RESEARCH



Bodily waste management and related hygiene practices in nursing homes of Vaud: findings from a multicentre cross-sectional survey as a basis for targeted interventions



Emmanouil Glampedakis^{1,5*}, Marie-Catherine Snoussi¹, Béatrix Sobgoui¹, Firmino Battistella¹, Patricia Cuiña Iglesias¹, Coralie Riccio¹, Laetitia Qalla-Widmer², Alessandro Cassini^{3,4} and Marie Immaculée Nahimana Tessemo¹

Abstract

Introduction Bodily waste management is a critical yet frequently neglected domain of infection prevention and control. We conducted a survey to examine various aspects of bodily waste management and related hygiene practices in nursing homes (NH) based on existing recommendations.

Methods All NHs (n = 120) of canton Vaud in Switzerland were invited to participate in this cross-sectional survey between July 2022 and February 2023 using a questionnaire.

Results Eighty-seven NHs participated in the survey (72.5%). Of these, 33% had internal protocols on bodily waste management, 98% had at least a dirty utility room (median: 4 per NH) and all a bedpan washer-disinfector (WD), yet only 66% met the cantonal recommendation of bedpan WD density (1/15 beds). Separation of soiled and clean compartments was present in 51%, complete hand hygiene supplies in 73% and personal protective equipment (PPE) in 30% of utility rooms. Fifty-four percent of NHs reported having a lid for each bedpan. Systematic use of lids was reported in 33% of institutions and of gloves in 98%, for the transport of used bodily waste collection tools. All surveyed institutions reported performing automated reprocessing of bodily waste collection tools in bedpan WDs and use of manual pre-cleaning was anecdotal. Regular maintenance and validation of bedpan WDs was present in almost all participating NHs.

Conclusion Identified actionable priorities include making bodily waste management protocols accessible to staff, delineation of clean and soiled compartments in utility rooms and equipping them with PPE and hand hygiene supplies, as well as educating healthcare workers on best practices for the transport and disposal of bodily waste.

Keywords Bodily waste, Hygiene, Excreta, Human waste, Bedpans, Urinals, Standard precautions, Prevention, Infection prevention and control, IPC, Nursing

*Correspondence: Emmanouil Glampedakis emmanouil.glampedakis@vd.ch Full list of author information is available at the end of the article



© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by-nc-nd/4.0/.

Introduction

Pathogens of enteric origin, including *Clostridioides difficile*, vancomycin-resistant enterococci and carbapenemase-producing Enterobacteriaceae share the capacity to contaminate healthcare environments and are shed from their gastrointestinal reservoirs over extended periods [1–3]. Several studies have demonstrated the potential of transmissions originating from contaminated surfaces, bodily waste collection tools or other toileting aids in healthcare settings [4–7]. As a result, safe bodily waste management is a critical component in the prevention and control strategies aimed at reducing the spread of multidrug-resistant organisms (MDRO).

Although nursing homes (NHs) face fewer concerns from the aforementioned microorganisms compared to hospitals, they nonetheless encounter significant infectious challenges related to human waste. During winter seasons, outbreaks of norovirus can affect substantial proportions of residents and staff, leading to considerable morbidity and mortality among the elderly, and severely disrupting the operation of facilities [8–10]. The spread of antimicrobial resistance through human waste is equally present in NHs. For instance, the spread of extended-spectrum beta-lactamase Enterobacteriaceae (ESBL) is particularly worrisome given their high prevalence in long-term care [11]. ESBL can readily disseminate through contaminated environment, and in case of infection, pose therapeutic challenges that might urge hospitalization of the resident and use of expensive intravenous therapies. A recent Swiss study including NHs of Vaud indicated that ESBL prevalence is on the rise among residents [12].

In Switzerland, NHs are included in the national strategy for reducing healthcare associated infections [13]. Nonetheless, NHs are regarded as community structures akin to ordinary households, thus presenting challenges for the implementation of transmission-based precautions for ESBL and other MDRO carriers. Current guidelines emphasize the strict adherence to standard precautions to prevent transmission within these institutions [14]. Considering the concerning epidemiological trends and the pivotal role human waste plays in the spread of MDRO, we aimed to conduct a comprehensive evaluation of various aspects related to bodily waste management and related hygiene practices in NHs of canton Vaud in Switzerland. Additionally, our objective was to identify areas for improvement based on the findings from this evaluation.

