, ecology, safety, effectiveness, and caregiver ergonomics must favour the new method of eliminating excreta. In addition—and this is the objective of this initiative—it must be verified that the change in procedure does not increase costs for the facility.

A change as radical as removal of bedpan washers in a facility that is equipped with 32 of them in its various care-delivery units requires a global approach to validate feasibility.

Materials and methods

Our facility is a public hospital including medicine, surgery and obstetrics wards. It has 470 beds and spaces. Each ward is equipped with one or more bedpan washers, with a total inventory of 32 bedpan washers, for which preventive maintenance and repairs are performed by the hospital's technical services team.

Financial study
The facility's biomedical engineers performed costing of bedpan washer operation: water consumption, electrical consumption, and antiscalant and detergent products consumption. Likewise, amortization of the machine purchases, preventive maintenance and repairs were accounted for. Note that each bedpan washer is equipped with a cycle-count mechanism providing information on frequency of use in each ward. Time worked by orderlies managing and treating patients' excreta was also evaluated, by observing and timing these practices in a care unit. In addition, the cost of the methods used as substitutes for bedpan washing was evaluated, by calculating the cost to purchase bags, supports and gelling agents, and the cost to dispose of excreta in non-infectious medical waste (NIMW) or via the potentially infectious medical waste (PIMW) disposal chain, the cost of treatment being higher depending on the clinical situation.

The cost calculation has been expressed per wash cycle or per excreta elimination unit for ease of comparison.

Ergonomic study
Staff in three units volunteered for trials over a period of 2 to 3 weeks. They were provided with single-use bags with gelling agents as well as individual-patient supports for bedpans and urinals, and instructed not to use the bedpan washers during the trial period. The professional staff completed feedback sheets. The information collected provided us with information on feasibility, ease of use, patient comfort, etc.

Results

Financial study
The detail of costs incurred by the two excreta-elimination procedures—one bedpan washer cycle or a single-use bag with gelling agent, disposed of either with NIMW or with PIMW—is summarized in Table I. To sum up, one bedpan washer cycle consumes 29 litres of water, 0.16 kW of electricity during 8 minutes, 4 mL of antiscalant, and 40 mL of detergent. The cost per cycle in consumables is therefore 54.5 eurocents (net of taxes). The user labour cost is evaluated to be 0.995 euros net of taxes per cycle, considering the time taken to proceed to the bedpan washer room (1 min par cycle), preparation time, and time spent waiting for the cycle to complete (average 1.5 min per cycle), plus the time required for weekly maintenance of the bedpan washer (10 min per week), which results in an hourly cost for the staff performing this activity of 25.9 euros.

Table I – Comparative cost analysis: bedpan washers and single-use bags at Centre hospitalier de Haguenau (current situation: inventory of 32 bedpan washers)

Cost structure	Bedpan washer[1]	Single-use bag	Single-use bag (patient isolated)
Energy – Products – Waste			
Water consumption per cycle (L)	29		
Cost (incl. taxes) of water per m^3 (€)	2.55[2]		
Cost (incl. taxes) of water per cycle (€)	0.074		
Electricity consumption per cycle (kWh)	0.16		
Duration of cycle (min) (info)	8		
Cost (incl. taxes) of electricity (€/kWh)	0.070		
Price (incl. taxes) of electricity per cycle (€)	0.011		
Antiscalant consumption per cycle (mL)			
5 L container (for 1,250 cycles)	4		
Price (incl. taxes) of antiscalant per cycle (€)	0.042		
Detergent consumption per cycle (mL)	40		
5 L container			
Price (incl. taxes) of detergent per cycle (€)	0.417		
Unit price (incl. taxes) of absorbent bag (€)		0.550	0.550[3]
Unit price (incl. taxes) of waste (used absorbent bag) per cycle (€)		0.040	0.144[4]
Unit price (incl. taxes) of waste (support) per cycle (€)		0.0002	0.0005[5]
Cost of cycle (€)	**0.544**	**0.360**	**0.360**
Labour			
Average time to transport pan (min)	1.0		
Average time to prepare pan with absorbent bag + clean support (min)		1.0	1.0
Machine preparation per cycle (min)	1.5		
Weekly machine maintenance (min)	10.0		
Hourly cost of staff member (€)	25.90	25.90	25.90
Cost of staff member per cycle (€)	**0.995**	**0.360**	**0.360**
Maintenance – Amortization[6]			
Cost of maintenance and amortization for one cycle (cf. maintenance calculation sheet) (€)	**0.128**	**–**	**–**
Total cost of cycle			
Total cost of cycle (€)	**1.675**	**0.950**	**1.055**

