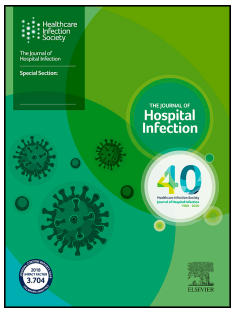

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Hand hygiene performance in medical students and the general population: objective assessment and behavioural factors

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Summary

Background: Inadequate hand hygiene (HH) remains a major driver of healthcare-associated infections, with implications extending beyond healthcare workers to the general population.
Aims: To objectively assess HH performance among medical students, compare it with the general population, and examine associated attitudes and self-reported behaviours.
Methods: In this cross-sectional study, third- and fifth-year medical students (n=192 and n=134) and a general population sample (n=216) performed HH using a fluorescent dye-containing alcohol-based hand rub (ABHR). Coverage was objectively quantified by digital imaging, and participants completed a study-specific questionnaire.
Findings: Mean coverage across four hand surfaces was 86.4% overall and higher in medical students than the general population (94.2% vs 74.6%; p<0.001), and in fifth- than third-year students (96.8% vs 92.4%; p<0.001). The dominant palm showed the highest coverage, whereas the dorsum and thumb were most often insufficiently covered. Target coverage (≥95%) across all surfaces was achieved by 37.5% overall, more frequently in medical students than the general population (58.0% vs 6.5%; p<0.001) and in fifth- than third-year students (75.4% vs 45.8%; p<0.001). Multivariable analysis showed that prior HH training (odds ratio [OR] 12.8, 95% confidence interval [CI] 6.4-25.6), ABHR preference (OR 10.8, 95% CI 6.1-19.0), and self-reported adherence to HH technique (OR 1.6, 95% CI 1.0-2.4) independently predicted target coverage. Protection of one's own health predominated across groups; however, medical students more frequently also reported prosocial motives for ABHR.
Conclusion: The findings underscore the importance of strengthening HH training, shaping attitudes, and integrating real-time electronic feedback throughout medical education and the population.

Keywords: hand hygiene, medical student, general population, hand rub, objective assessment, questionnaire

Introduction

Healthcare-associated infections (HAIs) constitute the most common adverse events in hospital care, representing a major threat to patient safety and imposing a substantial burden on

health systems and society [1, 2]. Transmission of HAIs occurs predominantly via the contaminated hands of healthcare workers (HCWs), rendering effective hand hygiene (HH) fundamental to infection prevention [3]. Since the late 1990s, alcohol-based hand rub (ABHR) has been established as the global standard of care and remains the single most effective intervention for reducing HAIs and limiting the spread of antimicrobial resistance [1].

While earlier decades resolved many technical and laboratory-related aspects of HH, contemporary challenges increasingly concern behavioural determinants, including attitudes towards ABHR and the sustained adoption of appropriate HH practices. Use of ABHR is shaped not only by scientific evidence but also by extensive misinformation, which adversely affects HH implementation in both healthcare and community settings. HH should not be viewed merely as a technical procedure. Its effectiveness depends on a multimodal strategy that includes system-level factors, education, monitoring and performance feedback, workplace reminders, and a supportive institutional safety climate [1, 4].

The practical execution of HH, most commonly based on the World Health Organization (WHO) six-step technique designed to ensure complete coverage of all hand surfaces, represents a learned motor skill that requires systematic instruction and continuous reinforcement. A persistent and well-documented discrepancy between declared knowledge, formal education, attitudes, and actual HH practice among HCWs further highlights the need for a comprehensive research agenda aimed at identifying determinants of HH quality and behaviour [1, 5].

Concurrently, increased openness of healthcare facilities to patient visitors, an emphasis on shortening hospital stays, and the expansion of outpatient care have intensified contact between the general population and healthcare environments. Strengthening technically correct and time-efficient HH practices in the general population is therefore relevant not only for HAI prevention but also as a critical public health measure in extraordinary circumstances, such as the COVID-19 pandemic [1].

Medical students represent a distinct and underexplored group within this framework. During the second half of their training, they transition into regular bedside clinical practice and prepare for independent professional roles, at a stage when HH should already be firmly established as a habitual and resilient skill. Despite the tendency of HH performance to deteriorate over time without reinforcement, students approaching graduation would be expected to demonstrate consistently high-quality HH practice [6].

