



Evaluation of excreta management in a large French multi-hospital institution

M. Lepainteur^{a,*}, S. Nérôme^b, G. Bendjelloul^c, C. Monteil^a, B. Cottard-Boulle^d, M. Nion-Huang^a, V. Jarlier^{e,f}, S. Fournier^a, the Network of Infection Control Teams of Assistance Publique – Hôpitaux de Paris[†]

^a Infection Control Team, Direction de l'organisation médicale et des relations avec les universités, Siège Assistante Publique – Hôpitaux de Paris, Paris, France

^b Infection Control Team, Hôpital Beaujon, Assistante Publique – Hôpitaux de Paris, Clichy, France

^c Infection Control Team, Hôpital Bichat – Claude Bernard, Assistante Publique – Hôpitaux de Paris, Paris, France

^d Infection Control Team, Hôpital Ambroise Paré, Assistante Publique – Hôpitaux de Paris, Boulogne–Billancourt, France

^e Laboratoire de Bactériologie, UPMC Université Paris 06, France

^f Laboratoire de Bactériologie–Hygiène, Hôpital Pitié-Salpêtrière, Assistante Publique – Hôpitaux de Paris, Paris, France

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SUMMARY

Background: Excreta are a major source of multidrug-resistant Enterobacteriaceae including strains that produce extended-spectrum beta-lactamase (ESBL). The increase of ESBL incidence in Assistance Publique – Hôpitaux de Paris (AP-HP) hospitals prompted an evaluation of the equipment and practices used to dispose of excreta.

Aim: To evaluate the use of equipment for the management of excreta and to review practices of healthcare workers in their disposal.

Methods: A cross-sectional survey was conducted in 2012.

Findings: A total of 28 AP-HP hospitals including 536 units (342 acute care units and 194 rehabilitation and long-term care units) were evaluated. Among the patients on the day of the survey, 5697 (43%) wore diapers and 1767 (13%) were using a bedpan. Sixty-one percent of the beds were equipped with shared toilets and 43% of the toilets were equipped with hand sprayers, a device favouring the spread of faecal material in the environment.

Sixty eight percent of the units were equipped with bedpan washer-disinfectors. Only 52% of the bedpan washer-disinfectors were located in rooms where alcohol-based hand rubs (ABHRs) were available. In 71% of the units the bedpan was rinsed before disinfection, mostly in the patient's bathroom (62%). Finally, only 9% of questioned healthcare workers said they followed an educational programme about excreta disposal.

Conclusion: This survey shows that, in the field of multidrug-resistant Enterobacteriaceae control and the promotion of hand hygiene with ABHRs, excreta management is a concerning but neglected subject.

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* Corresponding author. Address: Infection Control Team, Hôpital Raymond Poincaré, 104 boulevard Raymond Poincaré, 92380 Garches, France. Tel.: +33 1 47 10 77 25; fax: +33 1 47 1079 49.

E-mail address: margaux.lepanteur@rpc.aphp.fr (M. Lepainteur).

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Introduction

Enteric bacteria are major agents of hospital-acquired infections, including *Clostridium difficile*, *Enterococcus* species and more recently extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae (ESBL-PE) which have emerged as among the most important multi-resistant pathogens in hospitals. In Europe, the prevalence of third-generation cephalosporin-resistant *Escherichia coli* and *Klebsiella pneumoniae* from bacteraemia cases in 2012 was 10% and 22.6% respectively.¹ These prevalences vary between countries but both have significantly increased over the last four years.¹ In France, ESBL-PE incidence significantly increased from 0.17 per 1000 patient-days (PDs) in 2002 to 0.48 per 1000 PDs in 2010.² In Assistance Publique – Hôpitaux de Paris (AP-HP), the largest public multi-hospital institution in France, the incidence of ESBL-PE isolated in clinical samples rose from 0.32 per 1000 PDs in 2006 to 0.73 per 1000 PDs in 2010, comprising ~50% of *E. coli* and 20% of *K. pneumoniae*.³

Enterobacteriaceae are commensal bacteria from the digestive tract, and stools are therefore a major source of spread of Enterobacteriaceae. Management of excreta is a concerning but neglected subject. Indeed, a search in the literature on this topic showed that no large-scale study had been performed. The increase in ESBL incidence in AP-HP hospitals prompted the evaluation of all the available equipment and a review of current excreta disposal practices within our hospitals. The aim of this was to determine whether the excreta management policy needed revision.

