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Title:

Attitudes and practices of Irish hospital-based physicians towards hand hygiene and handrubbing using alcohol-based hand rubs, a comparison between 2007 and 2015.

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Running Title:

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Key Words

Hand hygiene, handrubbing, alcohol-based hand rub, hospital-based physicians, medical doctors, attitudes, practices, patient safety.

Summary

Background: Hand hygiene is the cornerstone of infection prevention and control practices and reduces healthcare-associated infections significantly. Yet, international evidence suggests that medical doctors demonstrate poor compliance.

Aim: To explore and compare practices and attitudes towards hand hygiene, in particular handrubbing using alcohol-based hand rubs (ABHR), among hospital-based physicians in Ireland between 2007 and 2015.

Methods: In 2007, a random sample of doctors in a large teaching hospital was invited to complete a postal survey using a validated questionnaire. In 2015, the study was replicated among all doctors employed in a university hospital group, including the setting of the original study, using an online survey. Data were analysed using SPSS and Survey Monkey.

Findings: Predominately positive and improving attitudes and practices were found, with 86% of doctors compliant with hand hygiene before patient contact in 2015, compared to 58% in 2007. 91% were compliant after patient contact in 2015, compared to 76% in 2007. Just 39% of respondents in 2015 were using ABHR for hand hygiene almost always. However, this represents 13.5% more than in 2007. Stated barriers to use included dermatology issues and poor acceptance, tolerance and poor availability of ABHR products.

Conclusion: Greater awareness of hand hygiene guidelines and greater governance appear to have positively impacted practice. However, despite this, practice remains sub-optimal and there is scope for substantial improvement. Continued and sustained efforts are required in order to build on progress achieved since the publication in 2009 of the World Health Organisation hand hygiene guidelines.

Introduction

Patient safety is a healthcare priority and healthcare professionals globally have a responsibility to ensure that patients receive quality, safe healthcare. Infection prevention and control is a key component of patient safety programmes, with healthcare associated infections (HCAI), especially those caused by multi drug resistant organisms (MDRO), posing a significant threat to patient safety worldwide.¹ The impact of HCAI can be experienced by patients and their families, leading to increased patient morbidity and mortality and increased healthcare costs. A point-prevalence survey conducted in Ireland, the setting for this study, reported a national prevalence rate of HCAI in acute-care facilities of 5.2% and the setting for this report has experienced considerable HCAI challenges in recent years.^{2,3,4}

Preventing HCAI is a healthcare priority and hand hygiene is recognised as a standard precautionary and effective measure in controlling their spread.^{5,6} In particular, handrubbing is the preferred method of hand hygiene in most routine clinical situations and is defined as “applying an antiseptic handrub to reduce or inhibit the growth of microorganisms without the need for an exogenous source of water and requiring no rinsing or drying with towels or other devices”.¹ Yet, despite this, compliance internationally among healthcare professionals with hand hygiene remains unacceptably low.^{7,8,9} In particular, poor compliance among doctors is reported in many studies.^{5,10-13} While there has been much focus internationally on exploring doctors’ attitudes and practices regarding hand hygiene and handrubbing, research from Ireland regarding this topic has been limited.¹⁴ Hence, the significance of this study in addressing the deficit of research pertaining to doctors’ hand hygiene practices from an Irish perspective.

In 2007, as part of a larger study, we conducted a study of hand hygiene practices and ABHR use among doctors in a large teaching hospital. The study was replicated in 2015 and the setting was expanded to encompass additional sites, following the formation of a university hospital group anchored by the original large teaching hospital. In the interim, World Health Organisation (WHO) hand hygiene guidelines were published and widespread implementation of the guidelines was supported nationally by governmental agencies and locally by the hospital groups’ infection prevention and control team and management team. Hence, the aim of this paper is to compare and contrast results of the two studies, conducted 8 years apart, concerning hand hygiene and handrubbing attitudes and practices of hospital-based medical doctors in Ireland. Our report further attempts to provide insight regarding the demonstrable influence of national and international guidelines in the intervening years.

Methods

Setting

In 2007, the study setting was a large regional teaching hospital providing major surgery, cancer treatment, emergency department services, critical care services and other medical, diagnostic and therapy services. In 2015, the expanded setting encompassed a university hospital group, comprising six hospitals functioning collectively as a single hospital system and included the site of the original study, the largest of the hospitals. The hospital group offers a range of inpatient, outpatient, accident and emergency and maternity care services, serves a population of approximately 400,000 people and provides approximately 750 acute hospital beds.

