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Factors to Consider When Selecting Alcohol-Based Hand Sanitizers and Dispensers

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ABSTRACT

Introduction:
Hand hygiene (HH) is a critical factor in preventing the spread of microorganisms in healthcare facilities, helping to reduce the risk of infectious diseases. Alcohol-based hand sanitizers (ABHS) play a key role in HH practices, but careful consideration is needed when purchasing them for healthcare settings. This article discussed key factors when selecting ABHS and dispenser systems for healthcare facilities, drawing on our practical experience.

Materials and Methods:
A narrative review was conducted on the standardization process for alcohol-based hand sanitizers and dispensers. The review considered factors such as product quality, the installation location and surface for the dispenser, available financial and human resources, and relevant local regulations.

Results:
The review identified six key factors in the standardization process: the product, ABHS formulation, dispenser design, dispenser system, refill bags, and dispenser management. Discussion: A global analysis of standardization was conducted. In addition to the characteristics of ABHS, the dispenser's often overlooked or underestimated role, which directly impacts the product's accessibility and availability, was also discussed.

Conclusion:
It is possible to provide a dispenser and alcohol-based hand hygiene system that encourages higher user acceptance and satisfaction by ensuring reliable product availability. It can be achieved by considering the key factors outlined before standardizing alcohol for hand hygiene.

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Introduction

Hand hygiene (HH) is a crucial practice for disrupting the transmission of micro-organisms in healthcare settings, helping prevent infectious diseases (1). Alcohol-based hand sanitizers (ABHS) are widely used in HH due to their advantages: they are readily available, highly effective at reducing germs on healthcare providers' hands, and are the preferred hand-cleaning method in most clinical situations (1). The World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and other organizations provide guidelines on hand hygiene (HH) techniques and key moments for practice in healthcare settings. However, there needs to be more focus on the factors influencing the choice of ABHS and dispenser systems. Selecting the right ABHS and dispenser involves both direct and indirect factors that can impact product use. A comprehensive analysis of these factors is crucial to ensure higher staff acceptance and usage, ultimately helping to reduce healthcare-associated infection rates (2). In this review, we explore key considerations for choosing ABHS and dispenser systems, which are critical to promoting HH adherence and ensuring patient safety.

Materials and Methods

A narrative review was conducted on the standardization process for ABHS and dispensers, focusing on factors such as product quality, the location and surface where the dispenser will be installed (3,4), available financial and human resources (5), and local regulations. These factors were considered essential for thoroughly evaluating the ABHS and dispenser standardization process and were applied in our assessment.

Results

Six key factors related to the standardization process were identified: the product, ABHS formulation, dispenser, dispenser system, refill bag, and dispenser management. Each factor was further divided into variables, as shown in Table 1.

Table1. Summarized factors to consider when selecting alcohol-based hand sanitizers

Factor	Variable	Practical findings / Analysis
Product	Local law	Only use products approved by the local health agency (1)
	Product label	Evaluate the indication of use. Despite being an antiseptic product for hand hygiene, many are not recommended for use in healthcare facilities.
	Quality control	Some tests must be considered: microbiological and dermatological tests, and alcohol concentration (1,6).
	Product form(Gel - Foam - Spray)	Both forms are generally equally effective (6). However, they have distinct spreadability, yield, and staff acceptance.
Alcohol-based hand sanitizer formulation	Alcohol types	Distinct alcohols (isopropanol, ethanol, n-propanol, or a combination of two products) are accepted in hand sanitizers. Each alcohol has an optimal antimicrobial coverage, and in general, its use is more effective than handwashing with soap and water. Alcohols are not appropriate for use when hands are visibly dirty or contaminated with proteinaceous material (1,6).
	Alcohol concentration	Alcohol solutions containing 60%-95% alcohol are the most effective (1,6).
	Other antiseptics (Chlorhexidine - Triclosan - Hydrogen Peroxide - others)	Alcohol already has satisfactory efficacy. The addition of another antiseptic should be questioned regarding its cost-effectiveness. Local restrictions on the use of other antiseptics must be evaluated.
	Other components	The bitter compound is recommended to avoid unwanted ingestion. Emollients and humectants must be present in the product to prevent skin drying/irritation (1,6).
Dispenser	Dispenser material	Plastic dispenser is the most used. Malleable plastic shows less crack risk than rigid plastic. It is recommended to use sanitizable material (4).
	Electronic or mechanical dispenser	The electronic dispenser is more expensive, requires complex maintenance, and requires batteries for operation, but it has a lower breakage rate due to the lack of mechanical action to release the product. Some electronic dispenser allow remote monitoring of product quantity, reducing unavailability.
	Product release	The dispenser must release a sufficient amount of product in just one activation. (1) Some devices allow the selection of a dispensed volume.
	Product identification	The dispenser must allow the label to be viewed with product information (product name, expiration date, and batch).
	Bulk fill dispenser	This device should be avoided due to the difficulty of internal cleaning, as well as the possibility of mixing batches (10).
Dispenser system (dispenser and refill bag set)	Multipurpose or Select	The multipurpose set increases suppliers' offers, thus reducing costs and the risk of shortage. However, it may lead to product dispensing failures because the refill bag need to fit properly to the dispenser. The select set is more compatible and promotes minor failures but is more expensive.
	Refuel	A plug-and-play refill bag (closed system) is recommended. Some refill bags require valve reuse, which may promote product problems such as leakage or contamination.
	Fixing the dispenser to the surface	There are different ways to fix the dispenser to surfaces: glue, drilling, adjustable strap, and others. The dispenser fixation must be compatible with the installation surface (masonry/glass/plaster / other). Drilling produces the best result in fixing the dispenser to the walls. Straps are used to attach to different surfaces (e.g. beds).
Refill bag	Refill bag volume	Refill bags with greater volume reduce the unavailability of the product at the places of use.
	Refill bag rigidity	The refill bag must allow full use of the product. Very malleable packaging makes it difficult to dispose of the entire product. All technical product information must be included in the bag refill.
	Refill bag valve	It can be made of different materials, such as Latex, Silicon, or Plastic. Latex / Silicon valves are simple and low-cost but have a high breakage rate. Plastic valves should be preferred.
Dispenser management	Place to install a device	The location for installing the device must be evaluated aiming at greater product availability near the patient. (11) This would enable hand hygiene to be carried out in the 5 moments recommended by the WHO. An Infection Control Professional must be involved.
	Refill bag replacement and maintenance team	Routine review is necessary to maintain product availability (refill). In a non-remote monitoring system, the refill bag replacement time is worse. Eventually, replacement of the dispenser and battery will need to be replaced. Establishing which team is responsible for each activity is important to reduce product downtime.

