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Impact of hand sanitizer format (gel/foam/liquid) and dose amount on its sensory properties and acceptability for improving hand hygiene compliance

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SUMMARY

Background: Effective alcohol-based hand rubs (ABHRs) and healthcare worker compliance with hand hygiene guidelines are important in the prevention of infection transmission in healthcare settings. Compliance to hand hygiene guidelines is affected by many factors including education, ABHR availability, time pressure, skin health, and user acceptance of the sensory properties of ABHRs during and after application.

Aim: To examine the effect of ABHR format (gel/foam/liquid) and dose (0.7 mL, 1.5 mL, 3 mL) on its sensory properties and acceptability, and to consider how this might affect healthcare workers' hand hygiene compliance.

Methods: Sensory descriptive analysis established key sensory differences between ten market-leading ABHRs (three gels, four foams, two liquids, one aerosol foam). Focus groups reinforced these differences.

Findings: All formats were less desirable at the highest dose as they were more difficult to handle than the lower doses. Foams and gels became stickier, less clean-feeling and slower to dry at higher doses. Liquids gave a cleaner, smoother, more moisturized feel, but the increased difficulty in handling and applying the product negated these benefits. Overall, the gel and foam formats were more desirable than the liquid. The key desirable properties include: fast absorption, soft/moisturized hand feel, not sticky, clean feel, and low smell.

Conclusion: The 1.5 mL dose yielded the most acceptable properties with no extreme negative consequences. The foam provided the benefits of both the liquid and gel and combined them into a more widely acceptable format that may lead to greater hand hygiene compliance.

Introduction

Healthcare worker compliance with hand hygiene guidelines is important in the prevention of infection transmission. However, the level of hand hygiene compliance by healthcare workers is low, reported at 30–57% [1–6].

Alcohol-based hand rubs (ABHRs) are now widely used in healthcare settings to enhance hand hygiene among healthcare

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workers [7]. The World Health Organization (WHO) developed the 'five moments of hand hygiene' guidelines to help manage patient and healthcare worker safety, recommending a maximum ABHR drying time of 30 s for effective hand disinfection [8,9]. Compliance with hand hygiene guidelines is affected by many factors including education, ABHR availability, time pressure, skin health, and user acceptance of the sensory properties of ABHRs during and after application, which may be affected by dosage or format of the ABHR (gel, liquid, or foam) [5,8,10–14].

International standards such as EN 1500 have been developed to assess the efficacy of ABHRs that are claimed to have an antimicrobial action, and most gel, liquid, and foam formats on the market meet this requirement [15]. EN 1500 compares a manufactured product to a reference standard of 6 mL propan-2-ol 60% (v/v) for a contact time of 60 s following a standard hand-rub protocol (applied in 2 × 3 mL, 30 s rub-in per 3 mL) [8,15,16]. Manufacturers can define the dose of their product to use in the test, but the contact time is limited to 30 or 60 s. The EU Biocidal Product Regulation requires manufacturers to support their label claims with data that are principally compliant with EN 1500. Therefore, although EN 1500 was not designed to define product dosage, it has increasingly become normal practice for manufacturers to recommend a dosage of 3 mL for effective hand disinfection. Nevertheless, market research shows that 3 mL is not the dosage typically used by healthcare workers throughout the day [17].

Using the EN 1500 standard, Wilkinson *et al.* investigated the relationship between ABHR volume and efficacy, and they examined impact of drying time on user acceptability [18]. Results suggested that volumes of ABHR that dry in 20–30 s (1.5–2 mL) are unlikely to fulfil the EN 1500 requirements, and a 3 mL dose takes 35–45 s to dry, which participants thought was too long. This work concluded that the EN 1500 is a good standard to test efficacy under laboratory conditions, but that a different standard is required to help provide recommendations for dose and contact time in line with WHO guidelines and acceptable for healthcare workers to adhere to daily.

One might expect that different doses of ABHRs would affect their sensory properties, which, in turn, may affect whether healthcare workers comply with WHO guidelines in their usage.

The objectives of this study were to determine the sensory characteristics of a range of leading foam, gel, and liquid ABHRs; to understand the impact of dose on sensory attributes and the relative differences and similarities between ABHRs; to understand from healthcare workers what the positive and negative sensory attributes are and what would drive usage leading to increased hand hygiene compliance; and to identify the key sensory attributes that manufacturers should consider when developing new products that will drive acceptability.

Methods

Focus groups and sensory descriptive analysis were used to address the research objectives.

Focus groups

Two focus groups were conducted with nurses from two different National Health Service (NHS) hospital trusts. Participants were all full-time female nurses, aged between 18 and 60 years, with no allergies/sensitivities to products applied to the skin. All worked ≥22 h per week, applying ABHRs ≥5 times per hour in a working day and all had used at least two of the three categories (gel/foam/liquid) of ABHRs.

Participants were informed that the purpose of the focus group was to understand the positive and negative aspects of different formats of ABHRs from a nurse's perspective. Nurses were chosen for focus groups as they interact with ABHRs most often in a hospital environment. Informed consent was obtained from all nurses prior to participation and each received £30 incentive following the focus group.

Two focus groups were held to obtain wider insight into a nurse's perspective of ABHRs. In group 1, all five nurses were from the same workplace where gel is the format of ABHR used (although most had experienced foams and liquids in other healthcare settings). In group 2, comprising 11 members from a different workplace to group 1, all had recently experienced gels and foams in a work environment as their hospital switched from gel to foam six months prior to the focus group.

The focus group was led by a facilitator who followed a discussion guide (see Appendix A), designed to answer the following questions:

- Which properties of ABHRs do nurses perceive as being positive and negative?
- How do nurses feel about using the recommended dosage? Are there any barriers to using the full dose? If so, which product qualities affect this?
- Which format do nurses prefer? What are the positive properties associated with this?
- Which qualities would nurses like designed into (or out of) ABHRs if they had a choice?

During the discussions, words describing the positive and negative characteristics of ABHRs were recorded and arranged from most to least important. The focus group identified the positive and negative properties of the foam, gel, and liquid formats and discussed which properties were most affected by dose.

Sensory descriptive analysis

Samples

Ten market-leading ABHRs were assessed; three gels (A, B, C), four foams (A, B, C, D), two liquids (A, B), and one aerosol foam. Each was assessed for its skin-feel properties at three dose levels: 0.7 mL, 1.5 mL, and 3 mL.

Method

Thirteen trained sensory descriptive panellists participated in the study; informed consent was obtained from all panellists prior to participation. Each panellist attended seven 2 h training sessions in which quantitative descriptive analysis style methodology (sensory descriptive analysis) was used to identify and define 30 key sensory attributes that describe each ABHR [19,20]. The panel attended a further thirteen 2 h rating sessions in which they assessed the products for these attributes (Table I). A balanced design across samples and doses was used and each sample was seen in triplicate. The panel was divided into three groups, each assessing a different dose per

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