Design

Both studies employed a quantitative, survey approach, utilising a validated questionnaire comprising validated Likert-ordinal-attitudinal scales as the research instrument.

Between March and April 2007, a random sample of consultants and non-consultant hospital doctors employed in the aforementioned teaching hospital was invited to participate in a postal survey. A cover letter and the questionnaire were sent via the internal hospital postal system and participation indicated consent and was voluntary and anonymous.

Between November and December 2015, the setting was expanded to the aforementioned hospital group and all consultants and non-consultant hospital doctors were invited via staff email addresses to participate in the survey. They were provided a link to the online study instrument and to a concise, unbiased explanation of the survey topic. Participation indicated consent and was voluntary and anonymous. On completion of the online data collection, in order to enhance the response rate hard copies of the survey were also distributed at education and training seminars, and the data were subsequently added manually to the online database.

Study instrument and analysis

In 2007, following a literature review, a study instrument was selected for data collection. The validated questionnaire was originally developed at Columbia University, New York and was designed to assess barriers to adherence to the Centers for Disease Control and Prevention (CDC) 2002 hand hygiene guidelines.^{15,16} The survey was modified and contextualised to the Irish setting. A microbiologist and a statistician further reviewed the questionnaire for content validity and a pilot test was carried out (n=20). This helped to identify administrative and analytical issues with the research tool and process.

In 2015, the same questionnaire was used although slightly modified to reflect the publication of international hand hygiene guidelines in the interim. Additional questions were added following review by two experienced researchers (microbiologists) for content validity. No questions were removed. A pilot study was conducted contributing to the reliability and validity of the questionnaire as well as checking completion time and allowing for minor redrafting of some questions for greater clarity (n=9).

The survey was composed of 42 and 57 questions in 2007 and 2015, respectively, with Likert scale, multiple choice and 'yes or no' questions. It comprised three sections with focus on demographics, hand hygiene practices and handrubbing practices. In 2007, data were analysed using the Statistical Package for Social Sciences (SPSS), version 14 and in 2015, using SPSS, version 24. Descriptive statistics, including frequencies and percentages, were calculated. The relationship between variables was considered where there was a rationale to do so. Parametric testing was not carried out as data were ordinal and not normally distributed.¹⁷ The Pearson Chi-square test of independence (non-parametric) allowed for testing of association between variables and was suited to the categorical, ordinal data e.g. Likert scale answers in this study. We used a significance criterion of 0.05 for our statistical tests.

During data analysis, the 'agree' and 'strongly agree' response options were regarded as positive responses and the 'disagree' and 'strongly disagree' responses were regarded as negative responses. This is reflected in the presentation of results below. 'No opinion' was considered a neutral response and was not combined with any other response.

Ethics

Both studies were approved by the *Research Ethics Committee* of the hospital and hospital group, and performed in accordance with the code of ethics of the *World Medical Association Declaration of Helsinki*.¹⁸ Both studies were conducted anonymously with no identifiable data reported.

Results

In 2007, the response rate was 43% (n=65) and 15% (n=58) in 2015. 16.5% of respondents indicated medicine and 19% indicated surgery as their area of work in 2007, compared to 57% and 13.8% respectively in 2015.

Predominately positive attitudes towards hand hygiene were consistent, however, improved attitudes were found in 2015. In 2007, 76% of doctors agreed that hand hygiene improves patient outcomes, compared to 90% in 2015; while 76% in 2007 and 91% in 2015 agreed that if hand hygiene recommendations are followed it is likely that HCAI rates will decrease. 18% more doctors in 2015 believed that hand hygiene recommendations are based on sound scientific evidence. Significantly, 80% of respondents in 2015 considered that the person they report to expects adherence to hand hygiene policy, which is 24% more than in 2007 ($p=0.029$). 23% of doctors in 2007 preferred to continue personal hand washing routines rather than change to the recommended hand hygiene practices, compared to 14% in 2015. Despite these improved attitudes, some significant negative attitudes relating to convenience and practicality were more evident in 2015. Notably, 37% of respondents in 2015 considered hand hygiene to be inconvenient (10% more than in 2007) and 28% reported that it is not practical to follow hand hygiene recommendations, compared to 19% in 2007 ($p=0.039$).