Methods

Setting

As of 2022, the canton of Vaud is home to 120 NHs, comprising a total of 6'305 beds. The cantonal Hygiene,

Prevention and Control of infection unit of Vaud (HPCi Vaud) is responsible for coordinating efforts to prevent and control communicable diseases and healthcare-associated infections across healthcare facilities in the canton, including long-term care and NHs. Over time, HPCi Vaud has developed a strong infection prevention and control (IPC) network within NHs, consisting of IPC-trained link nurses. Hence, approximately 80% of NHs in the canton have an appointed IPC link nurse. Among other activities, HPCi Vaud promotes best practices, educates on IPC, monitors IPC indicators and conducts audits to ensure the provision of safe care for the residents and the protection of healthcare workers (HCW).

Design and temporal extent

We conducted a cross-sectional survey aiming to investigate various aspects of bodily waste management in NHs. All long-term care facilities hosting residents aged 65 years or older were invited to participate. Invitations were sent via emails to NH directors, chief nurses and when available (~80%) IPC link nurses. The invitations were distributed in July 2022, allowing for a flexible participation period, with the final responses collected in February 2023. Participation in the survey was voluntary.

Questionnaire and data collection

Data collection was performed using a survey questionnaire that was completed for each NH. The questionnaire was developed by HPCi Vaud considering standard precautions recommendations from French-speaking Switzerland [14], international recommendations on bodily waste management [15], the SN EN ISO 15883 standards for washer-disinfectors (WD) for bodily waste containers [16, 17] and the cantonal architectural recommendations for NH construction in Vaud [18]. The survey covered various aspects of bodily waste management in NHs, outlined in Fig. 1.

Key areas assessed included facility architecture, the presence of protocols for the safe removal of bodily waste, the availability of hand hygiene supplies and personal protective equipment (PPE), the layout and equipment of dirty utility rooms, and the handling of bodily waste collection tools (i.e. bedpans and urinals). This also encompassed practices for bodily waste elimination, cleaning and disinfection of bedpans and urinals, the existence and functionality of bedpan WDs, and storage of clean bodily waste collection tools. While the questionnaire was conducted in French, the official language of the canton, an English translation is provided in the Supplementary material.

One nurse from each NH (preferably the IPC link nurse, when available) was requested to complete the questionnaire for their institution. Data collection



Fig. 1 Visual summary of the surveyed aspects related to bodily waste management in nursing homes. NH: Nursing home, PPE: Personal protective equipment, WD: Washer-disinfector

involved an active inventory of room architecture, materials, and equipment, which was to be performed by the person completing the questionnaire. Concerning HCWs' practices, the nurse in charge was asked to provide a general estimation based on their previous experiences and interactions with their teams and no direct observation of HCWs was conducted.

Data analysis

Findings related to categorical variables are presented as numbers and percentages while from continuous variables as medians and interquartile ranges (IQR). In cases with incomplete data, denominators are provided, and summary statistics are calculated accordingly. All analyses were performed using R Statistical Software (version 4.1.2; R Foundation for Statistical Computing, Vienna, Austria).

Ethical statement.

This study did not involve the collection of personal data from HCWs or residents and was conducted in accordance with the local ethic committee's criteria on quality studies, hence an ethics committee approval was not required.

Results

Participation

Eighty-seven of the 120 NHs in the canton participated in the survey (72.5%) covering 4'490 NH beds (71.2% of the canton's NH beds). The results for each surveyed domain are presented below.

Architecture

The participating NHs included a total of 3'748 rooms, comprising 3'006 individual rooms (80%) and 742

Table 1	Architectural	characteristics	of nursing	homes
participa	ting in the su	rvey		

Architectural characteristic	Results
Number of beds, median (IQR) (Range)	46 (36) (10–119)
Percentage of single rooms, median (IQR) (Range)	86 (40) (0–100)
Number of NHs by percentage of single rooms, N (%)	
0–25%	5 (6)
25–50%	15 (17)
50–75%	19 (22)
75–100%	48 (55)
Percentage of rooms with toilets, Median (IQR) (Range)	43 (95.5) (0–100)
Number of NHs by percentage of rooms with toilets, N (%)	
0–25%	36 (41)
25–50%	10 (12)
50–75%	9 (10)
75–100%	32 (37)

IQR Interquartile range, NH Nursing home

Table 2 Bodily waste collection tools in nursing homes participating in the survey

Bodily waste collection tools	Results	
	12 (17) (0–119)	
Number of bedpans per bed, median (IQR)	0.30 (0.35)	
(Range)	(0–1.08)	
Number of urinals, median (IQR)	10 (7)	
(Range)	(1–119)	
Number of urinals per bed, median (IQR)	0.19 (0.15)	
(Range)	(0.02–1.08)	

IQR Interquartile range, NH Nursing home

double-bed rooms (20%). Of these, 2'186 rooms (58%) were equipped with a toilet. A more detailed overview of the distribution of rooms and toilets is provided in Table 1.

