ORIGINAL RESEARCH ARTICLE

Hygiene and waste management practices in healthcare facilities: Toward sustainable nursing care. A cross-sectional survey

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ABSTRACT

Background: Hygiene practices in healthcare settings are crucial for infection prevention, patient safety, and they have significant public health and environmental implications. Routine patient-care activities generate substantial healthcare waste, contributing to the ecological footprint. This multicentre, cross-sectional observational study investigated patient hygiene management and waste disposal in healthcare facilities, focusing on nursing and midwifery coordinators' practices, knowledge, awareness.

Methods: An anonymous online survey was conducted between April and December 2024 among coordinators from eleven public and private healthcare facilities in Apulia, Southern Italy. Data included organizational protocols, hygiene practices, and waste management procedures. Descriptive statistics and Chi-square tests were used, with $p < 0.05$ considered significant.

Results: 123 coordinators participated. Sixty-five percent (n = 79) reported absence of hygiene protocols, 71.5% (n = 88) lacked standard operating procedures. Liquid soap was used by 58% (n = 72) and single-use soaped gloves by 41.5% (n = 51) . Urban-like waste management protocols were present in 79.7% (n = 98) of units. Refillable dispensers and reusable bottles were used in 30.1% (n = 37) of units, while 69.1% (n = 85) disposed of residual detergents into the sewage system. Refillable dispensers were in 21.6% (n = 8) of ICUs, 42.3% (n = 16) of surgical wards, and 35.1% (n = 13) of medical and long-term care wards. The source of hygiene products for self-sufficient patients differed significantly across clinical areas ($\chi^2 = 10.91$, df = 2, $p = 0.013$).

Discussion and Conclusions: Considerable variability exists in hygiene practices and waste management across clinical areas, with gaps in protocol availability and adherence. Environmental sustainability remains inconsistently addressed. Coordinators play a strategic role in improving standardization and promoting sustainable

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practices. Implementing standardized, evidence-based hygiene protocols, staff training, and sustainable waste-management practices, is essential to improve patient safety, infection prevention, and environmental sustainability in healthcare facilities.

Key words: nursing practice, environmental sustainability, hygiene management, waste disposal, sustainable healthcare, nursing leadership

Introduction

Personal hygiene represents a fundamental public health measure, contributing to health promotion, infection prevention and control (IPC), and patient safety within healthcare settings. From a broader public health perspective, hygiene practices in healthcare facilities should not be regarded solely as elements of bedside care; rather, they constitute structured preventive interventions embedded within institutional IPC systems and quality-of-care frameworks (1,2). In healthcare settings, hygiene-related care activities are a core component of nursing practice,including skin cleansing, oral care and perineal hygiene- are routinely performed as part of daily management. These practices are particularly relevant for individuals who are unable to perform self-care due to acute illness, functional limitations, or cognitive impairment (3,4). In this context, the organization, standardization and supervision of hygiene practices represent key components of IPC strategies aimed at reducing healthcare-associated infections (HAIs) (5). The IPC strategies framework should be broader, encompassing environmental hygiene, organizational practices and operational conditions influencing infection prevention (6). Although hygiene procedures may be carried out by different healthcare professionals, the responsibility for planning, standardizing, and monitoring these processes traditionally falls within the nursing domain, given nurses' central role in care coordination and patient safety (7).For this reason, hygiene practices should be formalized through shared protocols and operational guidelines, ensuring consistency, traceability, and adherence to evidence-based standards (8). The availability of written procedures has been associated with improved compliance with recommended practices and with a reduction in procedural errors and variability among healthcare operators (9,10). Beyond their clinical relevance, hygiene-related care activities represent a significant source of healthcare waste, including disposable materials, packaging, and single-use devices. Hospitals generate large volumes of waste on a daily basis, much of which derives from routine patient-care procedures, thereby contributing significantly to the environmental footprint of healthcare systems (11). The World Health Organization (WHO) has emphasized that inadequately managed healthcare waste poses serious risks to human health and ecosystems, highlighting the need for structured systems for waste segregation, recycling and safe disposal as integral components of healthcare quality and safety (12). Within a One Health perspective—recognizing the interconnection between human health, environmental health and ecosystem sustainability—the excessive production and improper management of healthcare waste can itself become a determinant of adverse health outcomes (13, 14). Thus, while personal hygiene remains a cornerstone of infection prevention and health promotion, its implementation within healthcare settings must be balanced with environmentally responsible practices that mitigate avoidable waste generation and resource overuse (15). Clarifying this relationship is essential: hygiene practices contribute directly to infection prevention, whereas the materials and processes used to implement them may indirectly affect population health through environmental impact. Integrating IPC and sustainable waste management therefore represents a dual public health objective (16). In recent years, environmental sustainability has increasingly been recognized as a