Against this background, the present study examined HH among medical students and the general population. The primary aim was to assess the quality of hand rub coverage among medical students during the clinical phase of their education and to compare these findings with the general population. In parallel, the study evaluated attitudes towards HH and self-reported behaviour. By integrating objectively measured hand rub performance with attitudinal and behavioural data, the study sought to identify associations, gaps, and determinants of HH quality, to inform targeted educational strategies and guide future research.

Methods

Study population and setting

A cross-sectional study was conducted among medical students enrolled in the General Medicine programme at the Faculty of Medicine and Dentistry, Palacký University Olomouc, Czech Republic, and a comparison sample from the general population. All third-year (n=219) and fifth-year (n=173) medical students were invited to participate during scheduled teaching activities at the Department of Public Health between November 2024 and June 2025. This department delivers undergraduate teaching in hygiene, epidemiology, and infection prevention, including practical training in HH techniques. Within the medical curriculum, HH training is provided during preclinical and clinical years through a combination of lectures and supervised practical sessions with visualisation of hand coverage using fluorescent ABHR; however, formal competency-based validation is not uniformly implemented.

The general population sample consisted of adult patients attending routine preventive and occupational health examinations at a general practitioner's office (author's practice) between September and November 2025; all attendees during this period were invited to participate. No financial or material incentives were provided. The study population was ethnically homogeneous, with participants predominantly of European origin.

Participants first completed a paper-based questionnaire and were subsequently asked to perform HH in the manner they considered correct, using ABHR dispensed from a pump bottle. All measurements were performed under direct investigator supervision. Assessments were conducted using the Semmelweis Training Rub (HandInScan Zrt., Debrecen, Hungary), a liquid ABHR containing 70% ethanol and a regulatory-wise insignificant amount (<0.02%) of fluorescent dye. Neither the duration of hand rubbing nor the volume of ABHR applied (number of pump actuations) was standardised or recommended and was left to participants' discretion. After participants indicated that their hands felt dry, hand rub coverage was assessed using the Semmelweis Hand Hygiene System (HandInScan Zrt.), a digital health technology enabling objective visualisation and quantification of hand coverage following a HH event. The system uses fluorescence-based imaging combined with artificial intelligence-driven image processing to detect adequately and inadequately covered areas at pixel-level resolution and to compute the percentage of covered hand surface relative to total hand area. Target (safe) coverage was defined as at least 95% of the total hand surface, in accordance with the manufacturer's recommendation [7, 8]. Participants received immediate visual feedback on hand rub coverage following assessment as part of the study procedure.

Questionnaire

A study-specific questionnaire was developed based on a review of the existing literature to assess descriptive characteristics, prior HH training, and self-reported HH practices, preferences, motivations, and attitudes (Supplementary Appendix 1). The questionnaire comprised ten closed-ended items, including two multiple-response questions, and was piloted in medical students and members of the general population to ensure comprehensibility. A bespoke instrument was used because commonly applied questionnaires primarily focus on HH knowledge or are insufficiently concise for the objectives of the present study, including WHO-based tools. For regression analyses, multiple-response items were conceptually aggregated to avoid overparameterization, with decision-related factors grouped into practical barriers and perceptual concerns, and motivational responses dichotomised according to the presence of any

prosocial motive. Ordinal items with sparse response categories were collapsed a priori to ensure model stability (Supplementary Appendix 2).

Statistics

Statistical analyses were conducted using the R software environment (R Foundation for Statistical Computing). Numerical variables were summarised using descriptive statistics, and normality was assessed with the Shapiro–Wilk test. Group differences were evaluated using the Mann–Whitney U test for non-normally distributed continuous variables and the χ^2 test for categorical variables. Determinants of achieving target hand rub coverage (≥95%) across all four hand surfaces were examined using multivariable logistic regression. Predictors were defined a priori based on a conceptual framework encompassing sociodemographic characteristics and questionnaire-derived items. Two complementary models were fitted: one including the entire study population and a second restricted to medical students to explore determinants within the clinical training context. The significance level was set at 5%.

Results

The study population comprised 326 medical students (192 third-year and 134 fifth-year students) and 216 participants from the general population. While sex distribution in the general population was approximately balanced, women were significantly overrepresented among medical students (by 21.5%; $p<0.001$; Table 1). Participants from the general population were, on average, 11.6 years older than medical students ($p<0.001$). The representation of hand dominance was similar across study groups. Mean hand surface area was significantly larger in the general population than among students, consistent with the higher proportion of men in this group (difference 8.7 cm^2; $p<0.001$).