1. The following costs were not accounted for in the case of bedpan washers: entry of malfunction in CMMS (time for biomedical engineer and care unit) – Cost of bedpans and urinals requiring renewal – Cost of gloves.
2. Average cost taking into account the cost of cold water (€2.44) and hot water (€2.6).
3. List price (most expensive): 10 cartons of 20 bags (10 supports include) @ €110 net of taxes.
4. Assumption: Using the principle that the mass of stool is approximately 150 g /24h and one patient defecates once per day. Urination is based on 4 times a day for an average total of 1.2 litres. The cost of waste disposal was calculated using the NIMW chain price (€146.70/tonne) and the PIMW chain price (€533.30/tonne). (Cost does not include support.)
5. Assumption: The support is used by a single patient. Mass of support (bedpan): 20 g. Average length of stay at Centre hospitalier de Haguenau in MCO (except day admissions and outpatient sessions): 4 days. One patient defecates/urinates approximately 5 times daily (see conditions above), which results in 20 cycles per stay.
6. Per the current status of inventory at the Centre hospitalier de Haguenau: 12 machines considered for amortization.
NIMW: non-infectious medical waste; PIMW: potentially infectious medical waste; CMMS: computerized maintenance management system; MSO: medicine-surgery-obstetrics.

The maintenance and amortization cost for the hospital's bedpan washer inventory is evaluated at 12.75 eurocents net of taxes per cycle. The number of interventions is known and the total maintenance cost is calculated for the entire inventory. This study also enabled measurement of the frequency of use of the bedpan washers in the care units: an average of 6 cycles per day (median 5.3) with extremes extending from 0.2 to 23.3 cycles per day. The cost of management therefore varies from one bedpan washer to another, as the amortization charges are identical regardless of whether or not all washers are used.

In total, the 32 bedpan washers in our hospital execute 70,000 cycles per year, for a total annual operating cost of 117,250 euros net of taxes. Each bedpan emptying-cleaning-disinfection cycle costs the hospital 1.67 euros net of taxes, not counting the purchase and amortization costs of the bedpans and urinals.

To calculate the costs of using a single-use device employing a plastic bag and gelling agent including bag supports for both stool and urine, we used the price listed in the catalogue of the firm Hygie®. The estimated mass of 150 g of stool produced once per day on average and the volume of 1.2 litres of urine over 4 urinations per day allows us to calculate the average daily cost of the waste to be disposed of: 4 eurocents net of taxes per disposal with NIMW and 14.4 eurocents net of taxes per bag disposed of in the PIMW chain. Labour requirements are lower and there is a clear time savings, since the bags are disposed of directly in the wastebaskets in patients' rooms: 0.36 eurocents net of taxes per bag (versus 0.995 euros per bedpan washer cycle). The total for management using the complete single-use system is thus evaluated at between 0.949 and 1.054 euros net of taxes respectively when the bag is disposed of in the NIMW or PIMW chain.

Financially speaking, withdrawal of the bedpan washers would mean a savings for our hospital of nearly 52,000 euros per year and abandonment of progressive renewal of the inventory (procurement of 2 new washers per year on average), representing an additional savings of 16,000 euros. The single-use system should enable substantial savings in the hospital's operating budget.

Ergonomic considerations

Use of single-use bags with an absorbent and an individual-patient support is an interesting alternative and offers real time savings.

For patients, the support on which they are positioned is more comfortable than the classic "cap" design bedpan. In the case of urinal supports, however, proper use of the bag and support must be explained to the patient.

Feedback on the trial of the single-use bag system by volunteer staff was very good overall. The material is lightweight, and ideally prepared in advance so that it is immediately available to the patient. The professionals were very satisfied and were disappointed that the trial period was "too short." A decision to cease using bedpan washers is eagerly awaited.

Discussion

The trials conducted in the units were conclusive. Patient comfort is substantially improved, and this observation alone ought to prompt us to change practice in favour of single-use devices. The health professionals describe time savings and a significantly simpler procedure for management of excreta, and the resulting savings in working time can be redeployed to benefit the patient. At this stage, therefore, the single-use solution should be preferred. This observation is shared by the team at the Singapore Hospital that tested exclusive use of single-use bags for elimination of secretions [6].

Economic considerations remain a major issue in our facilities, and an alternative method should be implemented only if the cost is equal to or less than the previous one. The financial study indicates a budget for management of excreta that is halved; i.e., a savings of more than 60,000 euros per year (0.04% of the hospital's operating budget).

The single-use procedure does run counter to the requirement to limit waste generation. Nevertheless, the plastic material used originates from recovered industrial plastic waste: this represents a "second life" for those plastics.