In 2015, just 2% of respondents had been requested by a patient to perform hand hygiene, while 15% had observed a patient requesting another member of staff to carry out hand hygiene. When asked about their perceptions of patients' wishes, 22% of doctors in 2007 compared to 14% in 2015 agreed that patients prefer to see doctors completing a traditional hand wash instead of using ABHR and over 50% of respondents in both cohorts expressed no opinion on this. Further results of attitudes towards hand hygiene can be found in Table I.

Self-reported hand hygiene compliance improved from a low baseline in 2007. 82% of respondents in 2015 reported implementing hand hygiene recommendations, compared to 60% in 2007. Of significance, 86% of respondents in 2015 reported compliance with hand hygiene before patient contact, compared to 58% in 2007 ($p=0.004$), while 91% in 2015 reported compliance after patient contact, compared to 76% in 2007. A significant relationship was found between awareness of hand hygiene guidelines and when the study was conducted, with awareness of hand hygiene guidelines significantly improved in 2015 compared to 2007. 65% of respondents in 2015 were familiar with the WHO hand hygiene guidelines, compared to just 4.8% in 2007 ($p<0.001$), when draft guidelines were available. Similarly, in 2015 awareness of Irish national hand hygiene guidelines was 56% compared to 16% in 2007 ($p<0.001$). Further results of hand hygiene compliance can be found in Table II.

Attitudes towards handrubbing using ABHR improved. Remarkably, 98% of respondents in 2015 reported feeling competent using ABHR products in accordance with recommendations, which is

22% more than in 2007. Also, in 2015, 87% reported that ABHR help to standardise care and ensure patients are treated in a consistent manner, compared to 74% in 2007. Notably, 93% of respondents in 2015 considered that it is important to act as a role model for others when using ABHR, compared to 81% in 2007. Further results of attitudes towards handrubbing using ABHR can be found in Table III.

Handrubbing practices using ABHR were explored by examining: factors that influence adherence (Table IV), the percentage of time respondents use ABHR for hand hygiene (Table V) and the barriers to ABHR usage (Table VI). Overall, handrubbing practices have improved from a low baseline. In 2007, 'prevention of cross infection' was identified as the single most important factor that influenced adherence to ABHR practices among 50% of respondents, and this is consistent in 2015 at 48%. In 2007 'infection control policy' was identified by just 5.6% and this has doubled to 11.1% in 2015. 7.4% identified 'personal protection' in 2015, while this was not an answer option in 2007.

39% of respondents in 2015 reported using ABHR almost always (>90% of time), compared to 25% in 2007. Consequently, in 2015 15% fewer (37%) reported using ABHR often (51%-90% of the time). In 2015 7% reported using ABHR for hand hygiene rarely (<10% of the time) or never, compared to 12.7% in 2007.

While 20% of respondents in 2015 and 30% in 2007 identified 'no barriers' to adhering to ABHR, those barriers that were identified have remained consistent in the intervening years. For example, in 2015 it was evident that 'skin sensitivity' (20%) and 'skin damage' (18%) were significant barriers to ABHR usage, compared with levels of 23% and 22% respectively in 2007. Consistently, over half of the respondents (54% - 2015, 51% - 2007) agreed that skin condition would become drier and more damaged if hand hygiene recommendations were followed. 76% of respondents in 2015 disagreed that ABHR improve skin condition, compared to 66% in 2007. These results are in the context of 49% of doctors in 2015 reporting personal experience of a dermatology issues arising from hand hygiene.

Issues of user acceptability were also explored. One third of respondents in both 2007 and 2015 reported that hands do not feel clean following the use of ABHR. 39% in 2015 reported that ABHR were unpleasant to use, compared to 46% in 2007. Notably, 24% of respondents in 2015 disagreed that ABHR are readily available in the workplace, which is 11% more than in 2007. Further analysis revealed that 5.8% of consultants compared to 32.4% of non-consultant hospital doctors (NCHDs) reported this finding in 2015. 7% of respondents in 2015 considered that they do not have the time to use ABHR compared to 11% in 2007.