Protocols for bodily waste management

Only 29 NHs (33%) had written protocols on safe management and removal of bodily waste. Protocols for the use of bedpan WDs were available in 58 facilities (67%), while 12 NHs (14%) had protocols for the manual reprocessing of bodily waste collection tools. All the aforementioned protocols were available in merely 8 institutions (9%).

Bodily waste collection tools

The numbers and distributions of bodily waste collection tools in participating NHs are shown in Table 2. Among all surveyed institutions, 54% reported having lids available for every bedpan and 44% for every urinal. Additionally, 79% of the institutions regularly replaced old, overused, or damaged collection tools. Only 6% of the surveyed NHs reported using disposable bedpan liners, and even then, only on special circumstances such as bedpan WD malfunctions or during outbreaks.

Layout and equipment of dirty utility rooms

Eighty-five (98%) of the surveyed institutions had at least one dirty utility room, with a median of 4 per NH (IQR: 4) and 1 per floor (IQR: 0.5). The utility rooms were located in the middle of the ward's corridor in 55% (45/82) of cases, at its extremities in 29% (24/82), outside the ward in 5% (4/82), and in 11% of cases, there was a mixed location (middle and/or extremities and/or outside the ward). Clean and dirty areas were separated in 51% of utility rooms, and a dirty-to-clean workflow could be maintained in 43%. The two institutions (2%) without a dedicated utility room performed cleaning and disinfection of bodily waste collection tools in resident bathrooms equipped with bedpan WDs.

Dirty utility rooms were equipped with a bedpan WD in 94% of cases. Other equipment included bins for soiled resident laundry (94%), general waste bins (91%), deep sinks (85%), and slop hoppers (81%). In 13% of cases, an immersion-disinfection tub was available.

Hand hygiene materials and PPE in dirty utility rooms

A handwash basin with a liquid soap dispenser was available in 94%, and a dispenser for alcohol-based hand rub was present in 79% of cases. All necessary materials for optimal hand hygiene (water, liquid soap, and alcoholbased hand rub) were available in 73% of cases. Regarding PPE, medical gloves were present in 95%, medical gowns in 41%, and goggles in 34% of utility rooms. However, only 30% of them had all the aforementioned PPE available.

Handling of used bodily waste collection tools and waste disposal

Surveyed institutions reported the use of a lid for transporting used bodily waste collection tools as follows: always (33%), sometimes (64%), and never (3%). PPE used during transport included medical gloves (98%), gowns (9%), and face masks (9%), while two institutions (2%) reported using no PPE at all. Disposal of bedpan and urinal contents was carried out in bedpan WDs in 78% of cases, slop hoppers of utility rooms in 48%, and residents' toilets in 37%, with only 32% performing disposal exclusively in the bedpan WD. Regarding the elimination of toilet paper from bedpans, this was done in resident toilets (48/86, 56%), bedpan WDs (45/86,52%), general waste bins (24/86,28%), and slop hoppers (22/86,26%), with only 24 institutions (24/86,28%) exclusively using bedpan WDs for this purpose.

Reprocessing of used bodily waste collection tools

Three institutions (3%) reported manually precleaning bodily waste containers in resident bathrooms, with two (2%) using handheld toilet water sprayers for this purpose. All participating NHs performed final reprocessing of used bodily waste collection tools in bedpan WDs. In most NHs (78/84, 93%), reprocessing was conducted after each use, while less frequent disinfection occurred in only 6 facilities (7%).

Bedpan WDs' numbers and qualifications

All 87 (100%) surveyed institutions had at least one bedpan WD, with a median of three per NH (IQR: 2). As shown in Fig. 2, the majority of NHs (66%) met the cantonal recommendation of having at least one bedpan WD per 15 beds. Sixty-six percent of WDs utilized thermal disinfection, 6% chemical, and 28% mixed disinfection. All NHs with chemical or mixed disinfection WDs reported using appropriate detergent-disinfection products. Seventeen NHs (20%) reported regular problems in at least one of their WDs. When specified, the causes mainly included obstruction by inappropriate materials such as gloves or non-paper hygienic tissues. Eighty NHs (92%) reported conducting at least one annual validation of their machines by an accredited institution. Eighty-five





Fig. 2 Number of bedpan washer-disinfectors plotted against the number of beds in the surveyed nursing homes. WD: bedpan washer-disinfector. The dashed line represents the expected number of bedpan WDs for the given number of beds according to the cantonal recommendations of canton Vaud (1 per 15 beds) [18]

NHs reported regular maintenance of their machines (85/86, 99%).

