Provision and consumption of alcohol-based hand rubs in European hospitals

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Abstract

Hand hygiene is considered to be the most effective way of preventing microbial transmission and healthcare-associated infections. The use of alcohol-based hand rubs (AHRs) is the reference standard for effective hand hygiene. AHR consumption is a valuable surrogate parameter for hand hygiene performance, and it can be easily tracked in the healthcare setting. AHR availability at the point of care ensures access to optimal agents, and makes hand hygiene easier by overcoming barriers such as lack of AHRs or inconvenient dispenser locations. Data on AHR consumption and availability at the point of care in European hospitals were obtained as part of the Prevention of Hospital Infections by Intervention and Training (PROHIBIT) study, a framework 7 project funded by the European Commission. Data on AHR consumption were provided by 232 hospitals, and showed median usage of 21 mL (interquartile range (IQR) 9-37 mL) per patient-day (PD) at the hospital level, 66 mL/PD (IQR 33-103 mL/PD) at the intensive-care unit (ICU) level, and 13 mL/PD (IQR 6-25 mL/PD) at the non-ICU level. Consumption varied by country and hospital [...]
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Abstract

Hand hygiene is considered to be the most effective way of preventing microbial transmission and healthcare-associated infections. The use of alcohol-based hand rubs (AHRs) is the reference standard for effective hand hygiene. AHR consumption is a valuable surrogate parameter for hand hygiene performance, and it can be easily tracked in the healthcare setting. AHR availability at the point of care ensures access to optimal agents, and makes hand hygiene easier by overcoming barriers such as lack of AHRs or inconvenient dispenser locations. Data on AHR consumption and availability at the point of care in European hospitals were obtained as part of the Prevention of Hospital Infections by Intervention and Training (PROHIBIT) study, a framework 7 project funded by the European Commission. Data on AHR consumption were provided by 232 hospitals, and showed median usage of 21 mL (interquartile range (IQR) 9–37 mL) per patient-day (PD) at the hospital level, 66 mL/PD (IQR 33–103 mL/PD) at the intensive-care unit (ICU) level, and 13 mL/PD (IQR 6–25 mL/PD) at the non-ICU level. Consumption varied by country and hospital type. Most ICUs (86%) had AHRs available at 76–100% of points of care, but only approximately two-thirds (65%) of non-ICUs did. The availability of wall-mounted and bed-mounted AHR dispensers was significantly associated with AHR consumption in both ICUs and non-ICUs. The data show that further improvement in hand hygiene behaviour is needed in Europe. To what extent factors at the national, hospital and ward levels influence AHR consumption must be explored further.

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Keywords: Europe, HAI prevention, hand hygiene, hand rub consumption, hospital

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Introduction

Hand hygiene is considered to be the most effective way of preventing microbial transmission and healthcare-associated infections (HAIs), but healthcare workers’ compliance remains suboptimal [1–4]. Hand disinfection with alcohol-based hand rubs (AHRs) removes organisms most effectively, and is the reference standard for effective hand hygiene [5,6].

To increase hand hygiene compliance among healthcare workers, direct observation combined with feedback data has been described as the best way to convince staff of the need for improvement and motivate them to achieve and sustain best-practice targets [7]. However, direct compliance observations are costly and time-consuming, and they are often not performed in a standardized way, making interhospital comparison difficult. Ensuring the comparability of results depends, to a great degree, on the types of observer, the level and type of training that the observers receive, the duration of observation periods, and the number of hand hygiene opportunities observed [8].

Measurement of AHR consumption as a surrogate parameter for hand hygiene performance is a simpler way to characterize the frequency of hand hygiene actions and compare them between units or hospitals [9]. Good correlations

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between AHR consumption and observed hand hygiene compliance rates—and between AHR consumption and HAI reduction—have been described in the literature [10,11]. Hospital use of AHRs has also been monitored in the context of several national hand hygiene campaigns in Europe. For example, AHR consumption was integrated into the German Krankenhaus-Infektions-Surveillance-System to provide national reference data [12,13], and, in France, it has been a quality indicator with mandatory annual public reporting since 2006 [14]. In addition to AHR consumption measurement, hospitals should consider periodic observation to ensure sufficient hand hygiene compliance.

To improve hand hygiene, the WHO recommends a ‘system change’, which includes the availability of AHRs at the point of care as one key component of its ‘Clean Care Is Safer Care’ campaign. Dispensers located at the point of care ensure access to AHRs, and make hand hygiene easier by overcoming barriers such as a lack of optimal agents or inconvenient dispenser locations [6,15].