Discussion

This paper contributes to addressing the dearth of information pertaining to hand hygiene among hospital-based physicians in Ireland and allows for a greater understanding of their perspectives. This is the first study of its kind in Ireland and no comparable studies looking at constants and changes in hand hygiene attitudes and practices among hospital-based physicians over an eight year period were found elsewhere in the literature. Given the greater emphasis placed on hand hygiene in the intervening years, it is not unexpectedly that we report improving attitudes towards hand hygiene and in particular towards handrubbing, with more doctors in 2015 compared to 2007 accepting the scientific evidence, the likely decreased HCAI rates and the improved patient

outcomes achievable when hand hygiene recommendations are consistently followed. While the reported positive attitudes towards hand hygiene may be due to a response bias or a social desirability bias, this is somewhat offset by the inclusion of negatively worded questions and by negative attitudes also reported.

The widespread implementation of the WHO hand hygiene guidelines across the hospital group in which the study was set, coupled with the strong leadership provided by the management team and the infection prevention and control team, appears to have positively influenced attitudes and practices towards hand hygiene. More medical doctors in 2015 are aware of hand hygiene policies compared to 2007 and compared to previously reported.⁶ Almost a quarter more doctors in 2015 reported that the person they report to expects adherence to hand hygiene policy, suggesting greater governance of hand hygiene practice in recent years, in line with WHO recommendations. However, the positive attitudes are somewhat tempered by the contrasting negative attitudes expressed, relating to the effort required to comply. For example, over a quarter of doctors in 2015 (9% more than in 2007) reported that it is not practical to follow hand hygiene recommendations and over one third (10% more than in 2007) considered hand hygiene practice to be inconvenient. These findings suggest that doctors consider hand hygiene an onerous or burdensome task despite evidence that handrubbing with ABHR significantly reduces the time taken for hand hygiene.^{19,20} However, despite these negative perceptions reported, only 7% considered that they do not have time to use ABHR, differing from previous studies where workload and perceived lack of time to perform hand hygiene influenced compliance among healthcare professionals.^{19,21-23}

Despite widespread availability of ABHR dispensers throughout the hospital group poor availability of ABHR was reported among NCHDs. Perhaps, a contributing factor to this may be the regular turnover of NCHDs in the Irish healthcare system, leading to unfamiliarity with new surroundings and the location of product dispensers. However, this finding correlates with similar findings elsewhere in the US and Canada where location, inconvenience and empty product dispensers all served as potential barriers to compliance and where a working gel dispenser was found to be the most effective influencing strategy among doctors in Stanford University.^{5,13,24} Point of care availability of ABHR, conveniently located at the bedside, or the personal carriage of small containers of ABHR is essential. Sustained efforts are required to ensure supply, convenience and availability in order to avoid these potential pitfalls and support best practice among all healthcare professionals.^{1,8, 24, 25}

Self-reported hand hygiene practice has improved in the intervening eight years between the two studies, with 28% more doctors in 2015 reporting hand hygiene compliance before patient contact (86%), and 15% more after patient contact (91%), compared to in 2007. While the reported improvements are promising, these results should be interpreted cautiously. In light of the publication of the WHO guidelines in the intervening years, the sustained campaign within the study setting to improve hand hygiene compliance including target setting and the introduction of evidence-based practice bundles, few doctors can remain unaware of the importance of vigilant hand hygiene practice. In addition, we acknowledge the potential for bias associated with the study design and that inflated or inaccurate results can be introduced when respondents self-report better practice than their actual practice.²⁶⁻²⁸ However, it is reasonable to suggest that these same drivers of hand hygiene compliance, combined with the greater awareness of policies and the perception of improved governance reported in this study, may have positively impacted practice and compliance.

Another driver of hand hygiene is the patient perspective. Squires *et al.* identified the patient as an important influence for physician hand hygiene compliance and Barroso *et al.* found that 'patient request' for hand hygiene was an effective strategy for influencing compliance among medical students and doctors.^{13,24} However, in our study only 2% of physicians had been requested by a patient to perform hand hygiene. Despite the WHO recommendation to use ABHR for routine decontamination of hands in most clinical situations and not the traditional hand wash approach using soap and water, 14% (2015) of physicians considered that patients prefer to see physicians doing a traditional hand wash instead of using ABHR. This may provide one possible explanation for the low uptake of ABHR by physicians in this study. This insight into Irish physicians' perceptions of patients' perspectives supports previous findings.¹³ It further suggests scope to enhance patient education on the appropriate use of ABHR and the continuation of patient involvement in hand hygiene campaigns.