Storage of clean bodily waste collection tools

Eighty-six institutions provided data on the post-reprocessing storage of clean bodily waste collection tools. Storage locations included the dirty utility room (47%), residents' rooms (10%), dedicated cupboards outside of resident and utility rooms (30%), and both utility and patients' rooms in 13% of NHs. Notably, in 35 of the 51 NHs (69%) that reported storage in dirty utility rooms, separation of clean and soiled compartments was not in place.

Discussion

In this multicentre survey, we evaluated multiple aspects of bodily waste management in NHs, encompassing facility architecture, protocols, and all steps involved, from handling and reprocessing of used materials to storing clean bodily waste containers. Our survey contributes to the limited data [19–22] on this crucial aspect of IPC. Furthermore, this study provides an initial overview of areas in bodily waste management that may require improvement, which are further discussed here.

The architectural component of the survey revealed that, despite most rooms in participating NHs being single-bed, a substantial number lack private toilets. Previous studies have shown that shared toilets and NH crowding (number of residents per room) are factors associated with more extensive outbreaks of various infections, including diarrheal diseases [8, 23–26]. Therefore, new NH constructions and extensions should prioritize individual rooms with private bathrooms, as recommended by local architectural guidelines [18].

Most surveyed institutions did not have internal protocols for HCWs regarding the safe management and disposal of bodily waste, reflecting the scarcity of concise information on this neglected yet critical IPC domain. Easily accessible guidelines might increase adherence to best practices among personnel in healthcare settings [27]. In Switzerland, as in many other countries, there is no single guidance document specifically addressing safe bodily waste management and disposal for healthcare institutions. Instead, information can be found fragmented across various sources, including standard precaution recommendations, environmental cleaning, and disinfection of medical devices. This finding underscores the need to consolidate recommendations from different sources into a single, easily accessible guideline tailored to the needs of long-term care [15, 28]; with this in mind HPCi Vaud has developed a guidance document on safe bodily waste management long-term care facilities which is accessible and freely available online [29].

We performed a detailed inventory of bodily waste collection tools present in NHs of our canton. Given the lack of information on the number of residents who cannot independently use toilets, it is difficult to conclude on the sufficiency of these supplies, especially considering that resident profiles differ across institutions. Nevertheless, it is well known that many elderly individuals exhibit some degree of fecal and/or urinary incontinence [30], suggesting that they cannot use toilets and might be more dependent on toileting aids. Needs for bedpans and urinals might also increase during diarrheal disease outbreaks or in institutions with a low proportion of rooms with private toilets, hence NHs should possess sufficient numbers of such supplies [15].

The vast majority of institutions had dirty utility (or sluice) rooms. The presence of such rooms is fundamental, as they allow reprocessing of soiled bodily waste collection tools outside of the NH's living spaces, thereby minimizing the risk of contamination of residents and their environment. However, in many instances, these rooms were located in the extremities or even outside of wards, suggesting that HCWs need to walk longer distances with soiled bodily waste collection tools. Long distances may increase the risk of environmental contamination [31] or prompt HCWs to prefer manual cleaning of bedpans and urinals in residents' bathrooms [19], a risky practice for both the environment and the HCW that should be avoided.

Current guidelines recommend separating clean and soiled compartments in dirty utility rooms to enable HCWs to maintain a unidirectional dirty-to-clean workflow [15, 18, 32]. This separation was present in only 51% of the surveyed institutions, with even fewer able to adhere fully to the dirty-to-clean flow. The rationale behind this recommendation is to prevent contamination of clean bodily waste collection tools after their reprocessing in bedpan WDs. Although rearranging existing sluice rooms may be challenging, it should be encouraged when possible, while a proper layout is mandatory for all new NH constructions [18]. When a complete rearrangement of the dirty utility room is not possible, marking (e.g. with marking tape) can be used to clearly delineate soiled and clean compartments, preventing contamination of reprocessed bedpans and urinals.