Methods

Settings

AP-HP is a public health institution administering 38 teaching hospitals [22 acute care (AC) and 16 rehabilitation/long-term care (RLTC) hospitals]. With a total of 21,000 beds, AP-HP serves a population of 12 million inhabitants spread over Paris, suburbs and surrounding counties. AP-HP admits about one million patients per year. Administrators and medical committees manage AP-HP hospitals locally but large investments and medical developments are taken by the central administration. A local infection control team (LICT) is in charge of prevention and surveillance of healthcare-associated infection in each hospital but actions of foremost importance for the whole institution are co-ordinated centrally by a multi-disciplinary infection control team (CIC: infectious disease physician, bacteriologist, epidemiologist, and nurse).⁴

Survey on excreta management

A cross-sectional survey was conducted to evaluate the management of excreta in the AP-HP hospitals. During this survey, a questionnaire was administered by the LICT to each unit of the participating hospitals, between January and April 2012. This questionnaire aimed at evaluating:

- The characteristics of the unit: medical specialty, numbers of beds, rooms and patients present on the day of the survey, numbers of patients wearing diapers (children or adults) or using a bedpan.

- Equipment on the unit for excreta management (visitors' restrooms in public areas were not included in the study): number of patients' individual restrooms, presence of a hand sprayer in the restroom (a spray used to wash bedpans and situated near the lavatory in patients' restrooms), number of bedpans, and whether or not dedicated to the whole length of the patient stay, availability of lids for bedpans, number of bedpan washer-disinfectors (WDs) and the location of bedpan WDs. For each bedpan WD: brand, year of installation, number of breakdowns per year, existence of at least yearly maintenance and documentation of the maintenance was recorded. For each bedpan WD room: location, presence of hand sprayer to rinse the bedpan, storage of bedpans, availability of hand hygiene disinfectant in the room was recorded.
- Healthcare workers' practices on excreta disposal were evaluated to determine whether bedpans were: (i) directly disinfected in a bedpan WD; (ii) rinsed before disinfection in a bedpan WD; (iii) rinsed and disinfected without use of a bedpan WD; or (iv) only rinsed.
- Randomly sampled nursing auxiliaries (one per unit) were interviewed on practices concerning excreta management.

Statistical analysis

Questionnaires were analysed by the central infection control team with descriptive statistics, chi-square test, and analysis of variance. $P < 0.05$ was considered to indicate statistical significance.

Results

Characteristics of hospitals and units

Among the 38 hospitals of AP-HP, 28 participated in the survey: 16 AC hospitals (73% of AP-HP AC) and 12 RLTC hospitals (75% of AP-HP RLTC). Overall, 536 units (342 AC and 194 RLTC units) were evaluated, covering 13,230 beds (7505 AC beds and 5725 RLTC beds) representing 62% of the total of AP-HP beds and 87% of the participating hospitals' beds ($N = 15,142$).

The medical specialties of the participating units are represented in Table I.

Characteristics of patients

Among the 13,230 patients, 5697 (43%) were wearing diapers, 1640 in AC units (22% of AC patients) and 4057 in RLTC

Table I
Medical specialties of the 536 participating units

Specialty	No.
Medicine	143
Surgery/obstetrics	79
Intensive care	39
Paediatrics	60
Rehabilitation	94
Long-term care	100
Psychiatry	8
Emergency	13

units (71% of RLTC patients) ($P < 0.001$). A total of 488 paediatric patients (49% of paediatric patients) and 5209 adult patients (43% of adult patients) were wearing diapers. In addition, 1767 patients (13%) were using a bedpan, 1212 in AC units (16% of AC patients) and 555 in RLTC units (10% of RLTC patients) ($P < 0.001$). The distribution of patients' characteristics is indicated for each medical specialty in Figure 1.