In ecological terms, one emptying-cleaning-disinfection cycle uses 29 litres of potable water. Considering the total of 70,000 bedpan washer cycles executed per year, the single-bag plus absorbent system would mean a savings of 2,030 m^3 of water per year, which represents approximately 4% of the total consumption for hospital operations in 2017 and some 7,000 euros net of taxes saved per year (this amount is included in the preceding calculation). The bags are not biodegradable, as the technology in this area does not yet allow for a degradable product that would ensure watertightness.

The detergent and antiscalant products consumed by the bedpan washer are disposed of with wastewater, which has a potential impact on the environment [3] and on the quality of discharged water (e.g., chemical and biological oxygen demand, suspended matter, and halogenated organic compounds) with consequences on the wastewater treatment fees charged to the hospital.

In the financial analysis, the "tie-up" of a technical room dedicated to and equipped with a bedpan washer was not included. In our cost calculation, we also ignored the share represented by purchase and continual replacement of the bedpan and urinal inventory [2].

Multiple investigations of standard and complementary precautions have revealed significant difficulty in the field when it comes to proper management of excreta in healthcare facilities [1,2]. And yet, this action is paramount in combating healthcare-associated infections, as it is one of the recommendations in the "standard precautions" applicable to every patient. "Fecal peril" is also one of the areas of focus of the national program for prevention of healthcare-associated infections [7] applicable to healthcare facilities and nursing homes.

In ensuring hospital hygiene, prevention of cross-transmission, and epidemic risk management, the bedpan washer has up to now been the preferred technique for disposal of excreta of bedridden and dependent patients [8]. The bedpan washer must reduce the risk of contamination of professionals and the risk of cross-transmission, since the bedpan is treated in an enclosed, sealed space. Equipped with a method for controlling the process (e.g., cycles, temperature), it performs automatic cleaning of the bedpan, with the door closed and without human presence, and effective disinfection of bedpans and lids, urinals, and urine samplers to eliminate germs and viruses.

In spite of the qualities required, however, bedpan washers are "merely toilets," with the siphon directly connected to the bowl and splashing. The cleaning cycle is not always perfect [4], and the minimum disinfection performed is not sufficient to effectively eliminate *Clostridium difficile* spores [5]. Plastic pans and urinals are often damaged, scratched or cracked owing to temperature variations and wear.

Bryce et al. [8] have shown that bedpan washer maintenance is essential to ensuring continued cleaning-cycle quality and to limiting malfunctions of the machines with potential to cause cleaning faults that are visible to the naked eye! While maintenance is crucial to optimizing bedpan washer effectiveness, improper use and storage of dirty pans before the wash cycle, lack of verification of detergent and antiscalant products, and incorrect positioning of the cleaning devices on the support can also contribute to poor results [8]. Training and awareness-raising of professionals on compliance with instructions are thus indispensable, but clearly often neglected [1]. Aging of machines results in malfunctions and reduced wash performance. Sorensen et al. have shown that 20% of bedpans require a second washer cycle to ensure a visually satisfactory result [9].

The acute problem of risk of transmission of *Clostridium difficile* strains must also be considered [5,8,10]. *C. difficile* is the leading cause of healthcare-associated diarrhea, and epidemics caused by spread of the especially virulent *C. difficile* 027 strain in Canada and in northeastern France in 2006 confirm the risk of dispersion from patients' stool to other hospitalized persons or their environment. Since *C. difficile* spores are not eliminated by thermal disinfection cycles [4], bedpan washers enable reduction of bacterial load only via a mechanical effect that is uncertain and probably incomplete when the bedpan is damaged or scratched and not subject to effective cleaning.

The cost of epidemics and of certain nosocomial infections caused by *C. difficile* should therefore also militate in favour of a single-use method of elimination of excreta. Every infection results in a longer hospitalization period as well as treatment and patient isolation procedures that are extremely restrictive in the case of *C. difficile* infection [10]. It should be further noted that some facilities have adopted sheathing of bedpans with single-use bags [2,3], which are disposed of with PIMW in the case of excreta from patients subject to additional precautions, precisely in order to limit the risk of dispersion owing to an insufficient disinfection cycle. Others recommend sterilization of bedpans after use, if they are made of metal, in the case of patients suffering from diarrhea caused by *C. difficile*

[5,11], as sterilization at 118°C or 134°C for 18 minutes is the only means of eliminating the bacterial spores.
Simplification of the excreta disposal chain, with no transportation or bedpan washer availability wait time, is certainly an improvement that can help limit the spread of MARB or eXDR from colonized stool or infected urine. At present, however, a reduction in resistant bacterial carriage or in incidence of *C. difficile* infections cannot be proven, notably for the share of carriage resulting from cross-transmission from an improperly managed or insufficiently effective excreta management chain.