core dimension of public health and healthcare performance. In line with this prospective, the European Union has introduced progressively stricter regulations on recyclable packaging, waste reduction and environmental reporting within the healthcare sector, with the objective of achieving full recyclability of all packaging by 2030 (17). Despite these regulatory efforts, the implementation of sustainable or "green" practices in healthcare settings remains heterogeneous and often limited by organizational constraints, insufficient staff training, and the absence of standardized operational models integrating environmental considerations into routine clinical activities (18–20).Within this framework, nurses and midwives – and particularly those holding coordination and managerial roles - are increasingly recognized as key actors in promoting environmentally responsible healthcare practices. Nursing and midwifery coordinators are typically responsible for the development, implementation, and supervision of clinical protocols, including those related to patient hygiene and waste management, and they play a strategic role in translating institutional sustainability goals into everyday practice (21, 22). Coordinators are commonly entrusted with: (i) drafting and updating local operational procedures; (ii) ensuring staff compliance with institutional and national IPC standards; (iii) monitoring resource utilization and supply management; (iv) overseeing waste segregation practices within clinical units; and (v) liaising with hospital management regarding procurement and sustainability initiatives (23, 24). Their decision-making authority therefore extends beyond direct patient care to encompass organizational governance, quality assurance, and environmental performance at unit level (25). Emerging evidence highlights the potential of nursing leadership to support environmentally sustainable health systems through staff education, advocacy, and participation in organizational decision-making and policy development (26). Eco-conscious nursing is increasingly conceptualized as an ethical and professional responsibility, linking patient well-being, infection prevention and environmental stewardship (27). Given this governance role, focusing specifically on nursing and midwifery coordinators is methodologically justified. Unlike staff nurses, whose primary responsibilities concern direct care delivery, coordinators operate at an intermediate managerial level where clinical protocols, resource allocation, and waste management practices converge (24, 25). Their knowledge, attitudes, and practices therefore have the potential to influence both infection prevention outcomes and the environmental footprint of healthcare services (24, 28). In light of these considerations, this study aimed to investigate the management of patient-hygiene activities and related waste-disposal processes in healthcare facilities in Southern Italy, focusing on the practices, knowledge, and awareness of nursing and midwifery coordinators. By situating hygiene-related care within the broader intersection of public health, IPC strategies, and sustainable healthcare waste management, the study seeks to explore how organizational leadership at unit level may contribute to aligning infection prevention objectives with environmental sustainability goals (13, 28). The decision to focus on coordinators was based on their organizational authority and their capacity to influence both clinical and environmental performance within healthcare institutions, particularly through protocol development, staff supervision, and resource management.

Methods

Study design

A multicentre, cross-sectional observational study was conducted between April and December 2024 using an anonymous online survey. The study adopted a descriptive-analytical approach to explore organisational practices related to patient hygiene procedures and the management of waste comparable to municipal waste within healthcare facilities. The study was designed and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (29).

Setting and participants

The study was carried out across eleven public and private healthcare facilities located in the Apulia region of Southern Italy. including hospital and long-term care institutions operating within the Italian

National Health Service. A convenience sampling strategy was adopted. Eligible participants were nursing and midwifery coordinators, working in medical, surgical, intensive care units, geriatric and long-term care units. Exclusion criteria included professionals without organisational or managerial responsibilities, those engaged exclusively in direct patient care, and those working solely in academic or educational roles. Emergency departments and outpatient services were excluded because hygiene procedures and related waste management processes in these settings are highly variable and primarily influenced by acute, time-critical clinical interventions rather than standardised organisational protocols. The exclusion was therefore intended to ensure greater homogeneity of organisational practices across the included units.