Data on AHR consumption and availability at the point of care in European hospitals were obtained as part of the Prevention of Hospital Infections by Intervention and Training (PROHIBIT) study, a framework 7 project funded by the European Commission.

**Methods**

The PROHIBIT survey was developed by an interdisciplinary group, and comprised questionnaires that explored infection control organization and activities and process/outcome parameters at the hospital level, in intensive-care units (ICUs), and in medical and surgical wards.

European surveillance representatives were invited to act as national contact points and to identify up to 30 hospitals to participate in the survey between September 2011 and March 2012. Overall, data from 309 hospitals in 24 countries were included in the PROHIBIT reference dataset. The complete methods of the survey and characteristics of the 309 hospitals are described elsewhere [16].

According to the WHO, AHRs at the point of care are defined as AHRs at the place where the patient, the healthcare worker and care or treatment come together, and at which AHRs should be easily accessible [15].

ICU and ward head nurses provided data on AHR availability (liquid, gel, or foam) in wall-mounted or bed-mounted dispensers at patient points of care (bed space, examination room, or treatment/procedure area) and in individual pocket or belt bottles. Nurses reported AHR availability in quartiles (0–25%, 26–50%, 51–75% or 76–100% of points of care).

Leading infection control personnel provided retrospective data on AHR consumption for the year 2010. Data were analysed descriptively as mL/patient-day (PD) in ICUs, medical wards, and surgical wards. Data at the country level were summarized according to United Nations geographical region [17]. The association between AHR consumption and good AHR availability (76–100% of points of care) was analysed with the Wilcoxon rank sum test (two-sided). p-Values of <0.05 were considered to be significant. All analyses were performed with SPSS version 22 (IBM SPSS Statistics, Somer, NY, USA) and SAS 9.3 (SAS Institute, Cary, NC, USA).

**Results**

Data on AHR availability were obtained from 396 ICUs and 1029 non-ICUs (514 medical and 515 surgical wards) from all 309 hospitals. Most ICUs (86%) had AHRs available at 76–100% of points of care, but only approximately two-thirds (65%) of non-ICUs did.

Data on AHR consumption at the ICU and non-ICU level were provided by 249 hospitals, with a median of 423 beds (interquartile range (IQR) 265–800 beds). More of the hospitals were located in eastern Europe (32%) and southern Europe (29%) than in western Europe (21%) and northern Europe (17%). As shown in Table 1, AHR consumption was higher in ICUs than in non-ICUs, and it varied across Europe, with lower consumption being seen mainly in southern and eastern European countries. Hospital-wide consumption data for 232 hospitals showed a median AHR usage of 21 mL/PD (IQR 9–37 mL/PD), with higher consumption in specialized and tertiary hospitals (39 mL/PD (IQR 9–79 mL/PD) and 23 mL/PD (IQR 13–36 mL/PD), respectively).

A further analysis showed a significant association between AHR consumption and high AHR availability in ICUs, medical wards, and surgical wards (Fig. 1).

**Discussion**

We analysed data from 24 countries on AHR availability and consumption, to determine the structure and performance of hand hygiene in hospitals in Europe.

Our findings on AHR consumption were similar to the results of the Point Prevalence Survey of HAI and Antimicrobial Use in Europe, which showed a median hospital-wide consumption of 18.7 mL/PD (IQR 10.3–30.6 mL/PD) in 805 hospitals in 2011–2012 [18]. In both surveys, AHR usage varied by hospital type, with lower consumption in primary and secondary hospitals, which is not surprising, given that
### TABLE I. Alcohol-based hand rub (AHR) consumption (AHRC) and the availability of AHR dispensers in intensive-care units (ICUs) and non-ICUs in Europe: The Prevention of Hospital Infections by Intervention and Training (PROHIBIT) survey

<table>
<thead>
<tr>
<th>European regiona</th>
<th>Country</th>
<th>AHR provision</th>
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<tbody>
<tr>
<td></td>
<td>ICU</td>
<td>MW</td>
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<td></td>
<td>ICUs providing data (n)</td>
<td>AHR dispensers at 76–100% of points of care (%)</td>
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<tr>
<td>Eastern Europe</td>
<td>Bulgaria 24</td>
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<td></td>
<td>Hungary 41</td>
<td>93</td>
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<td>Poland  9</td>
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<td>Slovak  53</td>
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<td>Northern Europe</td>
<td>Finland 10</td>
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<td>Ireland 12</td>
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<td>Latvia 8</td>
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<td>Lithuania 15</td>
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<td>All 127</td>
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<td>Southern Europe</td>
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<td>Portugal 33</td>
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<td>Slovenia 12</td>
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<td>Spain 24</td>
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<td>All 106</td>
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<td>All 86</td>
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<td>All countries 395</td>
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**Notes:**
- IQR, interquartile range; MW, medical ward; PD, patient-day; SW, surgical ward.
- Geographical regions according to United Nations grouping [17].
- Point of care includes bed space, examination room, or treatment/procedure area.
- Shown where there were eight or more units or wards per country.