Additionally, given the reprocessing of heavily contaminated bodily waste containers in dirty utility rooms, it is imperative to equip these spaces with all essential supplies for optimal hand hygiene, including a handwash basin, liquid soap, alcohol-based hand rub, paper towels, and a waste bin for their disposal. Regarding PPE, it should be stored in the clean compartment of the dirty utility room and include all necessary equipment to protect HCWs from contact with bodily fluids and splashes, such as medical gloves in all sizes, gowns, and goggles. Regular audits could help ensure the availability of necessary supplies and adherence to the designated layout. Along with auditing and feedback, adherence to proper PPE use and hand hygiene might be improved through reminder posters [33], such as visual guides on correct glove and gown donning and doffing or step-by-step hand hygiene instructions placed near sinks and alcoholbased hand rub dispensers.

Most NHs reported a systematic use of gloves by HCWs for the transport of used bodily waste containers, in line with standard precautions for contact with bodily fluids [14, 28]. However, the use of lids during transport was not always observed. This could be due to either a lack of lids for all available bodily waste collection tools or unawareness of related risks. Similarly, in a considerable proportion of institutions, HCWs disposed of bodily waste and toilet paper in various locations, suggesting manipulation of used containers with significant risks of cross-contamination. Bedpan WDs are designed to allow direct disposal of bodily waste and toilet paper from containers without the need for risky handling by HCWs. In light of these findings, educating HCWspotentially through auditing and feedback from IPC link nurses-is necessary and should be promoted to ensure the safe transport of soiled bodily waste collection tools using PPE and lids, as well as the proper disposal of bodily waste in bedpan WDs.

Some guidelines apply Spaulding's classification and categorise urinals, bedpans, and other bodily waste collection tools as non-critical equipment requiring low-level disinfection [34]. Nonetheless, the high pathogen load on this equipment and its use in proximity to mucous membranes have led other recommendations to classify them as semi-critical, necessitating higher levels of disinfection [35]. Current guidelines in Vaud favor the automated reprocessing of these items using bedpan WDs. These machines automatically empty, clean, disinfect, and dry bodily waste containers. The efficacy of the whole process is standardized in a formal procedure [16, 17]. The energy costs associated with the use of bedpan WDs are counterbalanced by the reduction in waste from disposable bodily waste collection tools [36] and their demonstrated disinfection efficacy [37–39]. In our study, all institutions used bedpan WDs for the reprocessing of bodily waste containers, and almost all of them complied with the requirements for regular maintenance and annual validation of these machines by accredited institutions [40].

The automated cleaning and disinfection process in bedpan WDs eliminates the need to apply risky manual handling by HCWs [36]. For instance, precleaning of bedpans and urinals using handheld toilet water sprayers in residents' bathrooms can lead to contaminations of HCWs and the environment through splashes and aerosols [28, 41]. Fortunately, this dangerous practice was reported in only 2% of institutions in the canton, much lower compared to other settings [19]. In cases of bedpan WD malfunction bedpan and urinal liners could serve as alternatives [42]. The addition of a solidifier in such equipment allows for the disposal of bags in general waste bins, after which the bodily waste collection tool can be cleaned using disinfectant-impregnated wipes.

The present study has limitations. Although this was an extensive and detailed survey on bodily waste management and related hygiene practices in long-term care, certain supplementary aspects were not addressed, as the study team aimed to keep the project straightforward for participating institutions. Future surveys could include further inquiries such as the proportion of residents dependent on bodily waste collection tools, the presence of lids in resident toilets, the availability of paper towels for hand hygiene to dry hands after washing with soap and water, waste bins for paper towels, the use of automated doors and ventilation systems in dirty utility rooms, and the materials used for walls and floors in these spaces. Another limitation of the current survey was the lack of direct observation of HCW practices; instead, institutional responses were based on nurses' general estimations from previous interactions with their colleagues. A more in-depth analysis of HCW practices, potentially through audits from IPC link nurses, might better elucidate areas in bodily waste management needing improvement, while it would allow to correct practices via direct feedback to HCWs. Such audits should be promoted in long-term care settings given the vulnerability and the dependence of their population on bedpans and urinals. Nonetheless, given the high participation rate, we are confident that our results are representative and provide a sufficient initial overview of bodily waste management and related hygiene practices in the NHs of our canton. It is noteworthy that generalisation of our findings would require similar surveys in other geographical regions and resource settings.