While previously, researchers contended that high self-evaluation of hand hygiene behaviour is not reflective of actual compliance and is likely inflated, our study differs, reporting low self-evaluation of ABHR usage and is comparable with others who report low compliance rates among doctors.^{22, 26, 27} ABHR are ineffective in the removal and destruction of certain spore-forming organisms (e.g. *Clostridium difficile*). However, they are appropriate in most routine clinical situations and, therefore, high compliance among rates among healthcare professionals are expected. The low percentage of doctors routinely using ABHR reported in this study raises concerns for the possible transmission of microorganisms and the potential for HCAI. While it is promising to note a 14% improvement in the use of ABHR, despite this, just 39% of doctors in 2015 were using ABHR for hand hygiene indications 'almost always'. This echoes the findings of a systematic review by Kingston *et al.* reporting that despite the widespread implementation of multi-modal hand hygiene intervention strategies compliance rates remained poor.⁷

We noted that the self-reported compliance rate of 39% in this study is considerably lower than results of a national observational hand hygiene audit. A national compliance rate of 74% is reported in Ireland for handrubbing using ABHR as a percent of hand hygiene opportunities taken, with a set target of 80%.²⁹ Notwithstanding the bias potential associated with a self-report design, the disparity between the two results adds to the debate in the literature around the merits of observational hand hygiene audit, with researchers in the UK and Australia recently suggesting that observational audit hand hygiene results, may be artificially inflated and may deny poor performance, poor methodology, poor training, the Hawthorne effect and avoidance tactics.^{19,23,30,31} We concur that it may be timely to review the setting of unrealistically high targets and move towards progressively improving performance with reasonably achievable targets and more realistic expectations, with the ultimate goal of achieving improved practices and less infection transmission.^{30,32}

Enablers or influencers of hand hygiene previously identified among doctors include self-protection, availability of role-models and perceptions of risk.^{10,21,33} In our study more doctors were influenced to adhere to handrubbing with ABHR by 'prevention of cross infection' than any other factor. 'Infection prevention and control policy', 'evidenced-based practice' and 'patient outcomes' also featured as practice influencers and these results suggest that patient safety is a priority for more Irish doctors than 'personal protection' or 'role model influence' and differ from previous results.^{21,33,34}

The barriers to hand hygiene identified in this study may provide some insight into reasons for poor compliance among doctors. One in five respondents in both cohorts identified skin sensitivity and skin damage as barriers to hand hygiene. Given that almost half of respondents in 2015 reported personal experience of a dermatology issues arising from hand hygiene, it is unsurprising that these barriers feature prominently. These barriers may constitute a deterrent to adherence to recommended practices and the widespread adoption of ABHR, and may partially account for the sub-optimal self-reported handrubbing practices. Despite evidence to suggest that ABHR are well tolerated and kinder to the skin than soap and water,³⁵⁻³⁷ our findings differ, as the majority of doctors disagreed that ABHR improve skin condition and over one third considered that their skin condition would become drier and more damaged if ABHR recommendations were followed. This is consistent with previous research where 'products drying out hands' (32%) is identified as a barrier to compliance among Canadian and American doctors and nurses.⁵

We acknowledge that there are some limitations to our research. The variation in methods between the two studies conducted and described earlier, for example, different study settings, different sample sizes and the move from postal to online survey may affect the comparability of data. Despite a larger sample (n=385) in 2015, compared to 2007 (n=151), the response rate in 2015 was lower. However, the numbers responding, although small, are comparable between both groups, 2007 (n=65) and 2015 (n=58) and are comparable to sample sizes, in similar studies on the topic.^{14,38,39} The move from postal survey in 2007 to online survey in 2015 may provide one possible explanation for the lower response rate in 2015, if medical doctors were not regularly using their employer-based email address. With response rates in mind, results need to be carefully interpreted and consideration given to the possible effect of a response bias, where those who responded were positively disposed to the topic. However, this is somewhat offset by the replication of the study and the consistent responses found in both cohorts. The transferability of the findings of our study may be limited, as the work was performed in one university hospital and one hospital group, in one region of Ireland. However, it is reasonable to speculate that opinions expressed in this study may be representative, in general, of their peers within the Irish population. Furthermore, findings are validated by similar results reported elsewhere while also contributing to a new knowledge base.^{5,19,23}

