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Review

COVID-19: considerations for the safe management and disposal of human excreta

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SUMMARY

Management and disposal of human excreta is an essential element of healthcare practice. The potential for cross transmission of SARS-CoV-2 in faeces and urine has led global healthcare providers to examine different infection prevention and control practices not least the management and disposal of human excreta.

There are two major systems in place to undertake this; one being the use of re-usable bedpans and urinals with reprocessing in a washer disinfectors (WD). The other is use of disposable system; either with pulp bedpans and urinals disposed of in a macerator or hygienic bags disposed of as waste. A review of the literature provided limited evidence to explore these different methods; both having pros and cons with regards to the environmental aspects as well as the infection prevention and control implications.

Manual cleaning can pose associated infection risks to both staff and patients. Disinfection of re-usable bedpans may not achieve the level of disinfection required. Disposable systems offer an alternative that can overcome some of the infection prevention and control limitations of washer disinfectors. Adherence to infection prevention and control standards are paramount to the safe management and disposal of excreta.

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Introduction

SARS-CoV 2 was first detected in Wuhan, China in December 2019. The subsequent spread of the virus to other parts of China and the rest of the world from January 2020 led the World Health Organisation (WHO) to declare a pandemic (COVID-19 the disease form of the virus) on 11th March 2020 [1]. Epidemiologists and infection prevention specialists have been seeking to understand and learn more about the virus to assist with methods for treatment as well as methods for prevention and control. Fundamental principles of infection prevention and control are often referred to as standard infection

control precautions (SICPs). Included in SICPs (amongst others such as hand hygiene and the use of personal protective equipment (PPE)), is the management and the safe disposal of waste (including sharps) [2]. WHO define infectious waste as “waste that contains blood and or body fluid or waste from a person who is deemed as infectious and are being nursed in isolation” [3]. Patients with or suspected or confirmed COVID-19 would fall into this category.

The management and safe disposal of waste will be the focus of this paper, which will outline infection prevention and control practices, the risks of environmental contamination and options for disposal.

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Background

Human excreta are a source of many significant pathogens within healthcare. These include *Clostridioides difficile* (*C.difficile*), Norovirus, multidrug-resistant Enterobacteriaceae (ESBL) and *Pseudomonas aeruginosa* [4]. There is some evidence that SARS-CoV-2 is present in faeces and urine although it is unclear, at this time, if this has any significance in the transmission of the virus. Studies to date have been limited to small numbers of critically ill patients with COVID-19 [5–7]. With the potential risk of SARS-CoV-2 being present in bodily fluid, a review of the infection prevention and control practices around the management and disposal of human excreta can assist in reducing the risk of transmission [8,9].

Managing the disposal of human excreta is an essential component in the delivery of healthcare and mainly falls under auspices of nurses and health care assistants [10]. Up to 50% of bedpans worldwide are emptied and cleaned manually by healthcare workers [11]. Of those that are manually cleaned 17% of bedpans are cleaned with water alone, 39% with detergent with only 44% using a disinfectant [11]. Not only is there is a risk of infection to the patients from inadequate decontamination of re-usable equipment [12,13] there is also a risk to the healthcare staff from handling and disposal of excreta with some staff expressing anxiety about handling human waste [14]. A lack of knowledge amongst healthcare staff can contribute to the poor practices of excreta management [15,16].

Methods

A literature search was performed using Cinahl and Medline databases incorporating the following terms; bedpans, bedpan washer disinfectors, macerators and disposable bedpans. Articles were restricted to those since 2005 and published in English. Although over 300 articles were found that included the term bedpans, the majority of these articles related to privacy and dignity issues rather than infection risk. There were a small number of articles found that related to macerators (7), bedpan washer disinfectors (14) and disposable bedpans (6). No studies were found that related to SARS-CoV-2 and the use of WD, macerators or disposable bedpans. The search failed to find high-quality research articles. There were a number of descriptive articles and these are reviewed here alongside the research articles.

Results

The research articles mainly focused on practices associated with the disposal of excreta during investigations into outbreaks or increased incidents of infection. These were often linked to poor practice and included the use of hand sprays and wands to manually rinse and clean bedpans (either in the patient's room or before using a WD) [14,17]. The manual cleaning process can create splashes and aerosols causing risk of contamination to both the environment and the healthcare worker and is unlikely to remove of all the enteric pathogens [18].

Failed disinfection cycles have been reported with WD [13]. These failures are often due to human factors issues such as ensuring the detergent bottle is filled, loading the machine

correctly and loading the bedpans into the WD immediately following use [13]. One study found 35% of bedpans were inadequately cleaned following reprocessing in WDs during a programme to decrease cases of *C.difficile* in a Canadian hospital [13]. Failure to remove the faeces during the WD cycle has led to staff resorting to manual cleaning prior to reprocessing in the WD with the associated risks already identified [17].