Mean hand rub coverage across all four hand surfaces was 86.4% in the entire study population (Table 1). In both medical students and the general population, the highest coverage was consistently observed on the dominant palm, whereas the lowest coverage occurred on the dominant dorsum. Overall hand rub coverage differed significantly between the two study groups, with higher coverage among medical students than in the general population (difference 19.6%; $p<0.001$). A smaller but statistically significant difference was also observed between student years, with fifth-year students achieving higher coverage than third-year students (difference 4.4%; $p<0.001$). Notably, even the lowest-performing surface, i.e. the dominant hand dorsum, did not fall below a mean coverage of 95% among fifth-year students. Figure 1 illustrates the distribution of hand rub coverage across individual hand areas, highlighting the thumb as the most frequently insufficiently covered region.

Target coverage across all four hand surfaces was achieved by 203 participants (37.5%) in the entire study population. Target attainment was substantially more frequent among medical students than in the general population (189 participants [58.0%] vs 14 participants [6.5%]; $p<0{\cdot}001$). Within the student group, success rates differed significantly by year of study, with higher attainment among fifth-year compared with third-year students (101 [75.4%] vs 88 [45.8%]; $p<0.001$).

Attitudes towards HH and self-reported behaviour are summarised in Table 2. Most questionnaire-derived measures differed significantly between medical students and the general population. Medical students - almost all of whom reported prior HH training, compared with

fewer than one third of the general population - more frequently reported adherence to the recommended HH technique, more often identified prosocial factors as a motivation for HH and rated ABHR as very effective. Within the student group, differences between years of study were limited to reported prior training and adherence to recommended technique, both of which increased from the third to the fifth year.

Multivariable logistic regression confirmed pronounced differences in achieving target hand rub coverage across study groups (Table 3). Medical students had substantially higher odds of successful coverage than the general population (odds ratio [OR] 4.2; $p<0.001$), and fifth-year students outperformed third-year students (OR 1.9; $p<0.001$). In the overall study population, prior HH training emerged as a strong predictor of success (OR 12.8; $p<0.001$), as did preference for ABHR over hand washing (OR 10.8; $p<0{\cdot}001$). Across both the entire population and the student group, self-reported consistent adherence ("always") to the recommended HH technique was similarly associated with higher odds of successful coverage. Among medical students only, a higher daily frequency of handrub was additionally associated with successful coverage.

Discussion

Achievement of objectively measured target hand rub coverage was uncommon in the general population, whereas medical students achieved this benchmark substantially more often, with performance improving with advancing year of study. This gradient mirrored the distribution of prior HH training within the study population, with previous training emerging as a strong determinant of successful hand rub coverage, increasing the odds more than twelvefold. These findings align with a broad body of evidence underscoring the role of education and training in improving HH performance. Even single-session HH training interventions have been shown to enhance technique [9], while sustained improvements have been reported among individuals exposed to repeated training within continuing healthcare education programmes [10]. In clinical settings, continuous education supported by electronic HH monitoring systems providing individualised feedback has been associated with improved technique among HCWs and with subsequent reductions in bloodstream HAIs [11]. In this context, the inclusion of a general population comparator provided contextual interpretation of medical students' performance, as objective assessment of HH using fluorescence-based systems is not routinely standardised and comparative data across populations remain limited.

Self-reported adherence to the recommended HH technique was significantly higher among medical students than in the general population and increased with year of study. In multivariable analyses, the adherence independently increased the likelihood of achieving target hand rub coverage, highlighting correct technique as a prerequisite for effective HH. A systematic review by Mouajou et al, encompassing 35 studies of HH among HCWs, reported adherence rates typically ranging between 60% and 70%, with most studies relying on self-reporting or direct observation rather than objective electronic assessment [3]. In contrast, the fluorescent-based method applied in the present study provides a validated and highly accurate measure of effective hand rub application, with reported sensitivity of 95.1% and specificity of 98.0% for identifying adequately disinfected hand surfaces [7].

The educational value of electronic HH monitoring systems has been demonstrated previously. Using the same device as in the present study, Lehotsky et al. reported incorrect

hand rubbing in 33% of HCWs across 26 Hungarian hospitals [12]. In an interventional study, the proportion of inadequate hand rubbing decreased from 50% to 15% when participants received immediate visual feedback highlighting missed areas on their hands [13].

