

Hand hygiene quality indicator in Nursing home Ljubljana Slovenia

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A – Development of the concept and methodology of the study; B – Query – a review and analysis of the literature; C – Submission of the application to the appropriate Bioethics Committee; D – Collection of research material; E – Analysis of the research material; F – Preparation of draft version of manuscript; G – Critical analysis of manuscript draft version; H – Statistical analysis of the research material; I – Interpretation of the performed statistical analysis; K – Technical preparation of manuscript in accordance with the journal regulations; L – Supervision of the research and preparation of the manuscript

Abstract

Introduction. Hand hygiene is a key indicator of quality and safety in long-term care facilities. This study aimed to assess compliance with hand hygiene practices in a nursing care home for older adults in 2025.

Methods. An observational audit was conducted from 1 July to 27 August 2025 across six departments of the care home, following the World Health Organization (WHO) “Five Moments for Hand Hygiene” methodology. Observations were performed openly, and healthcare personnel were aware that hand hygiene monitoring was taking place. The minimum required number of 424 hand hygiene opportunities was defined according to institutional standards issued by the Ministry of Health. The target number was not based on a statistical power calculation but followed predefined quality assurance requirements.

Results. Overall hand hygiene compliance was 84.76%, with the highest adherence among physiotherapists, occupational therapists, and social workers (100%), followed by healthcare professionals with compliance above 80%, and the lowest among cleaning staff (68.75%). A total of 433 hand hygiene opportunities were observed. Overall compliance ratio was 367 out of 433 (84.76%), with a 95% Wilson confidence interval of 81.07% to 87.84%.

Discussion. The results indicate good overall compliance with hand hygiene practices, although improvements are possible regarding disinfectant accessibility and the regularity of monitoring. These findings may inform quality improvement efforts aimed at strengthening resident safety and care quality.

Keywords: hand hygiene, quality, long-term care facility, observational audit.

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INTRODUCTION

Hand hygiene is a fundamental measure for preventing the transmission of infections in healthcare and social care settings. For over a decade, the World Health Organization (WHO) has promoted global hand hygiene programmes as a key indicator of patient safety and quality of care [1]. In long-term care facilities, where vulnerable populations reside, consistent hand hygiene is especially important. In Slovenia, the Ministry of Health and the National Institute of Public Health (NIJZ) regularly issue guidelines for the proper implementation of hand hygiene practices [2]. The Ministry of Health of the Republic of Slovenia (MZ RS) has incorporated the regular monitoring and evaluation of hand hygiene practices into the quality system in healthcare and social care institutions [3].

In residential settings for older people, such as long-term care facilities (LTCFs), hand hygiene is a critical, yet often under-optimised aspect of infection prevention. Residents of these institutions are typically elderly people, have with multiple comorbidities, and are physiologically vulnerable; conse-

quently, the risk and impact of healthcare-associated infections (HAIs) are disproportionately high compared with acute care settings [4]. A recent European Centre for Disease Prevention and Control (ECDC) survey reported that 3.1% of residents in European LTCFs had at least one HAI at the time of measurement, and almost one-third of facilities lacked a regular system to monitor hand hygiene compliance or provide feedback [5].

Empirical studies consistently show suboptimal adherence to hand hygiene protocols among care staff in long-term care settings. Observational data indicate that average compliance rates can be as low as 17 %, with considerable variation between wards and facilities [6]. Intervention research shows that targeted environmental changes, such as the strategic placement of alcohol-based hand rub (ABHR) dispensers, can significantly improve compliance. For example, a Danish study found that installing an additional ABHR dispenser in each resident’s room increased compliance by 18 percentage points within five months [7].

These findings highlight that, although the efficacy of hand hygiene in preventing microbial transmission is well established,

its consistent implementation in the social care context remains inadequate. Therefore, there is a pressing need for multimodal, context-specific strategies, including improved accessibility of hygiene resources, behavioural interventions, staff training, monitoring, and systematic feedback, to strengthen infection prevention practices and safeguard the health of older residents [8].

The aim of this study was to analyse hand hygiene compliance among staff at the Residential Care Home for Older Adults in Ljubljana, Slovenia, and to identify areas where further improvements are possible.