Description of the equipment

The survey listed 5127 individual restrooms (39% of the beds) and 3538 restrooms shared by at least two patients, i.e. 61%.

Hand sprayers were present in 3639 restrooms (43%). A total of 229 units (44%) were equipped with hand sprayers in at least one of the restrooms.

Overall, 6965 bedpans, mostly made of plastic, were available for the 13,230 beds (i.e. one bedpan for two beds). In only 73 units (15%) were bedpans equipped with lids. One bedpan was dedicated to a given patient during all the length of hospitalization in 62% of the units.

A total of 563 bedpan WDs were operating in 366 of the 536 units whereas 170 units were not equipped. Furthermore, two RLTC hospitals were not equipped with a bedpan WD at all. Distribution of WDs differed according to medical specialty: more than two WDs for intensive care unit but less than one in RLTC units. Bedpan WDs were based on different methods of disinfection: thermal (408 WDs), chemical (49), or both (76). Half of the WDs had been set up within the last six years (interquartile range: 4–9).

Regular maintenance of the bedpan WDs occurred in 125 units (26%). A majority of the WDs (65%) experienced at least one breakdown per year. The length of the down period was greater than a week in 65% of the breakdowns. Breakdowns were less frequent when planned regular maintenance occurred (Table II).

Location of WDs differed depending on the type of unit: 68% in dedicated rooms, 14% in patient rooms, especially in intensive care units and transplantation units, and 18% in unsuitable

Table II

Associations between frequency of bedpan washer-disinfector (WD) breakdowns and brand, age, and preventive maintenance of bedpan WDs

Variable	Frequency of bedpan WD breakdowns	P-value
Brand		
Arjo (N = 232)	62%	0.37
Meiko (N = 88)	67%	
Age		
<6 years (N = 150)	63%	0.80
≥6 years (N = 155)	62%	
Preventive maintenance		
Yes (N = 65)	46%	<0.05
No (N = 245)	67%	

areas (e.g. in a corridor). Storage of bedpans was considered not appropriate in 32% of the bedpan WD rooms. Alcohol-based hand rub (ABHR) was available next to bedpan WDs in only 52% of situations, although 77% of WD areas had adequate hand-washing facilities. However, 20% of bedpan WDs were located in spaces with no hand hygiene facilities (neither ABHR nor sink for handwashing).

Description of nursing auxiliary practices

The 36 units (7%) which did not use bedpans were mainly paediatric and RLTC units, where most of the patients wore diapers. A minority of the units (3%) used disposable bedpans or excreta collection bags. Surprisingly, in only 19% of the units, bedpans were directly disinfected in bedpan WD, whereas in a majority of them (71%) bedpans were rinsed before disinfection in WD, most often in patient restrooms (62%).

When asked why bedpans were rinsed before use in the bedpan WD, nursing auxiliaries indicated that bedpans were

