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SELF-REPORTED DERMAL EFFECTS OF HAND SANITISERS IN INDUSTRIAL WORKERS

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Abstract

Background: During COVID-19 pandemic, preventing the virus spread was extremely important to reduce the overall burden of the disease, to maintain the companies running and to remain safe. WHO recommended physical distances, appropriate use of personal protective equipment and hand hygiene practices to reduce the spread. Hand hygiene practice by using alcohol-based hand sanitisers was generalized in all sectors of activity, including those with no previous need to implement preventive measures against biological risks. **Objective**: The aim of this study was to obtain self-reported data on hand hygiene habits and perceived symptomatology regarding skin health effects associated with skin exposure to alcohol-based hand sanitisers of industrial workers during COVID-19 pandemic. **Method**: Between November 2021 and April 2022, a questionnaire-based descriptive cross-sectional study was conducted using 97 study participants. **Results**: The reported information on hands sanitisers used show that most of the participants at work, use the hand sanitizer provided by the company a alcoholic solution of 2-propanol 70%. Nearly half of the workers disinfected their hands more than 3 times per day, but at work, there was a concern to also disinfect wrists and forearms. Self-reported dermal effects show that half of the participants noticed skin dryness with the increased use of hand sanitisers. **Application**: The novelty of this work is posed by the type of sample under study (industrial rather than hospital context) which allow gathering data to build knowledge in this field and to develop guidelines of good practices on how to make adequate disinfection and to promote skin health in industrial settings.

Keywords: COVID-19, Skin Exposure, Hand Disinfectants

Introduction

The World Health Organization (WHO) and national authorities recommended and promoted frequent hand hygiene through handwashing or use of hand sanitisers, indicating that hand hygiene procedures were one of the best methods to prevent the COVID-19 transmission. Indeed, in the context of this pandemic, hand hygiene habits have changed. Not only health care workers who work with infected cases or work in a high-risk situation have naturally increased their frequency of hand disinfection, but also workers from other sectors of activity with no previously identified biological risks, quickly had to implement hygiene protocols and contingency plans to prevent SARS-CoV-2 infection (Carvalhais, Querido, Santos, & Pereira, 2021). Those internal hygiene protocols to avoid transmission, contributed to the widespread use of alcohol-based sanitisers in occupational context, mainly due to their rapid action and protection against bacteria and virus (Jing, et al., 2020). The most common alcohol-based sanitisers used contain 62%-95% of different types of alcohols, and despite the high risk of development of irritant contact dermatitis and consequent damage of the skin barrier (Pacheco, 2018), the benefits in terms of its use far outweighed the risks.

The aim of this study was to investigate potential skin health effects associated with skin exposure to alcohol-based hand sanitisers in industrial workers during COVID-19 pandemic.

Materials and Methods

A cross-sectional study was conducted at a multinational corporation devoted to the production of mechanical cables for the automotive industry, located in Maia, Portugal. The company works 24 h a day and working hours are distributed over three shifts (morning shift: 6 a.m. to 2 p.m.; afternoon shift: 2 p.m. to 10 p.m.; night shift: 10 p.m. to 6 a.m.).

The study was approved by the School of Health of the Polytechnic of Porto Ethics Committee (CE0045B) and was conducted according to the Declaration of Helsinki and its amendments; written informed consent was obtained from all participants. In total, 97 workers were recruited from November 2021 to April 2022 in the above-described company. Workers were initially approached by the company health and safety manager, and fully informed of the study aims and implications of their participation. Only participants without diagnosed dermal diseases prior to the COVID-19 pandemic (March 2020) and working for at least one year in the company were included in the study (8 excluded). The remaining volunteers provided information on sociodemographic characteristics, hand-sanitisers and disinfectant's use at home and at work, and skin health perception in a self-administered questionnaire.

Information on used hand sanitisers; frequency of exposure; and disinfected areas were obtained from the questionnaires, and used to calculate skin loading (g/cm^2) per use and per day. A total of 3 mL of applied volume per use was considered both for work (according to dispensers available) and home (as this is the volume recommended by WHO (WHO, 2009). Hand surface area of each participant was estimated based on Lee, et al. (2007), using the formula HSA=22,348 x Hand length. Wrist and forearms surfaces were considered 6% of the total body surface area (Gehan and George, 1970), as described by Liu, et al. (2009). Skin loading estimates were calculated for 62 participants (22 excluded due to missing hand measurements and 5 excluded due to missing info on weight and height necessary for wrist and forearms surface estimation). The main characteristics of the study population are expressed as means, standard deviations, minimum and maximum values, or as counts and percentages.