METHODS

In 2025, we conducted the first hand hygiene (HH) observation of the year, an important indicator of the quality and safety of resident care. Compliance was monitored according to the World Health Organization (WHO) “Five Moments for Hand Hygiene” methodology. Observations took place across all six departments of the nursing home from 1 July to 27 August 2025. Nurses with specialised expertise in infection prevention, who held certification in hand hygiene observation, performed the observations. The nursing home has 212 beds, and 433 hand hygiene opportunities were recorded. Observations were conducted openly, and healthcare personnel were informed that monitoring was taking place. The minimum required number of 424 hand hygiene opportunities was determined in accordance with institutional standards issued by the Ministry of Health. The minimum required number of observed hand hygiene opportunities were calculated according to institutional audit standards as: $N = \text{number of beds} \times \text{opportunities per bed} \times 2$, where the factor $\times 2$ represents, where the factor $\times 2$ represents two observation cycles performed to improve representativeness across routine care. Although observers were certified, formal inter-observer reliability testing or calibration (such as agreement statistics) was not performed. The target number of observations was set by institutional audit standards rather than statistical power considerations.

The predefined minimum of 424 observed hand hygiene opportunities represents the institutional audit threshold required to complete monitoring. Data collection continued until the end of the observation period, resulting in 433 opportunities recorded; all observed opportunities were included in the analysis.

Compliance was calculated as the proportion of observed hand hygiene actions performed (alcohol-based hand rub and/or hand washing) out of the total number of observed hand hygiene opportunities, expressed as a percentage. For indication-based compliance (Table 3), each opportunity was classified according to the corresponding indication moment, and compliance for each moment was calculated as $(\text{hand rub} + \text{hand washing}) / \text{opportunities for that moment} \times 100$. Percentages may not sum due to rounding. Note: $\text{Compliance (\%)} = (\text{Disinfections} + \text{Washing}) / \text{Indications} \times 100$ for each indication moment.

RESULTS

No handwashing events were observed; all recorded hand hygiene actions were performed using alcohol-based hand rub.

TABLE 1. Number of observed occasions by individual departments.

ID	Department	Number of beds	Number of occasions observed	Number of opportunities collected at the end of the observation
1	AP	2	40	44
2	A1/D1	43	86	86
3	A2/D2	43	86	86
4	CP	22	44	44
5	C1/B1	42	84	87
6	C2/B2	42	84	86
TOTAL		212	424	433

Note: No handwashing events were observed; this is reflected as 0 in the Handwashing column.

Table 2 presents variations in hand hygiene compliance across different professions. The results show that the highest compliance was among physiotherapists, occupational therapists, and social workers, followed by registered nurses, social caregivers, nursing technicians, paramedics, doctors, nursing students, and cleaners. Overall hand hygiene compliance was 84.76%.

Note: Some professional categories include a small number of observed opportunities; compliance estimates for these subsamples (e.g. 100%) should be interpreted with caution due to statistical imprecision.

TABLE 2. Basic calculation of compliance in hand hygiene implementation according to classification.

#	Prof.Cat.	Opportunities (no.)	Hand rub (ABHR) (n)	Handwashing (n)	No. of observers	Compliance (%)
1	Doctor	26	21	0	1	80.77%
2	Registered nurse	19	17	0	1	89.47%
3	Healthcare technician	38	33	0	1	86.84%
4	Paramedic (health care assistant)	120	102	0	1	85%
5	Social care worker – nursing care	112	98	0	1	87.50%
6	Physiotherapist	8	8	0	1	100%
7	Occupational therapist	8	8	0	1	100%
8	Social worker	5	5	0	1	100%
9	Cleaners	16	11	0	1	68.75%
10	Nursing students	81	64	0	1	79.01%
TOTAL NUMBER OF HAND HYGIENE		433	367	0	1	84.76%

Note: Some professional categories, including social workers (n=5), had a limited number of observed hand hygiene opportunities, likely reflecting their reduced frequency of direct daily contact with residents in the ward setting.

We also presented the calculation by individual indication. The highest compliance was observed for the “Before contact” moment (89.17%), which may reflect increased attention to hand hygiene before patient contact and the perceived importance of protecting both patients and staff. This was followed by “After contact with a patient” (84.54%), “After contact with bodily fluids” (83.72%), “Before aseptic procedure” (81.82%), and “After contact with the environment” (80%), as shown in Table 3.

TABLE 3. Optional calculation of compliance in hand hygiene implementation according to indication.

#	Indication	Indications (no.)	Hand rub (ABHR) (n)	Handwashing (n)	Compliance (%)
1	Before contact	157	140	0	89.17 %
2	Before aseptic procedure	11	9	0	81.82 %
3	After contact with bodily fluids	43	36	0	83.72 %
4	After contact with a patient	97	82	0	84.54 %
5	After contact with the environment	125	100	0	80.0 %

During the observation of hand hygiene practices, in addition to monitoring compliance with the “Five Moments for Hand Hygiene”, several other irregularities were identified, all of which are crucial for preventing the transmission of infections in long-term care facilities. These findings will be discussed in the Discussion section.

