

## Original article

### Parental knowledge, attitudes and practices regarding safe handling and disposal of alcohol-based hand sanitizers and surface disinfectants in urban Sri Lanka

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#### Abstract

**Introduction:** Hand sanitizers were increasingly used in most households during the COVID-19 pandemic. This study aimed to assess knowledge and practices regarding the safe handling and disposal of alcohol-based hand sanitizers and surface disinfectants in urban Sri Lanka.

**Methods:** A cross-sectional study was performed including parents of children admitted to North Colombo Teaching Hospital for a period of one year in August 2021. Data were collected regarding parental knowledge about the safe handling and disposal of hand sanitizers, and their health hazards by paediatric post-graduate trainees. All data were analyzed using SPSS 17.0. Chi-square test was used to find the association of overall knowledge and attitude scores with potential socio-demographic determining factors.

**Results:** A total of 153 parents were recruited. The majority of mothers (126, 82.4%) and fathers (133, 86.9%) had attended up to secondary school. Approximately 113(73.9%) parents believed that pre-school children were the most vulnerable for accidental ingestion of sanitizers and 40 parents (26.1%) did not believe that sanitizer solutions can be accidentally inhaled by toddlers. Only 132 parents (86.2%) knew how to disinfect their home premises safely and 29 parents (18.9%) didn't know how to store cleaning products safely. Overall, lower knowledge scores correlated with lower maternal education ( $p < 0.05$ ) and lower socio-economic status ( $p < 0.05$ ). The gender ( $p = 0.06$ ) and age of the parent ( $>35$  years versus  $<35$  years) ( $p = 0.21$ ) did not show a significant association. Attitude scores positively correlated with parental education ( $p < 0.002$ ) and socio-economic status ( $p < 0.03$ ). The gender ( $p = 0.12$ ) and age of the parent ( $>35$  years versus  $<35$  years) ( $p = 0.07$ ) did not show a significant association.

**Keywords:** safe handling; sanitizers; surface disinfectants; parental knowledge attitude and practice

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**Conclusion :** Overall knowledge and attitude scores in parents were associated with education level of parents and the level of socio-economic status. Gender and parental age did not show a significant association.

## Introduction

Hand sanitizers were increasingly being used by many people during the COVID-19 pandemic [1]. The sanitizers are effective products that reduce microorganisms on the skin surfaces, but ingestion or improper handling can be associated with increased health risks. Hand sanitizers are classified as over the counter drugs by the U.S. Food and Drug Administration (FDA) [2]. Most of the hand rubs contain about 60%-95% ethanol or isopropyl alcohol by volume, and are frequently combined with fragrances that can be attractive to young children [3]. Some hand sanitizers contain variable amounts of methanol which can be significantly toxic if ingested either accidentally or deliberately by children and young people [4]. Unsafe storage and use of sanitizers are increasingly associated with local and systemic effects on children and can rarely lead to severe complications including death. Therefore, caregivers need to be aware of the potential risks and dangers associated with improper use of hand sanitizer products among children.

Previous studies that have assessed the safe use and storage of hand sanitizers and participants' knowledge, attitudes, and practices during the COVID-19 Pandemic reported that knowledge scores were high among participants who reported that they knew how to clean and disinfect their homes safely, were

able to clean and disinfect safely, and were able to store cleaning products safely than among those who did not agree with these statements [5]. Similarly, respondents who agreed that they knew where to get information on safe cleaning behaviours had higher knowledge scores than those who did not agree. Respondents who agreed that misuse of household cleaners and disinfectants can result in injury had higher scores than those who did not agree [5].

Another study that evaluated the use of hand sanitizers and access to children reported that alcohol-based hand sanitizer (ABHS) exposure was most common whilst isopropanol ABHS exposure was minimal. Primarily exposed route was through ingestion, followed by ocular contamination. These children needed medical advices and OPD (out-patient department) treatments as well as some hospital admissions. Unintentional exposures accounted for highest number of the cases [6].

While it is important to use hand sanitizers to prevent cross-infections, the safety should be taken into consideration as this may be hazardous in children. Studies have shown that the increase use, misuse and unsupervised availability of alcohol-based hand sanitizers during the Covid 19 pandemic resulted in adverse events in children such as skin irritation, dryness, cracking and peeling [7].

Unintentional or intentional ingestion of hand sanitizers in children under the age of 12 years may occur because of the colour, smell and flavour added to it [3]. Consumption of alcohol in children may result in hypoglycaemia, apnoea and acidosis [3]. This allows the invasion of other bacterial and viral infections. Children may also rub their eyes with sanitized hands and cause ocular injury [3]. Children can be exposed to sanitizers and subsequently poisoned in communities where the parents are not practicing safety measures and precautions whilst handling, storing and disposing sanitizers. However, knowledge, attitudes, and practices are shown to be highly variable in different populations and there were no studies performed in Sri Lanka on this aspect of children's safety.

### **Objectives**

To assess parents' knowledge, attitudes, and practices on use of sanitizers and access of these sanitizers to children. and potential hazards of using alcohol-based hand sanitizers and surface disinfectants

### **Methods**

This observational cross-sectional hospital-based study was conducted recruiting parents of children admitted to North Colombo Teaching Hospital, Sri Lanka. North Colombo teaching hospital functions as main and the only tertiary care center for Gampaha district and receives a population of varied ethnicities and socio-cultural backgrounds. All parents of chil-

dren admitted to North Colombo teaching hospital were selected as the study population. The study was conducted within ward settings once children were admitted for acute medical conditions. Parents were recruited prospectively to the study over a period of one year from 01/08/2021 to 01/08/2022.