Conclusions

This original study reports improved hand hygiene attitudes and practices among hospital-based physicians in a university hospital group in Ireland between 2007 and 2015. While attitudes towards handrubbing using ABHR were predominantly positive and have also improved, there remains scope for substantial improvement in handrubbing practices and scope also to address a number of perceived barriers among doctors. The adoption of international evidence-based hand hygiene guidelines and the widespread support for their implementation both by the government and by the hospital groups' infection prevention and control team and management team appear to have positively influenced hand hygiene practices and raised awareness of this important patient safety issue among doctors in this study. Ongoing education and training, audits and feedback provided by the local infection prevention and control team, coupled with announced and unannounced audits conducted by governmental agencies appear to be contributing to greater compliance among medical doctors. The heightened emphasis placed on the importance of hand hygiene both in mainstream media and social media, and in society at large, and the resulting greater expectations of the public may have positively impacted doctors' attitudes and practices. However, given the sustained focus on hand hygiene practices in the intervening years between the two studies, greater improvements were envisaged. Further improvements in hand hygiene practices are essential in

addressing the challenges and complications that arise from HCAI, as recently experienced in the study setting.^{3,4} Our findings provide new insight into hand hygiene practices among doctors in Ireland and to some degree address the scarcity of recent evidence on the topic. Findings will be of particular interest to medical educators, those in the field of infection prevention and control and to clinicians working in this field.

ACCEPTED MANUSCRIPT

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Table I. Attitudes towards hand hygiene

Questions	Strongly Disagree % (n)		Disagree % (n)		No Opinion % (n)		Agree % (n)		Strongly Agree % (n)	
	2007	2015	2007	2015	2007	2015	2007	2015	2007	2015
In this organisation, hand hygiene is important	0.0 (00)	7.0 (04)	1.5 (01)	1.7 (01)	0.0 (00)	1.7 (01)	12.3 (08)	26.3 (15)	86.2 (56)	63.1 (36)
I would prefer to continue my hand washing routines and habits rather than change based on recommended hand hygiene practices	12.3 (08)	24.5 (14)	56.9 (37)	49.1 (28)	7.7 (05)	12.2 (07)	20.0 (13)	12.2 (07)	3.1 (02)	1.7 (01)
The recommendations of the hospital hand hygiene policy are relevant to my work	0.0 (00)	1.7 (01)	1.5 (01)	3.5 (02)	3.1 (02)	0.0 (00)	52.3 (34)	36.8 (21)	43.1 (28)	57.9 (33)
Adherence to hand hygiene practice is inconvenient	23.4 (15)	14.0 (08)	43.8 (28)	42.0 (24)	6.3 (04)	7.0 (04)	20.3 (13)	31.5 (18)	6.3 (04)	5.2 (03)
The recommendations within the hospital regarding hand-hygiene are based on sound scientific evidence	1.6 (01)	3.5 (02)	6.3 (04)	5.2 (03)	31.3 (20)	12.2 (07)	46.9 (30)	54.3 (31)	14.1 (09)	24.5 (14)
It is not really practical to follow the hand-hygiene recommendation	20.6 (13)	24.5 (14)	50.8 (32)	47.3 (27)	9.5 (06)	0.0 (00)	12.7 (08)	26.3 (15)	6.3 (04)	1.7 (01)
I do not wish to change my hand-hygiene practices, regardless of what the policy/ research recommends	41.5 (27)	42.1 (24)	46.2 (30)	38.6 (22)	4.6 (03)	10.5 (06)	1.5 (01)	7.0 (04)	6.2 (04)	1.7 (01)
The person I report to expects me to adhere to the hand-hygiene policy	2.2 (02)	3.5 (02)	12.9 (08)	1.7 (01)	27.4 (17)	14.0 (8)	38.7 (24)	47.3 (27)	17.7 (11)	33.3 (19)
My patients prefer to see me do a traditional hand wash instead of using alcohol based hand rubs	3.2 (02)	5.3 (03)	20.6 (13)	24.6 (14)	5.4 (34)	56.1 (32)	14.3 (09)	10.5 (06)	7.9 (05)	3.5 (02)
Hand hygiene improves patient outcomes	0.0 (00)	3.5 (02)	1.6 (01)	1.7 (01)	21.9 (14)	5.2 (03)	42.2 (27)	38.6 (22)	34.4 (22)	50.9 (29)