Data collection procedures

Data were collected through a self-administered anonymous questionnaire distributed via the LimeSurvey® online platform. The survey link was sent by email to eligible participants, together with an information sheet explaining the study objectives, the voluntary participation, confidentiality guarantees and estimated completion time. A snowball dissemination strategy was subsequently adopted to maximise outreach within the regional network of nursing coordinators. Two reminder emails were sent at four-week intervals to improve the response rate. To ensure data security and prevent automated submissions, CAPTCHA verification was implemented. Access to the dataset was restricted to the principal investigator.

Instrument

The questionnaire was developed following a review of the relevant literature on patient hygiene practices, infection prevention and control, and healthcare waste management, environmentally sustainable healthcare practices.

As no validated instrument, the questionnaire underwent pilot testing with a small group of nursing coordinators to assess clarity and comprehensibility; minor wording adjustments were made accordingly. The questionnaire consisted of 11 multiple-choice items organised into three sections:

- Sociodemographic and work-related characteristics (3 items: region of employment, type of healthcare facility, and clinical working area);
- Procedures and operational instructions for patient cleansing and hygiene, including product types and packaging (4 items);
- Procedures and operational instructions for the management and disposal of waste comparable to municipal waste (4 items).

The complete questionnaire is provided in Figure 1.

Sample size

Given the exploratory nature of the study and the lack of prior data on this topic within the Italian healthcare context, a formal sample size calculation was not performed. In line with methodological recommendations for exploratory cross-sectional studies, a non-probability convenience sampling strategy was adopted. All eligible nursing and midwifery coordinators working in the participating centres during the study period were invited to participate.

Statistical analysis

Data were analysed using Stata/MP 14 (StataCorp LP, College Station, TX, USA). Continuous variables were described using means and standard deviations (SD), while categorical variables were summarised as absolute frequencies and percentages. Multiple-response items were treated as separate dichotomous variables (yes/no). Associations between reported practices and clinical working areas were assessed using contingency tables and tested with the Chi-square test of independence. All statistical tests were two-tailed, and a p-value < 0.05 was considered statistically significant.

Ethical considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki and complied with European and national data protection

DATA COLLECTION QUESTIONNAIRE

Survey on the Management and Disposal Procedures
of Products Used for Patient Hygiene Care

The questionnaire proposed by the research group of the Hygiene and Preventive Medicine Section and the Nursing Section of the University of Bari aims to investigate how environmental sustainability is addressed in daily patient hygiene practices, with a view toward increasingly green healthcare settings.

Through a series of questions directed to nursing and/or midwifery coordinators, we aim to identify operational procedures, the environmental sustainability of the products used, and their disposal methods currently in practice.

1. Region where you currently work (please specify): _____
2. Please indicate the type of facility that most closely reflects your current workplace:
- Hospital/University Hospital
- Scientific Institute for Research, Hospitalization and Healthcare (IRCCS)
- Hospice
- Private Clinic
- Residential Care Facility (RSA)
- Community Hospital
3. Current clinical area (please indicate the one most similar to your unit):
- Medical
- Surgical
- Intensive Care Unit
- Long-term care
4. Unit/Department: _____
5. In your hospital/unit, patient hygiene practices are based on:
- Hospital protocol or procedure
- Internal unit-specific procedure
- Simple internal operating instructions
- Routine practice
6. For non-self-sufficient or bedridden patients, which products are used for hygiene/cleansing?
- Liquid cleansing soap
- Solid soap
- Disposable cleansing wipes
- Cleansing foam
- Disposable soaped mitts or sponges
- Don't know
7. For self-sufficient patients, what is the source of hygiene/cleansing products?
- All products are provided by the healthcare facility
- Products may come from both the patient's home and the healthcare facility
- No products are provided; patients or relatives bring them from home
8. Regarding the packaging of hygiene products provided by the healthcare facility, which are mainly used?
- Wall-mounted refillable dispensers
- Single-use products/kits
- Paper/cardboard packaging
- Reusable plastic containers
- Biodegradable containers
- Don't know
9. In your unit, management and disposal of municipal-like waste are based on:
- Hospital protocol or procedure
- Internal unit-specific procedure
- Simple internal operating instructions
- Routine practice
10. Disposal of products/detergents provided for self-sufficient patients involves:
- Disposal in waste bins within patient rooms or care areas
- Disposal in bins located in areas accessible to users and designated for separate collection
- Disposal in bins located in staff-only areas designated for separate collection
11. Residual products/detergents used by healthcare staff (for non-self-sufficient or bedridden patients):
- Discharged into the sewage system
- Disposed of as liquid waste in dedicated containers
12. Residual products/detergents provided for self-sufficient patients:
- Discharged into the sewage system
- Handed over to healthcare staff for proper disposal