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Correlation between alcohol-based hand rub (AHR) consumption and the availability of AHR dispensers (<75%/>75%), stratified by type of unit: intensive-care unit (ICU) (n = 285, Wilcoxon rank sum test, p < 0.014), medical ward (MW) (n = 375, Wilcoxon rank sum test, p < 0.001), and surgical ward (SW) (n = 377, Kruskal–Wallis test, p < 0.001). The Prevention of Hospital Infections by Intervention and Training (PROHIBIT) survey. PD, patient-day.

there are fewer hand hygiene opportunities per PD in such hospitals.

AHR consumption data also varied between countries: consumption was higher in northern Europe than in eastern or southern Europe. Variations in key infection control practices in Europe have been reported in the literature, and can be explained by differences in resources, social and legal perspectives, and cultural norms [19,20].

Infection control policies may play an important role in AHR consumption: in 2006, the Antimicrobial Resistance Prevention and Control study showed regional differences in hand hygiene promotion programmes [19]. Substandard infection control policies were more common in hospitals in south-eastern and central—eastern Europe than in northern and western Europe. Guidelines for the promotion of hand hygiene were available in 89% of hospitals, but detailed recommendations for the use of AHRs were less accessible (70%), and the use of medicated soap was still recommended in a majority of the hospitals in southern Europe [19]. Such factors may explain, in part, the current low AHR consumption in Italy and Spain.

To achieve and to sustain best-practice targets such as compliance with effective hand hygiene, objectives must be defined. In the interdisciplinary PROHIBIT survey, hospital managers reported their infection control objectives for the year 2010. Without major regional differences, 91% of hospitals described ‘improvement of hand hygiene’ as an objective, but only 53% chose ‘increase in AHR consumption’, indicating a possible lack of hospital management support for improving effective hand hygiene in European hospitals [16].

On the basis of an average volume of 3 mL of AHR for each hand hygiene action, Point Prevalence Survey of HAI and Antimicrobial Use in Europe (PPS) and PROHIBIT data showed that the median number of hand hygiene procedures per PD in 2010–2011 was six to seven in the general hospital setting, 22 in ICUs, and four to five in non-ICUs [21]. The real frequency of hand hygiene action may be somewhat higher, as healthcare workers often press the dispenser hub only once, and receive <3 mL. However, even if frequencies are higher than the estimates, they are still considerably lower than the number of relevant hand hygiene opportunities described in the literature [3,22–25].

The significant association between AHR consumption and availability suggests that wall-mounted or bed-mounted dispensers may increase AHR use by appealing to healthcare workers’ intention to disinfect their hands more frequently. Our findings show that an increase in AHR provision at the point of care—particularly in the non-ICU setting—is still required. However, the quantity of AHR dispensers does not necessarily affect hand hygiene frequency; Chan et al. found that an increased number of wall-mounted AHR dispensers in patient rooms did not increase in-room hand hygiene, and that dispensers in the hallway and immediately inside a doorway were used more often than dispensers closer to the patient [26]. The authors concluded that such patterns might reflect healthcare workers’ focus on hand hygiene before and after patient contact, indicating that AHR provision should always be embedded in a multimodal improvement strategy [6,26].

The current analysis has some limitations, as participation in PROHIBIT was based mainly on hospital interest rather than on a systematic sampling process, and data were obtained by questionnaire rather than by observation [16]. The current data may overestimate overall AHR usage and dispenser availability in Europe. In addition, lower numbers of participating ICUs and non-ICUs in northern and western European regions indicate a possible selection bias. Therefore, the findings—particularly those related to country-specific AHR consumption—should be interpreted with caution, and not be used primarily for intercountry comparison. Despite these limitations, however, the results offer a baseline for future surveys and an interesting overview of the structure and performance of hand hygiene in European hospitals. How additional factors at the national, hospital and unit levels may influence AHR consumption needs to be explored further.

Transparency declaration

The authors declare that they have no conflicts of interest.

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The PROHIBIT study group


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