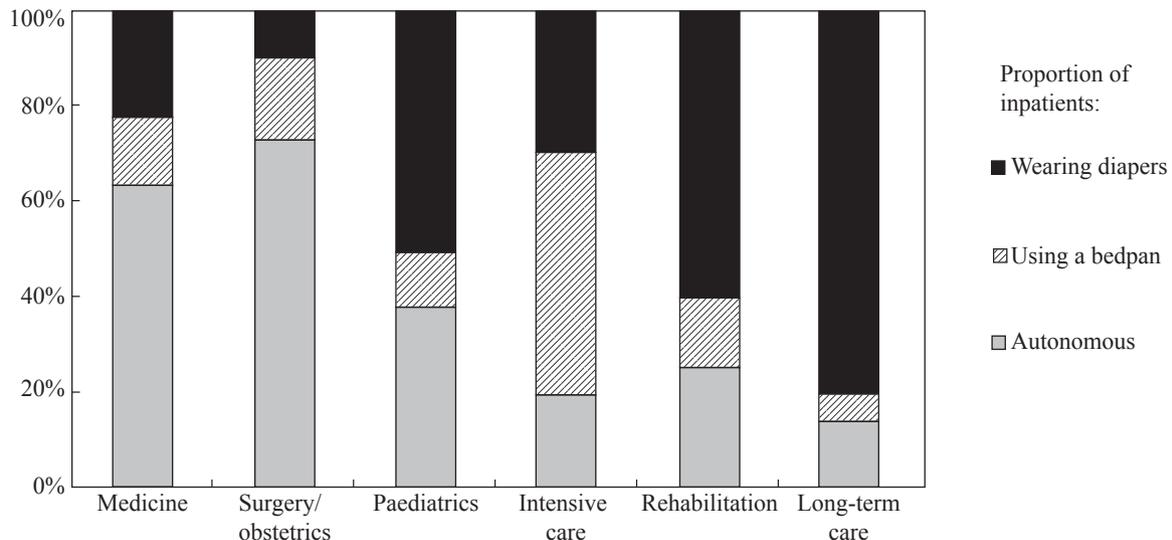


Figure 1. Proportion of inpatients using a bedpan or wearing diapers per specialty type among the 28 Assistance Publique – Hôpitaux de Paris (AP-HP) evaluated hospitals.

often incompletely washed by the bedpan WD, leaving bedpans visibly soiled with faecal material.

About 20% of the units used bedpans without a bedpan WD or disposable excreta collection bags. Most of these units rinsed the bedpan in the restroom and disinfected it with a detergent–disinfectant spray containing quaternary ammonium.

A minority of the nursing auxiliaries who were included in the sample for interview (9%) said they had followed an educational programme on excreta elimination.

Discussion

The central infection control team of AP-HP hospitals decided to investigate the management of excreta in AP-HP hospitals for several reasons. Excreta are a major source of spread of faecal bacteria in hospitals via faecal–oral transmission and contamination of the environment. Infection control measures focus mostly on hand hygiene and may underestimate the role of other transmission pathways. Excreta management is thus a major concern for controlling spread of gut bacteria and viruses, particularly multidrug-resistant enterobacteria and enterococci as well as *C. difficile*. Despite this, the topic is often neglected in hospitals. The present study was conducted in a large public health institution in France and covered more than 13,000 beds. There are apparently no available survey data on excreta management in hospitals in the literature.

Characteristics of patients showed that a large proportion of them wore diapers, particularly in RLTC units (71%), highlighting the importance of excreta management. Soiled diapers are eliminated as non-infectious medical waste in AP-HP according to current national guidelines. The high usage of diapers in non-paediatric patients was not expected in our survey and was linked to a large proportion of urinary or faecal incontinent patients in RLTC units. This emphasizes the need for the education of healthcare workers to adhere to good practices.

Inventory of equipment and practices raised several points that require improvement. Several studies showed that aerosol production when flushing may lead to bacterial surface contamination in the restroom environment.^{5–7} Moreover, use of hand sprayers results in splashing and aerosolization of faecal material.⁸ The environment of patients with *C. difficile*-associated diarrhoea has been shown to be contaminated when hand sprayers are present in restrooms.⁹ The fallout of droplets containing bacteria on bathroom surfaces is of concern since hand contact with contaminated surfaces can result in self-inoculation through hands and mouth.⁶ The results of the present survey show that restrooms are shared between patients in most AP-HP hospital beds (61%). Moreover, 43% of restrooms are equipped with hand sprayers used to clean bedpans.

Chadwick *et al.* reported potential cross-infection by vancomycin-resistant enterococcus (VRE) involving contamination of bedpans and bedpan WDs (10). Indeed, VRE were isolated in a disinfected bedpan shared by patients.¹⁰ In almost 40% of the units in our survey, a bedpan was not dedicated to a patient during their hospital stay. Chadwick *et al.* reported that VRE were also isolated in a bedpan WD even after heat and/or disinfectant. Bryce *et al.* listed the factors contributing to bedpan WD processing failures, such as human factors (e.g.