Conclusions

This multicentre survey provides a first comprehensive overview of bodily waste management in NHs in the of canton Vaud, Switzerland. It underscores the need for sound architectural design, accessible protocols, supplies and adherence to IPC best practices to ensure the safety of residents and HCWs. Key findings include the need for single rooms with private toilets, proper separation of soiled and clean zones in dirty utility rooms, and the ready availability of hand hygiene supplies and PPE in these spaces. Additionally, educating HCWs on safe transport and disposal of bodily waste along with the correct use of bedpan WDs also constitute actionable priorities in the surveyed institutions. Regular audits of infrastructure, supplies and practices, coupled with direct feedback, could help reinforce adherence to best practices and highlight areas needing further improvement. Moving forward, future investigations should incorporate direct observations of staff practices, assess resident reliance on toileting aids, and examine additional institutional and resident-level factors. By addressing these priorities in bodily waste management, long-term care facilities can strengthen their infection control efforts, thereby safeguarding both residents and staff.

Abbreviations

ESBL	Extended-spectrum beta-lactamase
HCW	Healthcare worker
HPCi Vaud	Hygiene, prevention and control of infection unit of Vaud
IPC	Infection prevention and control
IQR	Interquartile range
MDRO	Multidrug-resistant organism
NH	Nursing home
PPE	Personal protective equipment
WD	Washer-disinfector

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13756-025-01535-4.

Additional file 1.

Acknowledgements

The authors are grateful to the nurses and nursing homes of Vaud for their participation in this survey. We would like to thank Mrs. May-Kou Ku Moroni (HPCi Vaud) who helped with the design of Figure 1.

Author contributions

EG analyzed the data and wrote the first draft of the manuscript. LQW and MINT initiated the study and were responsible for the study design and coordination. FB and LQW designed the first version questionnaire while EG and MINT reviewed and approved the final version of it. BS, MCSP, FB, PCI, and CR collected the data. AC and MINT critically reviewed the manuscript. All authors have thoroughly reviewed and approved the final manuscript and declare no competing interests.

Funding

There was no specific funding dedicated to this project.

Data availability

Data (anonymized for nursing homes) might be obtained upon reasonable request to the corresponding author.

Declarations

Ethics approval and consent to participate

Not applicable. This study did not involve the collection of personal data from healthcare workers or residents and was conducted in accordance with the local ethic committee's criteria on quality studies, hence an ethics approval was not required.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Cantonal Unit for Infection Prevention and Control, Public Health Service, Lausanne, Switzerland. ²La Source School of Nursing, HES-SO University of Applied Sciences and Arts Western Switzerland, Lausanne, Switzerland. ³Public Health Department, Canton of Vaud, Lausanne, Switzerland. ⁴Infection Prevention and Control Unit, Infectious Diseases Service, Lausanne University Hospital and University of Lausanne, Lausanne, Switzerland. ⁵Unité Cantonale Hygiène, Prévention Et Contrôle de L'Infection (HPCi Vaud), Office du Médecin Cantonal, Avenue de La Gare 43, 1003 Lausanne, Switzerland.

Received: 14 October 2024 Accepted: 23 February 2025 Published online: 11 March 2025