If we all follow the recommendations of this policy in our practice setting, it is likely that HCAI/nosocomial infection rates will decrease	3.2 (02)	0.0 (00)	6.3 (04)	1.7 (01)	14.3 (09)	7.0 (04)	39.7 (25)	45.6 (26)	36.5 (23)	45.6 (26)
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ACCEPTED MANUSCRIPT

Table II. Hand hygiene compliance

Questions	Strongly Disagree % (n)		Disagree % (n)		No opinion % (n)		Agree % (n)		Strongly Agree % (n)	
	2007	2015	2007	2015	2007	2015	2007	2015	2007	2015
I am familiar with the hospital's hand hygiene policy	1.5 (1)	1.7 (1)	10.8 (7)	3.5 (2)	10.8 (7)	0.0 (0)	46.6 (30)	38.6 (22)	30.8 (20)	56.1 (32)
I have implemented the recommendations made by the infection control team regarding hand hygiene	1.6 (1)	0.0 (0)	15.9 (10)	8.7 (5)	22.2 (14)	8.7 (5)	47.6 (30)	50.9 (29)	12.7 (8)	31.6 (18)
The hospital hand hygiene policy is readily accessible if I want to refer to it	1.6 (1)	3.5 (2)	28.1 (18)	7.0 (4)	25 (16)	10.5 (6)	32.8 (21)	45.6 (26)	12.5 (8)	33.3 (19)
I make a conscious effort to carry out hand hygiene in front of patients before each patient contact	1.6 (1)	0.0 (0)	26.6 (17)	8.7 (5)	14.1 (9)	5.2 (3)	45.3 (29)	52.6 (30)	12.5 (8)	33.3 (19)
I make a conscious effort to carry out hand hygiene in front of patients after each patient contact	0.0 (0)	0.0 (0)	12.5 (8)	7.0 (4)	10.9 (7)	1.7 (1)	45.3 (29)	49.1 (28)	31.3 (20)	42.1 (24)
	2007		2015		2007		2015			
	Yes		Yes		No		No			
I am familiar with the WHO Guidelines on Hand Hygiene in Health Care (2009) *draft version 2007 study	4.8 (3)		65 (37)		95.2 (60)		35 (20)			
I am familiar with the SARI National Guidelines for Hand Hygiene in Irish Health Care Settings (2005)	19.4 (12)		56.1 (32)		80.6 (50)		43.9 (25)			
I am familiar with the Health Information Quality Authority (HIQA) National Standards for the Prevention and Control of Healthcare Associated Infections (2009)	N/A		65 (37)		N/A		35 (20)			

Table III. Attitudes to handrubbing using alcohol-based hand rubs

Questions	Strongly Disagree % (n)		Disagree % (n)		No Opinion % (n)		Agree % (n)		Strongly Agree % (n)	
	2007	2015	2007	2015	2007	2015	2007	2015	2007	2015
I am familiar with alcohol-based hand rubs	0.0 (0)	0.0 (0)	0.0 (0)	1.85 (1)	0.0 (0)	0.0 (0)	47.6 (30)	38.8 (21)	52.4 (33)	59.2 (32)
Alcohol-based hand rubs are practical to use	3.2 (2)	3.7 (2)	3.2 (2)	9.26 (5)	3.2 (2)	1.85 (1)	44.4 (28)	46.3 (25)	46 (29)	38.9 (21)
Alcohol-based hand rubs help to standardise care and assure patient are treated in a consistent way	4.8 (3)	0.0 (0)	4.8 (3)	7.4 (4)	15.9 (10)	5.5 (3)	52.4 (33)	57.4 (31)	22.2 (14)	29.6 (16)
I feel competent using alcohol-based hand rubs in accordance with recommendations	3.2 (2)	0.00 (0)	6.3 (4)	0.00 (0)	14.3 (9)	1.85 (1)	52.4 (33)	63 (34)	23.8 (15)	35.2 (19)
It is important to act as a role model for others, when using alcohol-based hand rubs	3.2 (2)	0.00 (0)	0.0 (0)	1.85 (1)	15.9 (10)	5.56 (3)	47.6 (30)	50.0 (27)	33.3 (21)	42.6 (23)
Generally, the costs of alcohol-based hand rubs outweigh the benefits	17.5 (11)	18.5 (10)	30.2 (19)	57.4 (31)	46.0 (29)	14.8 (8)	4.8 (3)	7.4 (4)	1.6 (1)	1.85 (1)
I am not really expected to use alcohol-based hand rubs in my practice setting	36.1 (22)	33.3 (18)	54.1 (33)	61.1 (33)	8.2 (5)	1.8 (1)	1.6 (1)	1.8 (1)	0.0 (0)	1.8 (1)