Results and Discussion

Table 1 presents the demographical characterization of the population, alongside the use of hand sanitisers, skin loading per use and per day in $\mu g/cm^2$, and the perception of hand sanitisers effects on dermal health.

The reported information on hands sanitisers used shows that participants prefered for their personal use ethanol 70%, mainly as gel (66,1%), followed by liquid formulations (18,6%). At work, most subjects reported to use the hand sanitizer provided by the company (43 out of 60 valid responses), a alcoholic solution of 2-propanol 70%. These are in fact the most frequent compounds as described by Jing, et al., 2020.

Data collected also showed that nearly half of the workers disinfected their hands more than 3 times per day; at home, participants favoured hand-only disinfection, while at work, there was an increased concern to disinfect also wrists and forearms.

Skin loading estimates show that the amount of hand sanitiser used per cm^2 is more than enough to cover the entire hand surface, as most participants report to apply more than 3 mL per use (recommended volume). Previous studies show that this contributes only to disinfectant spillage, rather than increased hand coverage (Voniatis, et al., 2021).

Table 1. *Characterisation of the study population.*

	N	Study population		
Age*	61	42,4 ± 9,3 (22 - 61)		
Sex				
Females	62	32 (51,6%)		
Males		30 (48,4%)		
Dermal health perception	**N**			
Reporting skin alterations since use of HS	60	13 (21,7%)		
Redness	57	3 (5,3%)		
Dryness	60	30 (50,0%)		
Cracking	58	3 (5,2%)		
Burning	58	2 (3,4%)		
Scaling	57	4 (7,0%)		
Itchiness	58	6 (10,3%)		
Irritation	57	4 (7,0%)		
Hand sanitisers use		**Home**		**Work**
Form	**N**		**N**	
Gel	59	39 (66,1%)	60	2 (3,2%)
Liquid		11 (18,6%)		47 (75,8%)
Gel and Liquid		6 (10,2%)		11 (17,8%)
Gel and Towels		3 (5,1%)		2 (3,2%)
Frequency				
None/day	53	2 (3,8%)	55	1 (1,8%)
1-3/day		25 (47,2%)		27 (49,1%)
More than 3/day		26 (49,0%)		27 (49,1%)
Area disinfected				
Hands	60	28 (54,3%)	57	26 (45,6%)
Hands and wrists		26 (37,1%)		25 (43,9%)
Hands, wrists and forearms		6 (8,6%)		6 (10,5%)
Dermal exposure assessment*	**N**	**Ethanol**	**N**	**2-Propanol**
Skin loading (g/cm^2; per use)	59	13,6 ± 18,2 (0 - 106,0)	55	10,8 ± 11,2 (0,9 - 63,7)
Total Skin loading (g/cm^2; per day)	52	71,4 ± 156,9 (0 - 900,9)	52	52,4 ± 92,1 (0 - 477,53)

*HS: hand sanitisers; *mean ± standard deviation (minimum - maximum)*

Self-reported dermal effects show that exactly half of the participants noticed skin dryness with the increased use of hand sanitisers. Indeed, this is the most frequently reported effect in the literature (Saha, et al., 2021), even though other studies indicate opposite results (Ahmed-Lecheheb, et al., 2012).

By categorising hand sanitizer use (skin loading) and reported skin dryness (Table 2), it is possible to observe that the group of individuals reporting skin dryness is the one with higher estimates of skin loading (both per use and per day).

Table 2. *Reported skin dryness and hand sanitiser loading*

		Skin loading (µg/cm^2)		
Reported skin dryness	N	per use	N	per day
Yes	29	28,4 ± 35,6 (6,3 - 169,7)	26	143,9 ± 298,8 (11,7 - 1378,4)
No	25	18,1 ± 15,0 (4,7 - 64,0)	23	101,4 ± 139,1 (3,6 - 533,1)

mean ± standard deviation (minimum - maximum)

Limitations

The content in excipients, e.g. glycerine, usually added to hand sanitisers to reduce the alcohol drying effect was not considered, nor the effect of different skin care routines. Furthermore, the total amount of applied sanitiser may constitute an overestimation of dose, as some of the alcohol contained in the product is immediately evaporated. A dispensing volume of 3 mL was also considered for use at home, even knowing that most hand sanitisers flasks available to consumers do not present a dispenser.

Conclusions

Hand disinfection with alcohol-based hand sanitisers has drastically increased during the COVID-19 pandemic, not only among healthcare workers, but also in the remaining occupational sectors and in the general population. Despite the unquestionable benefits of this utilization, data here collected confirms that the increased use of these products may be associated to skin dryness. Further studies assessing objective dermal indicators, such as skin hydration, and elasticity will follow to confirm these results.

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