Figure 1. Data collection questionnaire.

regulations, including the General Data Protection Regulation (EU Regulation 2016/679) and Italian Law 523/1999. Participation in the survey was voluntary and anonymous. Completion of the online questionnaire was considered to imply informed consent. The survey platform was password-protected, and only the principal investigator had access to the raw dataset. In accordance with current Italian regulations for observational studies (AIFA Determina Presidenziale n. 425/2024), formal approval from an institutional review board was not required.

Results

A total of 123 nursing coordinators participated in the study. Ninety-five point nine percent of coordinators (n=118) worked in hospital settings, 3.3 % (n = 4) in research hospital (IRCCS), and 0.8 % (n = 1) in a private nursing care clinic (Table 1).

Regarding clinical areas, 40.6% (n = 50) were in surgical wards, 42.3% (n = 52) in medical wards and long-term care, 17.1% (n = 21) in intensive unit. Sixty-five percent (n=79) of respondents reported the absence of a formal protocol for patient hygiene, and 71.5% (n=88) lacked standard operating procedures. Fifty-eight percent (n=72) of respondents used liquid soap and 41.5% (n=51) single-use soaped gloves, while solid soap was not reported. For self-sufficient patients, 53.7% (n=66) reported a mixed supply (hospital + home source). Urban-like waste-management protocols existed in 79.7% (n=98) of units. Refillable dispensers and reusable bottles accounted for 30.1% (n=37;) of packaging. However, 69.1% (n=85) of respondents reported disposing of residual detergents directly into the sewage system (Table 2).

Table 1. Characteristics of the study participants (N = 123).

Variable	n	%
Care setting		
Hospital employment	118	95.9
IRCCS	4	3.3
Private facility	1	0.8
Area		
Surgical area	50	40.6
Medical area	52	42.3
Intensive care unit	21	17.1
Total participants	123	100

Values are expressed as number (n) and percentage (%). *Abbreviations:* IRCCS = Istituto di Ricovero e Cura a Carattere Scientifico.

When stratified by clinical area (Table 3), refillable dispensers were reported in 21.6% (n=8) of intensive care units, 42.3% (n= 16) of surgical wardsand 35.1% (n=13) of medical and long term care wards. Hospital protocols for waste management were reported as reference documents from 44.9% (n=44) to 16.3% (n=16) across the different clinical areas. The availability of hygiene protocols was reported in 53.5% (n=23) of medical and long term care wards, 20.9% (n=9) of intensive care units, and 25.6% (n=11) of surgical wards. Among the investigated variables, only the source of hygiene products for self-sufficient patients showed a statistically significant difference across clinical areas ($\chi^2 = 10.91$, df = 2, p =0.013).

Discussion

This exploratory survey provides one of the first regional overviews of hygiene patients practices, and the management of waste, generated by hygiene-related procedures in Italian healthcare facilities.