DISCUSSION

Our observations of hand hygiene practices indicate that hand hygiene in the residential care home for older adults is good and meets the Ministry of Health in Slovenia’s required standard of over 70% compliance. The overall hand hygiene compliance observed in this study was 84.76%, which represents a relatively high compliance rate given the diverse professional groups employed in long-term care facilities. It is also important to note that, in Slovenia, staffing constraints may influence workload and infection prevention practices; therefore, achieving such a high compliance rate is particularly encouraging. These results suggest that staff are aware of the importance of hand hygiene and demonstrate a commitment to maintaining proper infection prevention practices.

Handwashing was not observed during the audit. This may reflect workflow constraints and local practice patterns, but it also limits interpretation of adherence to recommendations that specify handwashing in certain situations (e.g., when hands are visibly soiled).

Hand hygiene compliance reflects adherence to recommended practice and is widely used as a process quality indicator. However, compliance rates alone do not demonstrate infection outcomes in a given setting; outcome evaluation would require linked surveillance data and appropriate study designs.

Limitations in this observational audit was conducted in a single long-term care facility, which may limit generalisability. As observations were performed overtly, the Hawthorne effect cannot be excluded. Inter-observer reliability was not formally assessed, which may have introduced measurement variability. Finally, the audit measured hand hygiene compliance as a process indicator and did not include infection outcome data (e.g., healthcare-associated infection rates); therefore, the findings should not be interpreted as direct evidence of patient safety initiatives or infection prevention efforts.

Interpretation of subgroup estimates should be made with caution. Several professional categories and indication moments include small numbers of observed opportunities; therefore, proportions such as 100% compliance in these

subsamples are statistically unstable and may not reflect typical practice. Differences between groups and moments are presented descriptively without measures of uncertainty (e.g., confidence intervals) and should not be overinterpreted.

Group differences were reported descriptively; formal hypothesis testing for differences between professional categories or indication moments was not performed. Where feasible, future work could apply simple inferential statistics (e.g., chi-square tests) with confidence intervals to evaluate whether observed differences are statistically significant.

The present dataset reports compliance separately by professional category (Table 2) and by indication moment (Table 3). A combined analysis (professional category × indication moment) was not performed and is recommended for future audits.

Compliance differences by department or unit type were not analysed because observations were not separated by department in the dataset. Future audits could incorporate stratification by department and professional category to identify targeted improvement opportunities.

Examples of imprecision in small subsamples include: Physiotherapist: 8/8 (100.0%; 95% CI 67.6–100.0%); Occupational therapist: 8/8 (100.0%; 95% CI 67.6–100.0%); Social worker: 5/5 (100.0%; 95% CI 56.6–100.0%). Observed system-level hygiene deviations (qualitative observations). In addition to structured hand hygiene opportunities, observers noted several hygiene-related deviations in routine practice (e.g. glove use, laundry handling, trolley hygiene). These observations were recorded qualitatively and non-systematically to provide contextual information. They were not collected using a standardised checklist, and therefore no prevalence, causal inference, or trend interpretation is implied.

During inspection of the morning care trolley, it was found that the hand sanitiser dispensers were on multiple occasions non-functional—the pump mechanism was missing or the container was empty in several departments. Such deficiencies limit access to proper hand disinfection and can directly compromise infection prevention efforts. Furthermore, instances of improper handling of clean and soiled laundry were observed; clean laundry was occasionally placed on or in contact with protective work clothing, increasing the risk of cross-contamination. Proper preparation for work was not always ensured, as staff were sometimes seen leaning on the trolley during care procedures, which may compromise both safety and hygiene. Additionally, towels intended for residents were sometimes carried over the shoulder instead of being placed in designated clean areas, again posing a contamination risk. In several instances, gloves were not changed after contact with clean laundry, and staff occasionally touched door handles or opened doors while still wearing gloves used during resident care – practices that facilitate the spread of microorganisms. Some staff members were also observed dragging bed sheets across the floor while changing them, resulting in contamination of the linen and a breach of hygiene standards. These findings highlight that, beyond hand hygiene, strict adherence to all infection-prevention principles in daily routines is essential for safeguarding residents’ health and ensuring a hygienically safe environment in care homes.

Recent evidence indicates that hand hygiene practices in long-term care facilities (LTCFs) remain suboptimal despite the high risk of healthcare-associated infections (HAIs) among residents. Haenen et al. found that the overall hand hygiene

compliance rate in European LTCFs was only 17%, with considerable variation between wards and professional groups [6]. This low adherence is particularly concerning as older adults in care homes are typically immunocompromised and frequently exposed to invasive care procedures that increase infection risk [9].