Taken together, these findings reinforce the central importance of systematic education in HH technique and of sustained awareness of correct hand rub application, both of which emerged as key determinants of effective HH performance in the present study.

Although the present study focused on objectively measured hand rub performance, this represents only one, albeit critical, component of effective prevention of hand-transmitted HAIs. Establishing and sustaining appropriate HH practice requires consideration of individual attitudes, intentions, perceived barriers and facilitators, and social norms related to HH behaviour [14]. In our study, medical students, who outperformed the general population in hand rub coverage, more frequently reported prosocial motivations for performing HH, such as protecting the health of others, whereas no between-group differences were observed in the reported decision-making factors influencing the choice between hand washing and ABHR.

Importantly, self-reported preference for ABHR emerged as one of the strongest predictors of successful hand rub coverage. ABHRs are known to effectively remove microorganisms, require less time, and cause less skin irritation than hand washing with soap and water; consequently, they are considered the preferred method for routine HH in health-care settings [15]. These findings suggest that addressing barriers to the acceptance and preference of ABHR - through education, behavioural framing, and system-level support - may be essential for optimising HH performance and its preventive potential.

Although medical students are not primary decision-makers in clinical care, they play an integral role in patient safety through their direct contact with patients during clinical clerkships. A global review by Shyaka et al. showed that, despite generally positive attitudes towards HH, both knowledge and practical performance among medical students remain suboptimal, suggesting that favourable attitudes alone are insufficient without structured and repeated training [6]. In line with this notion, our findings demonstrate superior hand rub performance among senior compared with junior medical students, likely reflecting greater cumulative exposure to HH training and clinical practice during the later years of medical education. Similar gradients across years of study have been reported previously; for example, Barry et al. observed higher HH practice scores among fifth-year students compared with those in earlier years of training [16].

Previous studies have identified the fingertips, thumbs, and dorsum of the hand as areas frequently missed during HH [17, 18], including investigations using objective fluorescence-based assessment systems [8]. In the present study, the highest coverage was observed on the palm of the dominant hand, whereas the lowest coverage occurred on its dorsum. This palmar-dorsal asymmetry of the dominant hand has not been explicitly described previously, which may partly reflect the scarce use of objective, high-resolution methods for assessing hand rub coverage [8]. Effective HH depends not only on correct hand rub technique but also on the volume of ABHR applied. Previous studies consistently show a dose-response relationship between ABHR volume and bacterial reduction [19]. In this context, dispenser type, its functional status, and users' awareness of the need for sufficient ABHR volume (balanced against the risks of spillage and prolonged drying time) are critical determinants of effective HH [20]. Hand size was accounted for in the regression analysis, with no independent

association with target coverage. The volume and duration of hand rubbing were not standardised, as the aim was to capture real-world HH performance, in which selecting an appropriate amount and duration are integral components of correct technique.

A key strength of this study is the combined assessment of HH performance in medical students and the general population using both self-reported attitudes and behaviours and an objective, high-resolution system for hand rub coverage evaluation. Because safe HH depends on adequate coverage of all hand surfaces, analyses focused on a clinically meaningful binary outcome rather than mean coverage values. A limitation is the unequal sex distribution between study groups; however, this reflects the underlying composition of the respective populations, with women predominating among medical students.

In conclusion, using objective assessment of hand rub coverage, this study identified substantial gaps in effective HH within the general population and consistently better performance among medical students, improving with advancing year of study. Prior HH training emerged as a key determinant of safe hand rub performance, alongside preference for ABHR over conventional hand washing and, to a lesser extent, adherence to recommended technique. While personal health protection was the predominant motivation for HH, prosocial motives were more frequently reported among medical students. Together, these findings highlight the central role of structured education, technique awareness, and behavioural factors in achieving effective HH and underscore the importance of reinforcing these elements during medical training and beyond.

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CRediT authorship contribution statement

La. Štěpánek: Writing — original draft, Visualisation, Project administration, Methodology, Investigation. R. Trajerová: Writing — review & editing, Methodology, Funding acquisition, Data curation, Conceptualisation. Lu. Štěpánek: Visualisation, Formal analysis. D. Horáková: Writing — review & editing, Supervision.

Conflict of interest statement

None declared.

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Ethics statement

The study was approved by the Ethics Committee of the University Hospital Olomouc and the Faculty of Medicine and Dentistry, Palacký University Olomouc (reference number 138/24).

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Figure 1. Schematic representation of hand rub coverage in the overall population (A), medical students (B), and the general population (C). The dominant hand is shown on the right in all panels.