Table IV. Factors influencing adherence with alcohol-based hand rubs

The single most important factor that influences me to adhere to the use of alcohol-based hand rubs is		
Answer Options	Response % (n)	
	2007	2015
Prevention of cross infection	50 (27)	48.1 (26)
Infection control policy	5.6 (3)	11.1 (6)
Patient outcomes	11.1 (6)	9.3 (5)
Evidenced-based practice	13 (7)	5.6 (3)
Other	3.7 (2)	7.4 (4)
Personal protection	–	7.4 (4)
Convenience	9.3 (5)	5.6 (3)
No opinion	3.7 (2)	0.0 (0)
Role model influences	1.9 (1)	3.7 (2)
Patient/public expectations	1.9 (1)	1.9 (1)

Table V. Time spent handrubbing using alcohol-based hand rubs

In clinical practice the percentage of the time I use alcohol-based hand rubs for hand hygiene is:		
Answer Options	Response % (n)	
	2007	2015
Never	1.6 (1)	1.85 (1)
Rarely (<10% of time)	11.1 (7)	5.56 (3)
Sometimes (10-50% of time)	9.5 (6)	16.67 (9)
Often (51-90% of time)	52.4 (33)	37.04 (20)
Almost always (>90% of time)	25.4 (16)	38.89 (21)

Table VI. Barriers to handrubbing using ABHR

Questions	Strongly Disagree % (n)		Disagree % (n)		No Opinion % (n)		Agree % (n)		Strongly Agree % (n)	
	2007	2015	2007	2015	2007	2015	2007	2015	2007	2015
I have confidence that ABHR improve my skin's condition	27.4 (17)	25.9 (14)	38.7 (24)	50 (27)	24.2 (15)	14.8 (8)	8.1 (5)	3.7 (2)	1.6 (1)	5.5 (3)
If I follow the hand hygiene policy recommendations, it is likely my hands will be in worse shape (drier, more skin damage)	7.9 (5)	7.4 (4)	30.2 (19)	22.2 (12)	11.1 (7)	16.6 (9)	27 (17)	37 (20)	23.8 (15)	16.6 (9)
My hands do not feel clean following the use of alcohol-based hand rub	14.3 (9)	7.4 (4)	42.9 (27)	53.7 (29)	9.5 (6)	9.2 (5)	19 (12)	14.8 (8)	14.3 (9)	14.8 (8)
I find alcohol-based hand rub unpleasant to use	20.6 (13)	7.4 (4)	22.2 (14)	44.4 (24)	11.1 (7)	9.2 (5)	28.6 (18)	24 (13)	17.5 (11)	14.8 (8)
Alcohol-based hand rubs are cumbersome and inconvenient	28.6 (18)	25.9 (14)	54 (34)	63 (34)	7.9 (5)	3.7 (2)	3.2 (2)	5.5 (3)	6.3 (4)	1.8 (1)
I don't have the time to use alcohol-based hand rub	32.3 (20)	26 (14)	54.8 (34)	61 (33)	1.6 (1)	5.5 (3)	8.1 (5)	5.5 (3)	3.2 (2)	1.8 (1)
In my area of work, I find alcohol-based hand rub readily available	1.6 (1)	1.8 (1)	11.3 (7)	22.2 (12)	6.5 (4)	0.00 (0)	41.9 (26)	44.4 (24)	38.7 (24)	31.5 (17)
My religious/cultural beliefs prevent me from using ABHR in my healthcare setting	66.7 (42)	57.4 (31)	25.4 (16)	35.2 (19)	6.6 (11)	7.4 (4)	1.6 (1)	0.0 (0)	0.0 (0)	0.0 (0)