With a single-use-bag system, staff are certainly less exposed to potential contaminants and no longer contributory to the risk of spreading MARB and eXDR. Staff readily adhere to this considerably simplified procedure. With the new system, simple hand-rubbing with an alcohol-based solution after removal of gloves following disposal of the bag in the room wastebasket is sufficient. In Singapore [6], care teams have voiced their support for single-use devices as replacements for bedpan washers for elimination of excreta. In the study conducted among 1,700 caregivers in a large hospital, elimination of excreta using bags was considered to be simpler, more "hygienic," and time-saving. At the same time, use of bedpan washers is viewed as unrewarding and even "degrading" for caregivers and patients alike, and less effective. Care providers also report that single-use devices are appreciated by patients, who see the procedure as more hygienic and more comfortable than reusable bedpans, among other reasons because the stool remains in the "private space" of the room.

In economic terms, the "travel time" required for elimination of excreta has been recorded as zero with use of a single-use system. This time savings is deemed to be major in the Lapointe study [3] and reported in the interviews with care staff in the Singapore hospital [6] as being beneficial to patients.

Elimination of excreta using bedpan washers is dependent on the wastewater chain and, according to Sorensen et al. [9], contributes to greater biological pollution that should be taken into account. This is nonetheless difficult to assess insofar as "classic" toilet wastewater passes through the same treatment chain, and excreta from dependent patients represent only a small proportion of that generated by a hospital.

Other aspects are championed by the single-use device manufacturer. A bedpan in contact with the bed and the patient's perineum becomes heavily soiled even if it is not directly soiled by fecal matter. When bag supports are used, they remain in the patient's room and are used by one patient only. When the patient is discharged, the bag supports are disposed of in a plastics reclamation chain, do not require cleaning or disinfection, and as a result do not contribute to cross-transmission risk.

Conclusion
In our institution, all indicators are green for a change in procedure and removal of bedpan washers. Consultation and multidisciplinary analysis lead us to conclude that change-over to a complete system of individual-patient supports and single-use bags with gelling agents is financially, ecologically, ergonomically, and hygienically advantageous, including in terms of patient comfort and task simplification for orderlies.

Given that patient stool is a significant reservoir of MARB and eXDR, *C. difficile* spores and other enteroviruses, a management system that is simple, realistic, effective, and carries no risk of dispersion of patients' stool is advisable. It must be recalled, however, that hand hygiene remains paramount and nursing care, management of soiled linens, and biocleaning of the care environment are all areas that must be properly controlled in healthcare facilities and nursing homes in order to effectively manage fecal peril as a whole.

References

1. Lepointeur M, Nérome S, Bendjelloul G, et al. Evaluation of excreta management in a large French multi-hospital institution. J Hosp Infect 2015;91:346-350.
2. CClin-Arlin/Grephh. Optimiser la gestion des excreta, conseils pour prévenir la transmission croisée. 2017, p. 15.
3. Lapointe A, Lepanto L. Analyse coût-efficacité des lave-bassins et des enveloppes hygiéniques, mai 2010, DETMIS.
4. Alfa MJ, Olson N, Buelow-Smith L. Simulated-use testing of bedpan and urinal washer disinfectors: evaluation of *Clostridium difficile* spore survival and cleaning efficacy. AJIC 2008;36:5-11.
5. Tomiczek A, Stumps C, Downey J. Enhancing patient safety through the management of *Clostridium difficile* at Toronto East General Hospital. Healthc Q 2006;19:50-53.
6. Mei Yen Phua, Salmon S, Straughan P, et al. Disposable single-use receptacles in a tertiary hospital: a large survey of staff after a hospital-wide implementation. Am J infect Control 2016;44:1041- 1043.
7. Programme national d'actions de prévention des infections associées aux soins, juin 2015. Online: https://solidarites- sante.gouv.fr/IMG/pdf/propiasjuin2015.pdf *(accessed 07/28/2019).*
8. Bryce E, Lamsdale A, Forrester L, et al. Bedpan washer disinfectors: an in-use evaluation of cleaning and disinfection. AJIC 2011;39:566-570.
9. Sorensen BL, Wenzel H. Life cycle assessment of alternative bedpans – a case of comparing disposable and reusable devices. Journal of Cleaner Production 2014;83:70-79.
10. Birgand G, Blanckaert K, Carbonne A, et al. Investigation of a large outbreak of *Clostridium difficile* PCR-ribotype 027 infections in northern France, 2006-2007 and associated clusters in 2008-2009. Euro Surveill 2010;15(25):pii19597.
11. MacDonald K, Bishop J, Dobbyn B, et al. Reproducible elimination of *Clostridium difficile* spores using a clinical area washer disinfector in 3 different health care sites. Am J Infect Control 2016;44(7):e107-11.

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