Table 1. Characteristics of the study population – numerical variables as mean (95 % confidence interval of mean)

Table 2. Questionnaire survey – frequency of answers (n, %)

Table 3. Prediction of achieving target hand rub coverage across all four hand surfaces in the entire sample (left of slash) and in medical students only (right of slash)

Table 1. Characteristics of the study population – numerical variables as mean (95 % confidence interval of mean)

Characteristics	Entire sample	Medical students			General public	P-value (students vs public)	P-value (3rd vs 5th year students)
		All students	3rd year	5th year			
N (females, males)	542 (316, 226)	326 (218, 108)	192 (122, 70)	134 (96, 38)	216 (98, 118)	<0.001	0.126
Age (year)	27.4 (26.6, 28.2)	22.8 (22.6, 23.0)	21.9 (21.6, 22.1)	24.1 (23.9, 24.2)	34.4 (32.7, 36.1)	<0.001	<0.001
Right-handed (n, %)	505 (93.2%)	304 (93.3%)	181 (94.3%)	123 (91.8%)	201 (93.1%)	0.929	0.380
Surface area of hand (cm^2)	157.9 (156.3, 159.4)	154.4 (152.6, 156.3)	153.8 (151.3, 156.3)	155.3 (152.6, 158.0)	163.1 (160.4, 165.8)	<0.001	0.481
Overall hand rub coverage (%)*	86.4 (84.8, 88.0)	94.2 (92.9, 95.5)	92.4 (90.6, 94.1)	96.8 (95.0, 98.6)	74.6 (71.7, 77.6)	<0.001	<0.001
Dominant palm coverage (%)	92.6 (91.3, 93.9)	96.9 (95.9, 97.9)	96.0 (94.6, 97.4)	98.2 (96.7, 99.7)	86.1 (83.4, 88.9)	<0.001	<0.001
Non-dominant palm coverage (%)	91.2 (89.8, 92.6)	95.7 (94.5, 96.9)	94.7 (93.0, 96.4)	97.2 (95.4, 98.9)	84.4 (81.6, 87.3)	<0.001	<0.001
Dominant dorsum coverage (%)	79.4 (77.1, 81.7)	91.8 (90.1, 93.6)	89.3 (86.9, 91.7)	95.5 (93.1, 98.0)	60.7 (56.7, 64.6)	<0.001	<0.001
Non-dominant dorsum coverage (%)	82.3 (80.3, 84.3)	92.3 (90.6, 94.0)	89.5 (87.1, 92.0)	96.2 (94.2, 98.3)	67.3 (63.8, 70.8)	<0.001	<0.001

*mean coverage across four predefined hand surfaces (dominant palm, non-dominant palm, dominant dorsum, non-dominant dorsum)

Characteristics		Entire sample	Medical students			General public	P-value (students vs public)	P-value (3rd vs 5th year students)
			All students	3rd year	5th year			
Previous hand hygiene training (hand rub) - Yes		369 (68.1)	300 (92.0)	170 (88.5)	130 (97.0)	69 (31.9)	<0.001	0.005
Frequency of alcohol-based hand rub use per day	0–2 times	396 (73.1)	240 (73.6)	143 (74.5)	97 (72.4)	156 (72.2)	0.063	0.103
	3–4 times	115 (21.2)	74 (22.7)	46 (24.0)	28 (20.9)	41 (19.0)		
	5–7 times	21 (3.9)	9 (2.8)	2 (1.0)	7 (5.2)	12 (5.6)		
	≥ 8 times	10 (1.8)	3 (0.9)	1 (0.5)	2 (1.5)	7 (3.2)		
Preference for alcohol-based hand rub over conventional hand washing - Yes		94 (17.3)	64 (19.6)	35 (18.2)	29 (21.6)	30 (13.9)	0.084	0.445
Factors influencing choice between alcohol-based hand rub and conventional hand washing	Time required	153 (28.2)	103 (31.6)	58 (30.2)	45 (33.6)	50 (23.1)	0.148	0.717
	Effort required	65 (12.0)	37 (11.3)	20 (10.4)	17 (12.7)	28 (13.0)		
	Sensory perception of hands	339 (62.5)	212 (65.0)	127 (66.1)	85 (63.4)	127 (58.8)		
	Availability of appropriate facilities	286 (52.8)	183 (56.1)	104 (54.2)	79 (59.0)	103 (47.7)		
	Skin irritation	224 (41.3)	159 (48.8)	100 (52.1)	59 (44.0)	65 (30.1)		
	Concerns regarding effectiveness	49 (9.0)	33 (10.1)	20 (10.4)	13 (9.7)	16 (7.4)		
Adherence to recommended hand hygiene technique (WHO)	Always	73 (13.5)	55 (16.9)	28 (14.6)	27 (20.1)	18 (8.3)	<0.001	0.009
	Mostly	288 (53.1)	213 (65.3)	118 (61.5)	95 (70.9)	75 (34.7)		
	Occasionally	128 (23.6)	56 (17.2)	44 (22.9)	12 (9.0)	72 (33.3)		
	Never	53 (9.8)	2 (0.6)	2 (1.0)	0	51 (23.6)		
Motivations for hand hygiene with an alcohol-based hand rub	Protection of own health	462 (85.2)	285 (87.4)	169 (88.0)	116 (86.6)	177 (81.9)	<0.001	0.779
	Protection of others' health	248 (45.8)	187 (57.4)	112 (58.3)	75 (56.0)	61 (28.2)		
	Recommendations and institutional regulations	90 (16.6)	64 (19.6)	41 (21.4)	23 (17.2)	26 (12.0)		
Perceived effectiveness of	Very effective	354 (65.3)	245 (75.2)	136 (70.8)	109 (81.3)	109 (50.5)	<0.001	0.109
	Effective	177 (32.7)	80 (24.5)	55 (28.6)	25 (18.7)	97 (44.9)		