soiled items not processed immediately after use or improper loading of bedpan WD), mechanical problems (e.g. no warning light when detergent dispenser empty), and equipment factors (e.g. inner rims of certain brands of bedpans inaccessible to spray heads or physical design of bedpans not properly fitting into bedpan WD rack).¹¹ In our survey, flushing and rinsing bedpans before use of a bedpan WD was reported in more than 70% of the units, mostly in the patient restroom, because of incomplete cleaning of bedpans with visible residual soiling when bedpans are directly processed by bedpan WDs. We found that this problem was partially due to bedpan WDs which were not compatible with the bedpans used in our institution. The efficiency of bedpan WDs in our study seemed not to be linked with the brand or to the age but breakdowns were less frequent if a planned maintenance was done at least yearly. In AP-HP hospitals, the validation of thermal WDs is done by the manufacturer before installation and according to European guidelines. The validation is only done once in each thermal WD. Chemical WDs are going out of use and are not validated by any guidelines. The majority of the bedpans were not equipped with a lid and when the bedpan WD was not located in the patient's bedroom, healthcare workers had a long trip through the corridors to the bedpan WD room, holding the patient bedpan with high risk of spillage. For this reason, most of the time, healthcare workers discarded the content of the bedpan into the patient's restroom toilet and used the sink and hand sprayer to rinse the bedpan before bringing it to the bedpan WD room. During a WD's breakdown or where there is no WD, healthcare workers are supposed to dispose of the contents of the bedpan into a slop sink in the bedpan WD room and wash and disinfect bedpans in the same room in an adapted sink. Unfortunately, in AP-HP hospitals, most of the bedpan WD rooms are not equipped with adapted sinks and healthcare workers prefer to spill, wash and disinfect the bedpan in the patient restroom with a detergent–disinfectant spray. However, this process is not validated by any guidelines. Flushing and rinsing bedpans in patients' restrooms, either to augment the limited efficacy of bedpan WDs or to avoid transporting bedpans without lids to the bedpan WD, risks spreading faecal material into the environment.

Bedpan WD rooms are a critical place for cross-transmission. Carling *et al.* showed in a study concerning cleaning of the patient's environment in 23 AC hospitals, that bedpan WDs had a mean rate of cleaning of 25% which represents one of the lowest rates of environmental cleaning in the study.¹² In our survey, 20% of the bedpan WDs were located in rooms without any adequate hand hygiene facilities. Healthcare workers can recontaminate a clean bedpan by taking it out of the bedpan WD, a cross-contamination suggested by Chadwick *et al.* in the contamination of bedpans by VRE.¹⁰ Landelle *et al.* demonstrated that nearly a quarter of healthcare workers have hands contaminated with *C. difficile* spores after routine care of patients with *C. difficile* infections.¹³ As European guidelines recommend a mechanical removal of *C. difficile* spores by washing with soap and water rather than with alcohol-based hand rub, the lack of handwashing facilities in bedpan WD areas in our survey might increase *C. difficile* spores' transmission.¹⁴

In a review of literature, Delaney suggested that disposable bedpans should be the standard of care for bedside toileting rather than reusable bedpans in an emergency department.¹⁵ In our experience, disposable bedpans often leak and are not as acceptable to patients and to healthcare workers. The use of

disposable excreta collection bags to fill the bedpan seems more adapted to our practices and limits the risk of cross-transmission.

This survey highlights the diversity of excreta elimination practices in AP-HP hospitals and also within units of the same hospital, a fact that is probably due to the lack of education in excreta management reported by most of the interviewed healthcare workers.

In response to the results of this survey, the central infection control team decided to set up recommendations for the management of excreta (e.g. appropriate outfit, importance of hand hygiene, single room for patients colonized with enteric multidrug-resistant bacteria or *Clostridium difficile*, use of disposable excreta collection bag for every patient needing a bedpan, removal of hand sprayers, regular maintenance of bedpan WDs). An educational programme for healthcare workers was also launched with supportive educational material. The implementation of some of these recommendations was included as an incentive in the evaluation process within the institution as a quality indicator.

Such a programme has already shown efficacy to improve the cleaning, disinfection and maintenance of bedpan WDs in The Netherlands.¹⁶ Local infection control teams have an important role to play in healthcare workers' education to standardize and improve practices in each hospital.