Discussion

We summarized the factors that influenced the ABHS system and provided our assessment of the key variables (Table 1).

First, it is essential to select products approved by the local health agency, adhering to their recommended usage due to the diferent effectiveness standards adopted(1). ABHS can come in various forms, such as gel, foam, or spray, each with advantages and disadvantages. Requesting the product's technical data sheet, dermatological test results, and microbiological efficacy reports for quality control is important (1,6). While ABHS formulations are generally similar, each country has regulations, especially regarding the combination with other antiseptic agents. Most ABHS products use either a single type of alcohol or a blend. The primary alcohols used are ethanol, isopropyl alcohol, and n-propanol, often combined with optional additives like hydrogen peroxide, gelling agents, humectants, fragrances, and colorants (6). Humectants, such as glycerol and *aloe vera*, help prevent skin dryness from alcohol use, though lower concentrations are preferred to avoid a sticky residue (6). Thickening agents like xanthan gum adjust viscosity, while fragrances and colorants enhance the product's aesthetic appeal (6). The WHO recommends two specific formulations for ABHS: ethanol or isopropyl alcohol, hydrogen peroxide, and glycerol (6,7).

The recommended alcoholic concentration ranges from 60% to 95% (1,6). The use of multiple types of alcohol in hand hygiene products may not be the most critical factor when selecting a product because microbiological epidemiology is dynamic, making it difficult to identify the most effective product for various situations. Additional compounds are recommended in ABHS formulations, including emollients to prevent skin damage (1,6) and bitter agents to deter ingestion by children or individuals with alcohol dependence.

There needs to be more than the best ABHS product to promote proper usage; our standardization efforts must includ the dispensing system. The dispenser should be installed as close to the patient’s bed to ensure easy access to the antiseptic (3). The type of attachment should be carefully considered and compatible with the surface where the dispenser will be installed; otherwise, placing it close to the patient may not be feasible. The dispenser must be made of a cleanable material and designed to ensure the product label is visible (4). Another important feature of this type of device is the ability to regulate the volume of the product dispensed. Wilkinson *et al.* suggest that the volume between 1.5 and 2 mL is optimum for use acceptability, yielding a drying time of 20 to 30 s (8).

Based on our experience, there is no universally ideal standard for the volume of alcohol dispensed from these devices. The amount should be managable to prevent overuse and waste. It is important to instruct users to apply enough product to cover the entire surface of their hands, followed by rubbing until the product is completely dry. This practice ensures proper hand hygiene according to WHO recommendations (9). The dispenser and refill must be compatible for the system to function properly. However, universal dispensers only sometimes work effectively with universal refills. Using a dispenser and refill from the same manufacturer has shown better results, resulting in fewer dispensing failures. When adopting this option, assessing the risk of supply disruptions is important, as it may only be feasible to replace some dispensers in an institution quickly.

Electronic dispensers enable remote refill monitoring, facilitating better product supply organization. Additionally, they are typically touchless, which enhances the longevity of the dispensers by eliminating the mechanical action required to activate the device, reducing the likelihood of malfunctions caused by using the dispenser without product. Replacing refills is linked to the reservoir's volume: a larger reservoir requires less manual labor for replacements and reduces the likelihood of product unavailability for hand hygiene. Extreme rigidity or flexibility in packaging can hinder the complete use of the product, resulting in waste. Some systems utilize bulk ink containers, which we consider inappropriate due to the challenges in controlling potential contamination and

mixing different product batches (10). Furthermore, Blenkharn I. reported that open hopper systems could lead to a loss of alcohol-based hand rub efficacy due to alcohol evaporation, reducing ABHS volumes by up to 50% in about 14 days. (10) This can also form an unpleasant, sticky residue that dries slowly (10). A plug-and-play bag system is more suitable, as it requires no handling by the staff during refill replacement. However, an important aspect to evaluate is the valve quality used in the container. Various materials are used for valves, including silicone, latex, and plastic. In our experience, latex and silicone valves have proven unsatisfactory. They often need to fit properly in the dispenser, resulting in poor product release. Additionally, these types of valves can rupture, leading to spills on surrounding surfaces such as walls and floors. This review outlined the issues we considered in evaluating ABHS, and our perspective. The factors presented in our report need to be completed and can be tailored to meet the specific needs of each healthcare institution.

Conclusion

It is possible to provide a dispenser and alcohol set for hand hygiene that enhances user acceptance and satisfaction, particularly if the factors outlined are considered before standardizing alcohol for hand hygiene.

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