WD and macerators are both subject to breakdowns; mainly due to inappropriate items placed in the machine such as clothing, mop heads, patient wipes and diapers (none maceratable) [4,19]. In one study it was reported that 65% of WD broke down at least once a year resulting in the WD being out of action for 1 week or longer, however this was reduced with regular planned maintenance [14]. Delays in dealing with used bedpans can be a factor for both re-usable and disposable bedpans; the former causing a failure of the WD to clean the bedpan [4] and the latter causing a disintegration of pulp bedpans [14].

Poor knowledge leading to poor practice was thought to be linked to a high incidence of ESBL producing Enterobacteriaceae with a lack of understanding of excreta management and the risks of environmental contamination among healthcare staff [15]. Sixty five percent of healthcare workers touched doorknobs following excreta management, unaware of the environmental contamination [15]. Furthermore, investigation of increased incidence of ESBLs identified that only 9% of healthcare workers followed an education programme when disposing of excreta and not understanding the risks of manual cleaning of bedpans [4].

Considerations for excreta management systems

Primarily, there are two methods for the management and disposal of excreta in healthcare; a reusable bedpan system or a disposable system using either disposal bedpans or disposable bags [18]. Reusable bedpans are either manually cleaned or reprocessed in a bedpan WD or a combination of both [12].

WDs provide a closed system to clean and disinfect bedpans and urinals as well as the disposal of human waste [12,18]. The use of an automated system provides a more consistent approach to reprocessing bedpans [18]. However, to achieve thermal disinfection the temperature needs to reach 80°C for at least 1 minute during the disinfection cycle of the WD [12,18]. Monitoring of the temperature of the WD cycle is required to ensure it has reached the standard temperature with most modern WDs having a visible display with cycle print outs [12]. Furthermore, to remove bacteria such as *C.diff*, a detergent and increased temperature of 85°C is required [18].

Both WDs and macerators require regular maintenance [18,20]. When comparing the costs of the maintenance of WD and macerators, WD disinfectors were assessed as medium to high cost compared to macerators assessed as low to medium cost for maintenance [18]. In addition to regular maintenance, WDs also require regular validation (including a soil test) [4]. Soil tests are not required for macerators.

Re-usable bedpans can be either metal or plastic with Germany nearly exclusively using metal bedpans compared to the US and Netherlands who mainly use plastic [11]. Interestingly, a comparison between the efficiency of the WD cycles between plastic and metal bedpans found that plastic bedpans cleaned better than metal [13]. Synthetic bedpans (such as

those made from plastic) have to be renewed when the surface becomes damaged as even small areas of imperfection can harbor bacteria [21].

Disposable management systems include the use of pulp bedpans and urinals with a macerator used for the disposal of these products or the use of hygienic bags (which are then disposed of into the waste system) [18]. Both these systems are single use, removing the need for reprocessing the bedpans [20]. However, consideration must be given to plastics supports if they are used, as these require effective cleaning. Hygienic bags are disposed of into the waste streams whereas pulp bedpans are disposed of into a macerator that destroys the pulp bedpan/urinal which is then discharged into the wastewater system [18,20].

The use of disposable system bedpans requires sufficient storage area for either the pulp bedpans and urinals or the hygiene bags [18]. Delaney [22] perceived hygiene bags to be the best option for use in the emergency department due to low storage space required allowing them to be stored near to the patient so readily available for use. However, the consideration needs to be given to the disposal of these hygiene bags into waste bins that may cause odours and generate large amounts of waste [18].

The time element of managing and disposing of human waste should not be underestimated [14,20,22]. In one study, nurses found a disposable bedpan system using macerators as time saving, more convenient and less offensive [14]. The introduction of hygienic bags in an ED found this method also saved on nursing time [22]. Where bedpan disposal is provided within the patient's room, this can save nursing time as not having to move bedpan waste to a central ward area [18]. Near patient disposal systems (whether WD or macerator) also reduces the risk of spillage of body fluids when transporting bedpans. In areas without near patient human waste disposal, superabsorbent polymer gel granules can be used to solidify liquid waste preventing spillage.

Environmental factors such as water consumption and energy are important issues to consider with high water consumption for both WD and macerators [18,20]. One study claimed that a macerator (compared to a WD) used up to 60% less water, but water consumption can vary between different models and capacity of both WD and macerators [23]. The energy consumption is considered to be lower with the use of macerators and higher with the use of WD with annual costs estimated at \$236CAD (€150) and \$894CAD (€572) respectively [18,20].

Hygienic bags produce a large amount of waste which mainly goes to landfill. Plastic bedpans although reusable, will require replacement and therefore their disposal is considered as hazardous to the environment as they are not biodegradable [24]. Pulp bedpans and urinals are made from 100% recycled over-issued newspaper, which is totally biodegradable providing an environmentally green option [25]. A study that compared the overall environmental impact of re-usable bedpans with disposable bedpans and hygienic bags found the disposable method had a lower environmental impact [26].