alcohol-based hand rub in preventing infection transmission	Less effective	10 (1.8)	1 (0.3)	1 (0.5)	0	9 (4.2)		
	Ineffective	1 (0.2)	0	0	0	1 (0.5)		

Table 2. Questionnaire survey – frequency of answers (n, %)

Table 3. Prediction of achieving target hand rub coverage across all four hand surfaces in the entire sample (left of slash) and in medical students only (right of slash)

Determinants		**Odds ratio (OR)**	**95% confidence interval of OR**	**Standard error**	**P-value**
Study group (general public as reference) in first model		4.22	2.63-6.75	0.240	<0.001
Year of study (3rd year as ref.) in second model		1.94	2.68-1.41	0.165	<0.001
Sex (male as ref.)		1.11/1.01	0.84-1.46/0.74-1.39	0.142/0.162	0.469/0.934
Age (per 1-year increase)		1.02/1.00	0.98-1.06/0.85-1.18	0.020/0.085	0.456/0.987
Hand dominance (right as ref.)		1.15/1.71	0.76-1.76/0.99-2.51	0.215/0.259	0.507/0.052
Surface area of hand (per 1 cm² increase)		0.98/0.98	0.96-1.03/0.97-1.02	0.187/0.081	0.374/0.974
Previous hand hygiene training (no as ref.)		12.83/0.76	6.43-25.59/0.49-1.19	0.352/0.229	<0.001/0.230
Frequency of alcohol-based hand rub use per day (0–2 times as ref.)	3–4 times	0.71/0.86	0.47-1.06/0.52-1.42	0.207/0.257	0.096/0.547
	≥ 5 times	1.26/1.87	0.81-1.97/1.05-3.33	0.228/0.294	0.312/0.032
Preference for alcohol-based hand rub over conventional hand washing (no as ref.)		10.79/1.02	6.14-18.95/0.75-1.41	0.287/0.162	<0.001/0.881
Factors influencing choice between hand rub and hand washing	Practical barriers (no as ref.)	1.04/1.06	0.81-1.34/0.80-1.42	0.127/0.146	0.745/0.670
	Perceptual concerns (no as ref.)	1.02/0.97	0.76-1.36/0.70-1.36	0.149/0.172	0.918/0.882
Adherence to recommended hand hygiene technique (never or occasionally as ref.)	Always	1.57/1.65	1.04-2.36/1.03-2.65	0.208/0.240	0.032/0.036
	Mostly	1.22/1.18	0.91-1.65/0.84-1.66	0.152/0.174	0.183/0.347
Motivations for hand hygiene with an alcohol-based hand rub (no prosocial motive as ref.)		1.07/1.05	0.85-1.33/0.81-1.35	0.115/0.131	0.581/0.726
Perceived effectiveness of alcohol-based hand rub (not very effective as ref.)		1.17/1.05	0.92-1.49/0.80-1.40	0.123/0.143	0.198/0.714