The findings highlight substantial variability across clinical areas and reveal that standardized hygiene protocols are often lacking. Such heterogeneity suggests that hygiene routines are frequently driven by habit and local custom rather than institutional policy (30). Similar variability has been reported internationally, particularly in studies examining bed bathing and skin cleansing practices, where differences in bathing frequency, cleansing agents, and bathing methods reflect local protocols, resource availability, and professional preferences rather than standardized evidence-based guidelines (31-33). Stratification by clinical area, with higher availability of hygiene protocols in medical and long-term care wards, suggests that surgical and intensive care units may exhibit greater procedural gaps. Such disparities in adherence to hygiene practices could adversely affect the consistency and quality of patient hygiene behaviours, as evidenced by lower compliance rates observed in these

Table 2. Hygiene practices, product use, and waste management procedures (N = 123)

Item and Response' Options	No (%)	No (n.)	Yes (%)	Yes (n.)	TOT
Reference for patient hygiene					
Protocol	65.0	79	**34.9**	43	122
Standard Operating Procedures	71.5	88	28.5	35	123
Simple Operational Instruction	64.2	79	**35.8**	44	123
Informal practices	87.8	108	12.19	15	123
Dependent patients: type of hygiene product					
Liquid cleansing soap	41.5	51	**58.5**	72	123
Solid cleansing soap	100	123	0	0	123
Single-use cleansing wipes	82.9	102	17.1	21	123
Cleansing foam	95.9	118	4.1	5	123
Single-use soaped mitts or sponges	58.5	72	**41.5**	51	123
Don't know	97.6	120	2.4	3	123
Self-sufficient patients: source of products					
All supplied by facility	73.2	90	26.8	33	123
From patient's home and facility	46.3	57	**53.7**	66	123
Exclusively from patient's home	77.2	95	22.8	28	123
Management and disposal of urban-like waste					
Protocol	20.3	25	79.7	**98**	123
Standard Operating Procedures	88.6	109	11.4	14	123
Simple Operational Instruction	92.7	114	7.3	9	123
Informal practices	93.5	115	6.5	8	123
Residue disposal					
Discharged by patients into sewage system	30.9	38	**69.1**	85	123
Properly disposed by health care staff	69.1	85	30.9	38	123
Packaging supplied by the hospital/facility					
Wall-mounted refillable dispenser	69.9	86	**30.1**	37	123
Single-use products	78.9	97	21.1	26	123
Reusable plastic bottles/containers	69.9	86	**30.1**	37	123
Biodegradable bottles/containers	89.4	110	10.6	13	123
Don't know	91.9	113	8.1	10	123

Values are expressed as number (n) and percentage (%). Percentages may not total exactly 100% due to rounding. Items correspond to survey questions investigating patient hygiene practices, hygiene product use, and waste management procedures in healthcare facilities.

Table 3. Patient hygiene practices and environmental management across clinical areas

Item and response options	Surgical n (%)	Long-term/Medical n (%)	ICU n (%)	P-value
Reference for patient hygiene				0.215
Protocol	11 (25.6)	23 (53.5)	9 (20.9)	
SOP / operational instructions	**37 (44.6)**	**27 (32.5)**	**15 (18.1)**	
Informal practices	6 (40.0)	6 (40.0)	3 (20.0)	
Dependent patients: hygiene products				0.827
Liquid cleansing soap	**30 (41.7)**	29 (40.3)	**13 (18.1)**	
Single-use wipes	9 (42.9)	7 (33.3)	5 (23.8)	
Single-use soaped mitts/sponges	17 (33.3)	23 (45.1)	11 (21.6)	
Self-sufficient patients: source of hygiene products				0.013
All supplied by facility	13 (39.4)	8 (24.2)	12 (36.4)	
Home + facility	25 (37.9)	**34 (51.5)**	7 (10.6)	
Exclusively from home	**13 (46.4)**	11 (39.3)	4 (14.3)	
Packaging supplied by facility				0.801
Wall-mounted refillable dispensers	**16 (43.2)**	13 (35.1)	8 (21.6)	
Single-use packaging	11 (42.3)	11 (42.3)	4 (15.4)	
Reusable / biodegradable containers	18 (36.0)	**24 (48.0)**	8 (16.0)	
Municipal-like waste management reference				0.264
Protocol	38 (38.8)	44 (44.9)	16 (16.3)	
SOP / operational instructions	11 (40.7)	9 (33.3)	5 (18.5)	
Informal practices	5 (83.3)	1 (16.7)	0 (0.0)	
Disposal of hygiene products (self-sufficient patients)				0.449
Patient room container	33 (44.6)	28 (37.8)	13 (17.6)	
Recycling container	17 (34.0)	24 (48.0)	8 (16.0)	
Residue disposal				0.705
Discharged into sewage system	35 (38.5)	40 (44.0)	16 (17.6)	
Disposed in specialized containers	15 (46.9)	12 (37.5)	5 (15.6)	