References

- Henard S, Lozniewski A, Aissa N, Jouzeau N, Rabaud C. Evaluation of the duration of vanA vancomycin-resistant *Enterococcus faecium* carriage and clearance during a large-scale outbreak in a region of eastern France. Am J Infect Control. 2011;39(2):169–71.
- Mo Y, Hernandez-Koutoucheva A, Musicha P, Bertrand D, Lye D, Ng OT, et al. Duration of carbapenemase-producing *Enterobacteriaceae* carriage in hospital patients. Emerg Infect Dis. 2020;26(9):2182–5.
- Crobach MJT, Vernon JJ, Loo VG, Kong LY, Péchiné S, Wilcox MH, et al. Understanding clostridium difficile colonization. Clin Microbiol Rev. 2018;31(2):e00021-e117.
- Falkiner FR, Keane CT, Dalton M, Clancy MT, Jacoby GA. Cross infection in a surgical ward caused by *Pseudomonas aeruginosa* with transferable resistance to gentamicin and tobramycin. J Clin Pathol. 1977;30(8):731–7.
- De Geyter D, Blommaert L, Verbraeken N, Sevenois M, Huyghens L, Martini H, et al. The sink as a potential source of transmission of carbapenemase-producing *Enterobacteriaceae* in the intensive care unit. Antimicrob Resist Infect Control. 2017;6(1):24.
- Best EL, Sandoe JAT, 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;80(1):1–5.
- Johnson D, Lineweaver L, Maze LM. Patients' bath basins as potential sources of infection: a multicenter sampling study. Am J Crit Care. 2009;18(1):31–40.
- Utsumi M, Makimoto K, Quroshi N, Ashida N. Types of infectious outbreaks and their impact in elderly care facilities: a review of the literature. Age Ageing. 2010;39(3):299–305.
- Inns T, Wilson D, Manley P, Harris JP, O'Brien SJ, Vivancos R. What proportion of care home outbreaks are caused by norovirus? An analysis of viral causes of gastroenteritis outbreaks in care homes, North East England, 2016–2018. BMC Infect Dis. 2019;31(20):2.
- Calderwood LE, Wikswo ME, Mattison CP, Kambhampati AK, Balachandran N, Vinjé J, et al. Norovirus outbreaks in long-term care facilities in the United States, 2009–2018: a decade of surveillance. Clin Infect Dis Off Publ Infect Dis Soc Am. 2022;74(1):113–9.
- 11. Cochard H, Aubier B, Quentin R, van der Mee-Marquet N. Réseau des Hygiénistes du Centre. Extended-spectrum β-lactamase-producing Enterobacteriaceae in French nursing homes: an association between high carriage rate among residents, environmental contamination, poor conformity with good hygiene practice, and putative resident-to-resident transmission. Infect Control Hosp Epidemiol. 2014;35(4):384–9.
- Kohler P, Fulchini R, Albrich WC, Egli A, Balmelli C, Harbarth S, et al. Antibiotic resistance in Swiss nursing homes: analysis of national surveillance data over an 11-year period between 2007 and 2017. Antimicrob Resist Infect Control. 2018;7(1):88.
- 13. La stratégie NOSO en bref[Stratégie nationale de surveillance, de prévention et de lutte contre les infections liées aux soins. Santé 2020. [Internet]. Conseil fédéral. Confédération suisse; 2016. Available from: https://www. bag.admin.ch/bag/fr/home/strategie-und-politik/nationale-gesundheit sstrategien/strategie-noso--spital--und-pflegeheiminfektionen/noso-inpflegeheimen.html