Multiple factors influence compliance among care staff. Studies highlight management engagement, accessibility of hygiene materials, staff workload, and perception of infection risk as critical determinants of hand hygiene behaviour [10]. In residential care homes, where care delivery is often routine and less supervised than in acute hospital settings, these factors become even more pronounced. Organisational culture, resource availability, and leadership example significantly shape daily hygiene behaviour among nursing staff [11].

Multifaceted interventions have shown potential to improve compliance in LTCFs. In a stepped-wedge cluster-randomised trial in 14 Dutch care homes, Teesing et al. demonstrated a 13% absolute increase in compliance after an intervention combining education, visual reminders, observation, and structured feedback [12]. Similarly, a Danish study reported that simply adding alcohol-based hand-rub (ABHR) dispensers to each resident's room increased compliance by 18 percentage points within five months [6]. These results underscore that even modest infrastructural changes, when combined with feedback and staff engagement, can have measurable effects on infection control outcomes.

Despite promising results, several challenges remain. Methodological heterogeneity – differences in measurement methods, definitions of compliance, and contextual variables – limits the comparability and generalisability of findings [7]. Furthermore, many studies focus on the frequency of hand hygiene actions rather than their quality. A recent systematic review by Shi et al. [4] found that although reported compliance rates were sometimes high (up to 93%), the technique often did not meet WHO standards, with critical areas of the hands frequently missed [8]. This quality gap poses particular risks in LTCFs, where staff may have limited infection control training and high workloads.

Although the present audit demonstrated a relatively high overall hand hygiene compliance (84.76%), the assessment focused on whether hand hygiene was performed at the indicated moments and did not evaluate the quality or completeness of the technique. Proper execution of hand hygiene involves not only performing the action at the recommended moments but also applying the technique correctly. The World Health Organization's hand hygiene guidelines specify a structured multi-step technique designed to ensure that all hand surfaces are adequately decontaminated, as incomplete coverage may leave areas such as fingertips, thumbs, and interdigital spaces insufficiently treated, thereby reducing microbial removal efficacy (World Health Organization, 2009).

Experimental and observational evidence suggests that incomplete or incorrect technique significantly diminishes the effectiveness of microbial load reduction compared with full adherence to the recommended steps, indicating that compliance rates alone may overestimate the true effectiveness of hand hygiene practices (Erasmus et al., 2010). Therefore, high compliance observed in this study should be interpreted as adherence to the indication moments rather than confirmation of optimal decontamination quality.

Furthermore, systematic reviews demonstrate that sustainable improvement in hand hygiene requires not only monitoring frequency, but also continuous education, structured feedback, and multimodal strategies that explicitly address technique quality alongside behavioural and organisational determinants (Gould et al., 2017). Future audits in long-term care settings may benefit from incorporating structured assessments of hand hygiene technique (e.g., checklist-based evaluation or fluorescent marker methods) to complement compliance monitoring.

This audit focused on whether hand hygiene was performed at the indicated moments and did not assess the technique or completeness of hand rub application, such as coverage of all hand surfaces. Incorporating technique assessment using a structured checklist could strengthen future evaluations.

Suggestions for improving hand hygiene compliance include ensuring better availability of disinfectants in corridors, in front of resident rooms, and in isolation areas. Regular internal audits and feedback mechanisms, such as hand hygiene checks and monitoring the proper handling of laundry, can reinforce best practices. Practical training through simulations and workshops on the correct use of personal protective equipment, including gloves and disinfectants, is also recommended. To encourage adherence, incentives and recognition of good practice – such as introducing a symbolic “hygiene ambassador of the month” award – can be effective. Finally, posters and information boards illustrating proper hand hygiene techniques, placed in visible locations such as cloakrooms, corridors, and bathrooms, can serve as constant reminders for staff and help sustain high standards of infection prevention.

There is still a need for further research focusing specifically on LTCFs, as most existing studies are based on acute-care or hospital settings. Future studies should examine the sustainability of intervention effects, the influence of leadership and safety culture, and the cost-effectiveness of hygiene interventions in resource-limited social-care environments. Developing long-term monitoring systems and behavioural approaches tailored to the LTCF context will be essential to ensure lasting improvements in infection prevention and resident safety.

CONCLUSION

This observational audit found a relatively high overall hand hygiene compliance (84.76%) in the observed long-term care setting. Despite this, opportunities for improvement remain, particularly in sustaining performance across indications and professional categories, and in addressing system-level hygiene deviations noted during observations. Ongoing monitoring, feedback, and targeted quality improvement interventions are recommended.

Improving hand hygiene in LTCFs is not merely a procedural task—it is a core component of patient safety and quality of care. Achieving and maintaining high compliance requires a sustained cultural and organisational commitment that recognises hand hygiene as a shared responsibility among all staff involved in the care of older adults.

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