Percentages are calculated on the total number of responses for each option.

high-intensity settings compared with clinical wards (34, 35). Variability in hygiene infrastructure — including the presence of refillable dispensers, liquid soap, single-use wipes, and the absence of bar soap — reflects differences in operational guidance and logistical preferences across wards. These disparities can contribute to inconsistent adherence to hygiene practices, particularly in high-intensity units such as surgical wards and ICUs, potentially impacting patient safety and infection prevention (36). Moreover, the observation that a substantial proportion of self-sufficient patients rely on a mixed supply of hygiene products, including both hospital-provided and home-sourced items, points to a fragmented approach to resource management. Such variability may influence product quality, standardization of care, and infection control measures, highlighting a critical opportunity for improvement in health service effectiveness and governance (37). These findings are consistent with previous evidence indicating that the availability of

appropriate hygiene resources, combined with adequate patient education on proper cleansing practices, is associated with improved hygiene conditions and better adherence to recommended standards (35). Although environmental sustainability is increasingly acknowledged as a strategic goal, its integration into daily clinical practice remains limited (38,39). Several studies have highlighted a persistent gap between formal environmental policies and their actual implementation in hospital practice. Most healthcare organisations recognise sustainability as a strategic priority, but only a minority have formalised it in operational protocols (40). the existence of a formal protocol does not guarantee proper implementation and underscores the need for active managerial oversight, structured operational procedures, and continuous auditing to ensure compliance—core elements of public health governance (41,42). Insufficient staff training, limited resources, and weak organisational support are common barriers, while clinical priorities often override environmental goals (18,43). Similar gaps have been identified elsewhere, where hospitals continue to rely heavily on disposable products, contributing substantially to the healthcare sector's carbon footprint (41,42). From an organizational perspective, nurse and midwifery coordinators play a pivotal leadership role in advancing environmentally responsible behaviors in healthcare organizations. Prior research shows that targeted education and supportive institutional culture can significantly enhance compliance with sustainable practices (44,45). Developing structured training on product selection, recycling, and safe disposal could therefore reduce healthcare's ecological footprint while maintaining high standards of care quality and patient safety (46). Several limitations should be considered when interpreting these results. Data were collected from a single Italian region (Apulia), which limits generalizability to other contexts. The sample was predominantly composed of public hospital coordinators, with limited representation from long-term or private facilities. The cross-sectional design precludes causal inference, and self-reported data may have been influenced by recall or social-desirability bias. Nevertheless, this study provides valuable baseline evidence and identifies areas where standardized guidelines and targeted educational programs could enhance both clinical and environmental performance. Embedding environmental sustainability within nursing practice aligns with emerging global evidence that links resource efficiency with improved patient outcomes and organizational resilience (47,22). Moving forward, multicenter studies and policy-level initiatives should explore how healthcare systems can balance infection prevention, patient safety, and ecological responsibility.

Conclusions

This study reveals significant variability in patient hygiene practices and waste management across clinical areas, indicating gaps in standardization and health service effectiveness. The limited availability of protocols and the inconsistent sourcing of hygiene products highlight the need for stronger quality audit systems to ensure consistency and accountability. Despite the presence of waste management protocols, inappropriate disposal practices persist, reflecting weaknesses in public health governance and a gap between policy and implementation. From a policy and managerial perspective, the adoption of standardized, evidence-based protocols, combined with regular auditing, staff training, and stronger organizational oversight, is essential to improve care quality, patient safety, and environmental sustainability.

Abbreviation:

WHO — World Health Organization
STROBE — Strengthening the Reporting of Observational Studies in EpidemiologyIPC infection prevention and control
HAIs — healthcare-associated infections SD standard deviations
IRCSS — research hospital

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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