- Précautions Standard: Guide romand pour la prévention des infections associées aux soins [Internet]. Unité cantonale HPCi Vaud; 2017. Available from: www.hpci.ch
- 15. Optimiser la gestion des excreta: Conseils pour prévenir la transmission croisée [Internet]. Réseau national de prévention des infections associées aux soins & Groupe d'évaluation des pratiques en hygiène hospitalière; 2017. Available from: https://www.cpias-ile-de-france.fr/docprocom/ems. php
- SN EN ISO 15833 Part 1: General requirements, terms and definitions and tests [Internet]. International Organization for Standardization; 2006. Available from: https://www.iso.org/standard/41076.html
- SN EN ISO 15833 Part 3: Requirements and tests for washer-disinfectors employing thermal disinfection for human waste containers [Internet]. International Organization for Standardization; 2006. Available from: https://www.iso.org/standard/41078.html
- Directives et recommandations architecturales des établissements médico-sociaux vaudois (DAEMS) [Internet]. Département de la santé et de l'action sociale; 2019. Available from: https://www.vd.ch/sante-soinset-handicap/pour-les-professionnels/construire#c1028953
- Lepainteur M, Nérome S, Bendjelloul G, Monteil C, Cottard-Boulle B, Nion-Huang M, et al. Evaluation of excreta management in a large French multi-hospital institution. J Hosp Infect. 2015;91(4):346–50.
- Van Knippenberg-Gordebeke G. Surveys bedpan management in The Netherlands (1990 and 2010) progress in correct use of washer disinfectors. Am J Infect Control. 2011;39(5):E22–3.
- 21. Van Knippenberg-Gordebeke G. P376: dirty bedpans and MDRO: partners in crime? Antimicrob Resist Infect Control. 2013;2(1):P376.
- Popp W, Zorigt K, Borg M, Zerafa S, Khamis N, Damani N, et al. Global practices related to handling of faeces and urine in hospitals - results of an IFIC survey. Int J Infect Control [Internet]. 2015 Mar 11 [cited 2024 Oct 2];11(1). Available from: https://ijic.info/article/view/13605
- Lee MH, Lee GA, Lee SH, Park YH. A systematic review on the causes of the transmission and control measures of outbreaks in longterm care facilities: back to basics of infection control. PLoS ONE. 2020;15(3):e0229911.
- Fraenkel C, Inghammar M, Söderlund-Strand A, Johansson PJH, Böttiger B. Risk factors for hospital norovirus outbreaks: impact of vomiting, genotype, and multi-occupancy rooms. J Hosp Infect. 2018;98(4):398–403.
- Strausbaugh LJ, Sukumar SR, Joseph CL, High KP. Infectious disease outbreaks in nursing homes: an unappreciated hazard for frail elderly persons. Clin Infect Dis. 2003;36(7):870–6.
- Leece P, Whelan M, Costa AP, Daneman N, Johnstone J, McGeer A, et al. Nursing home crowding and its association with outbreak-associated respiratory infection in Ontario, Canada before the COVID-19 pandemic (2014–19): a retrospective cohort study. Lancet Healthy Longev. 2023;4(3):e107–14.
- Fischer F, Lange K, Klose K, Greiner W, Kraemer A. Barriers and strategies in guideline implementation—a scoping review. Healthcare. 2016;4(3):36.
- Actualisation des précautions standard [Internet]. SF2H; 2017. Available from: https://www.sf2h.net/publications/actualisation-des-precautionsstandard.html
- Bonnes pratiques de gestion des excreta en établissements de soins chroniques et socio-sanitaires [Internet]. Unité cantonale HPCi Vaud; 2024. Available from: www.hpci.ch
- Héquet D, Kessler S, Rettenmund G, Lemmenmeier E, Qalla-Widmer L, Gardiol C, et al. Healthcare-associated infections and antibiotic use in long-term care residents from two geographical regions in Switzerland. J Hosp Infect. 2021;1(117):172–8.
- Health Building Note 00-03: Clinical and clinical support spaces [Internet]. 2013. Available from: https://www.england.nhs.uk/publication/desig ning-generic-clinical-and-clinical-support-spaces-hbn-00-03/
- Macve JC, Weinbren MJ. Dirty utility room design and aerosolization of organisms. J Hosp Infect. 2012;81(1):66–7.
- Elia F, Calzavarini F, Bianco P, Vecchietti RG, Macor AF, D'Orazio A, et al. A nudge intervention to improve hand hygiene compliance in the hospital. Intern Emerg Med. 2022;17(7):1899–905.
- U.S. Centers for Disease Control and Prevention. Infection Control. 2024 [cited 2024 Oct 2]. A Rational Approach to Disinfection and Sterilization. Available from: https://www.cdc.gov/infection-control/hcp/disinfectionsterilization/rational-approach.html

- World Health Organization. Global guidelines for the prevention of surgical site infection [Internet]. [cited 2024 Oct 2]. Available from: https:// www.who.int/publications/i/item/9789241550475
- 36. Apple M. Toward a safer and cleaner way: dealing with human waste in healthcare. HERD Health Environ Res Des J. 2016;9(4):26–34.
- Hatt S, Schindler B, Bach D, Greene C. Washer disinfector and alkaline detergent efficacy against C. difficile on plastic bedpans. Am J Infect Control. 2020;48(7):761–4.
- Alfa MJ, Olson N, Buelow-Smith L, Murray BL. Alkaline detergent combined with a routine ward bedpan washer disinfector cycle eradicates clostridium difficile spores from the surface of plastic bedpans. Am J Infect Control. 2013;41(4):381–3.
- Dempsey KM, Chiew RF, McKenzie JA, Mitchell DH. Evaluation of the cleaning and disinfection efficacy of the DEKO-190; award-based automated washer/disinfector. J Hosp Infect. 2000;46(1):50–4.
- 40. Bonnes pratiques de retraitement des dispositifs médicaux [Internet]. Société suisse de stérilisation hospitalière, Société suisse d'hygiène hospitalière & Swissmedic, Institut suisse des produits thérapeutiques; 2022. Available from: https://www.swissmedic.ch/swissmedic/fr/home/dispo sitifs-medicaux/retraitement-et-maintenance/retraitement.html
- Arladeen Tomiczek C, Stumpo JD. Enhancing patient safety through the management of clostridium difficile at Toronto east general hospital. Healthcare Quart. 2006;9:50–3. https://doi.org/10.12927/hcg.2013.18459.
- 42. Molly Bridget Delaney. Right to know: reducing risks of fecal pathogen exposure for ED patients and staff. J Emerg Nurs. 2014;40(4):352–6. https://doi.org/10.1016/j.jen.2013.07.022.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.