When considering the different options for excreta management and disposal, the cost of the different systems should be assessed locally [18,20]. A cost analysis, using a hypothetical 400 bed hospital compared the cost of 3 systems for excreta disposal. This included a) re-usable bedpans with reprocessing in a WD b) pulp bedpans using macerator disposal

and c) hygienic bags disposed of as waste. The estimated annual costs of the three systems were as follows; a) \$16,349CAD (€10,455) b) \$145,293CAD (€92,915) and c) \$202,356CAD (€129,408.). [20] However there are some interesting points to consider from this cost analysis. Firstly, this cost analysis appeared to exclude the difference in costs of the maintenance of WD and macerators. Maintenance costs are suggested to be much higher for a WD, mainly due to the regular and frequent soil tests [18]. Secondly, within the cost analysis disposable protective covers, estimated to be \$21,199CAD (€13,557) were included in the annual cost for option b) but there were no costs included for protective covers for the other two options [20]. If comparing costs for the different options, the annual cost of bedpan replacement for the re-usable bedpan option and the cost of the waste for the hygienic bag option would need to be considered.

When comparing disposable systems for the management and disposal of excreta, the annual cost of consumables was estimated to be 25% higher for the use of hygiene bags (annual cost \$154,176CAD/€98,615) compared to pulp bedpans (annual cost \$113,705/€72,729) [20].

When selecting a system for the management and disposal of excreta, healthcare establishments should base their options on local goals and needs considering the infection risks with their associated costs, costs of installation, maintenance and consumables, use of energy and water and the availability of space [18].

Improving infection and prevention practices

It is important that training and education is provided for healthcare staff when dealing with any waste material and should also include hand hygiene and the correct use of PPE to prevent contamination and body fluid exposure risk [27]. In addition, the management and safe disposal of human excreta, including the prevention of environmental contamination, should be included in infection prevention training programmes [15,28]. Training and education are essential requirements but may not result in behaviour change alone [29]. Effective leadership setting good infection prevention and control standards along with a programme of audit and quality improvement can assist in bringing about sustainable change [29].

Finally, consideration should be given to human factors to improve the safety in the management and disposal of waste [30]. In one study disinfectant wipes were placed directly next to where the bedpan supports were stored, increasing the compliance of cleaning of these supports between patients [14]. WDs and macerators that are designed with hands free door opening mechanisms remove the need for hand contact and can help to reduce the risk of contamination [31].

Conclusion

Available published evidence to base best practice for the management and disposal of excreta is limited to descriptive studies opposed to quality research studies with nothing found in regard to SARS-CoV-2 virus. Manual cleaning of bedpans, including the use of sprays and wands is not advised due to the associated infection risks to both staff and patients. Disinfection of re-usable bedpans may not achieve the level of

disinfection required to destroy enteric pathogens due to either failure in reaching sufficiently high enough temperatures or due to human factors associated with poor loading or placing inappropriate items in the WD. Disposable systems offer an alternative that can overcome some of the infection prevention and control limitations but consideration should be given to the storage of either the pulp bedpans or the hygienic bags.

Fundamental principles of infection prevention and control and SICPs must be adhered to for any system including effective hand hygiene, appropriate use of PPE when handling and disposing of all body fluids along with environmental cleaning. This is particularly pertinent in the current COVID-19 pandemic. In the recent COVID-19 guidance from the WHO emphasis was also placed on SICPs including safe waste management and use of single and disposable equipment [27,32]. The management and disposal of human waste should be included in infection prevention and control training programmes and mandatory updates.

Human factors and as well as environmental and cost impacts should be considered when selecting a system for the human waste disposal. In either system it is important that SICPs are carried out along with the correct use of PPE.

Limitations

Whilst there was a review of the literature there were very few empirical studies found in particular recent studies within the last 5 years. Many of the studies that were found were descriptive studies either describing investigations of outbreaks or increased incidents of infection or as part of a changes or improvement in practice.

Recommendations for best practice

1. SICPs in particular hand hygiene and correct use of PPE are important in reducing the risk of infection and transmission in whatever system is used.
2. Environmental cleaning, specifically attention to frequently touched points can help to reduce risk of transmission.
3. The management and disposal of human excreta should be included in infection prevention and control training and education programmes.
4. With bedpans and urinals manual cleaning and emptying must be avoided due to the high risk of contamination.
5. Hands free foot operated macerators and WDs should be used where possible.
6. In order to reduce the risk of contamination from failed disinfection processes, disposable systems should be considered as they offer a viable alternative providing there has been a scope of available storage and waste/drainage streams.

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Declaration of Competing Interest

None declared.

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