This cross-sectional survey might serve as a template for audits about management of excreta in hospitals to identify practices for improvement.

In conclusion, infection control policies to limit cross-transmission concentrate on hand hygiene whereas actions for improving the excreta management are often neglected. This survey shows that an evaluation of excreta management practices is possible, may lead to healthcare workers and local infection control team involvement and, as an endpoint, result in optimizing and standardizing practices to limit the spread of faecal bacteria in hospitals. Such surveys or audits can also participate in the quality evaluation system.

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Conflict of interest statement

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References

1. European Centre for Disease Prevention and Control. *Antimicrobial resistance surveillance in Europe 2012. Annual Report of the European Antimicrobial Resistance Surveillance Network (EARS-Net)*. Stockholm: ECDC; 2013.
2. Carbonne A, Arnaud I, Maugat S, et al. National multidrug-resistant bacteria (MDRB) surveillance in France through the RAISIN network: a 9 year experience. *J Antimicrob Chemother* 2013;**68**:954–959.
3. Fournier S, Brun-Buisson C, Jarlier V. Twenty years of antimicrobial resistance control programme in a regional multihospital institution, with focus on emerging bacteria (VRE and CPE). *Am Resist Infect Control* 2012;**1**:9.
4. Jarlier V, Trystram D, Brun-Buisson C, et al. Curbing methicillin-resistant *Staphylococcus aureus* in 38 French hospitals through a 15-year institutional control program. *Archs Intern Med* 2010;**170**:552–559.
5. Best EL, Sandoe JA, Wilcox MH. Potential for aerosolization of *Clostridium difficile* after flushing toilets: the role of toilet lids in reducing environmental contamination risk. *J Hosp Infect* 2012;**8**:1–5.
6. Gerba CP, Wallis C, Melnick JL. Microbiological hazards of household toilets: droplet production and the fate of residual organisms. *Appl Microbiol* 1975;**30**:229–237.
7. Bound WH, Atkinson RI. Bacterial aerosol from water closets. A comparison of two types of pan and two types of cover. *Lancet* 1966;**1**(7451):1369–1370.
8. Tomiczek A, Stumpo C, Downey JF. Enhancing patient safety through the management of *Clostridium difficile* at Toronto East General Hospital. *Health Q* 2006;**9**(Special Number):50–53.
9. Alfa MJ, Harding GKM, Ronald AR, et al. Diarrhea recurrence in patients with *Clostridium difficile*-associated diarrhea: role of concurrent antibiotics. *Can J Infect Dis* 1999;**10**:287–294.
10. Chadwick BR, Oppenheim BA. Vancomycin-resistant enterococci and bedpan washer machines. *Lancet* 1994;**344**:685.
11. Bryce E, Lamsdale A, Forrester L, et al. Bedpan WD disinfectors: an in-use evaluation of cleaning and disinfection. *Am J Infect Control* 2011;**39**:566–570.
12. Carling PC, Parry MF, Von Beheren SM. Identifying opportunities to enhance environmental cleaning in 23 acute care hospitals. *Infect Control Hosp Epidemiol* 2008;**29**:1–7.
13. Landelle C, Verachten M, Legrand P, Girou E, Barbut F, Brun-Buisson C. Contamination of healthcare workers' hands with *Clostridium difficile* spores after caring for patients with *C. difficile* infection. *Infect Control Hosp Epidemiol* 2014;**35**:10–15.
14. Vonberg RP, Kuijper EJ, Wilcox MH, et al. Infection control measures to limit the spread of *Clostridium difficile*. *Clin Microbiol Infect* 2008;**14**:2–20.
15. Delaney MB. Right to know: reducing risks of fecal pathogen exposure for ED patients and staff. *J Emerg Nurs* 2014;**40**:352–356.
16. Van Knippenberg-Gordebeke G. Surveys on bedpan management in the Netherlands (1990 & 2010). Progress in correct use of washer disinfectors. *Am J Infect Control* 2011;**39**:E22–23.