All parents of children who were between the ages of 18 months and 12 years and considered as at risk for accidental and deliberate self-ingestions of sanitizers were recruited to the study. Parents of children suspected or confirmed COVID 19 infection were excluded due to difficulties in direct interviewing of parents. North Colombo Teaching Hospital serves a population of approximately 100,000. Sample size of 150 was calculated using "Qualtrics" sample size calculator available at <https://www.qualtrics.com/blog/calculating-sample-size/> (margin of error - 0.08 and significance-  $p < 0.05$ ). Participants were selected by simple random sampling.

An interviewer administered questionnaire was used for collection of data. Part 1 of the structured questionnaire contained demographic data (age and gender of parents, parental education levels and socio-economic status of the family). Socio-economic status was defined for the study based on monthly household income – low (less than 300 USD, medium (300-500 USD) and high (over 500 USD). Knowledge was assessed in a 27-item questionnaire and a score was calculated out of the correct responses provided for each of

the 27 questions. A cumulative score of less than 50 percent for the knowledge domain was considered as a poor knowledge score. The attitudes were assessed with an 18-item questionnaire. A similar score was calculated out of the correct responses provided for each of the 18 questions. The practices were assessed using a 7-item questionnaire. Questions were asked in participant parents' native language. The questionnaire was subjected to psychometric analysis and pretesting prior to the study. Administrative approval was obtained prior to collection of data from the Director, North Colombo teaching hospital. Ethical clearance for the study was granted by the ethical review committee, Sri Lanka College of Paediatricians.

All data were collected by post-graduate medical trainees and medical graduates trained for data collection by the investigators of the study. Data were analysed using SPSS 17.0. The respective descriptive data were compared with demographic variables and parental practices in use, and disposal of hand sanitizers.

Chi-square test was applied to find the association of overall knowledge and attitude scores with potential determining factors such as socio-economic status (low socio-economic status versus medium/high socio-economic status), age (> 35 years versus < 35 years) and gender of the parents and the educational background of parents (secondary or equivalent above education versus below secondary education level).

## Results

One hundred and fifty-three attendant parents were recruited to the study. The majority of mothers (126, 82.4%) and fathers (133, 86.9%) had received education at least up to secondary school. 124 parents (81%) had been using hand sanitizers at home regularly. Most mothers were housewives (113, 73.8%) whilst the majority of fathers were semi-skilled workers (drivers, salesmen, farmers, security and defence workers, and clerks) (74, 48.4%). Socio-economic status as assessed based on the monthly household income was low in the majority of participants (88, 57.5%) as compared to medium (51, 33.3%) and high (14, 9.2%) socio-economic status.

### Assessment of knowledge

Only 113(73.9%) parents believed that preschool children were the most vulnerable for accidental ingestion of sanitizers and 40 parents (26.1%) did not believe that sanitizer solutions can be accidentally inhaled by toddlers. Knowledge was poor regarding occurrence of potential symptoms and side effects of sanitizer poisoning such as sore throat (56, 36.6%), irritation of eyes (30, 19.6%), breathing difficulties (40, 26.1%), high heart rate (72, 47%), aspiration (43, 28.1%) and low blood sugar (108, 70.5%) (Table 1). Only 132 parents (86.2%) knew how to clean and disinfect their home premises safely whilst 29 parents (18.9%) didn't know how to store cleaning products safely. Sixty-four parents (41.8%) were unaware regarding how to get

information on safe cleaning practices. In the majority of parents, the main source of education regarding sanitizer safety was social media (134, 87.5%).

Table 1: Pattern of inaccurate knowledge regarding possible symptoms of sanitizer poisoning

Clinical manifestation/complication	Number (%) with inaccurate response
Drowsiness	17 (11.1%)
Loss of consciousness	32 (20.9%)
Vomiting	8 (5.2%)
Sore throat	56 (36.6%)
Irritation to eyes	30 (19.6%)
Haematemesis	92 (60.1%)
Malena	103 (67.3%)
Breathing difficulties	40 (26.1%)
High heart rate	72 (47%)
Aspiration to lungs	43(28.1%)
Low blood sugar	108 (70.5%)
Loss of balance	68 (44.4%)

Mean knowledge score was 14.1 (range – 7-23). Overall, lower knowledge scores correlated with lower maternal education (Pearson chi-square - 9.48,  $p=0.004$ ) and lower socioeconomic status (Pearson chi-square - 4.58,  $p=0.045$ ). The gender (Pearson chi-square - 3.12,  $p = 0.06$ ) and age of the parent (>35 years versus <35 years) (Pearson chi-square - 0.71,  $p = 0.21$ ) did not show a significant association.

#### Assessment of sanitizer handling related practices

Forty-two parents (27.4%) kept sanitizer bottles within easy access to children whilst 85 parents (55.5%) had been storing sanitizers in unlabelled bottles. Ninety-eight parents (64%) were not keen to read the signage alerts in sanitizer storage bottles. Only 25 parents (16.3%) safely

disposed sanitizer bottles. Thirty-three parents (21.6%) put sanitizer bottles together with food items in carriage bags from supermarkets.

Seventy-eight (51%) had been used to buy sanitizers with no description about the containing chemicals. Only 41 parents (26.8%) attempted to find out what chemicals were contained in hand sanitizers they used whilst only 119 parents (77.8%) took measures to keep sanitizer bottles out of reach to their children. Thirty parents (19.6%) said that they will make their own sanitizers at home whilst 49 parents (32%) said they would dispose sanitizer bottles to kitchen waste bin as a means of reducing access of sanitizer bottles to children at home. Parental practices regarding use and storage of hand sanitizers are illustrated in Table 2

Table 2. Parental practices regarding use and storage of hand sanitizers

Item relevant to assessment of practices related to use and disposal of sanitizers	Number (%)
I do not label the sanitizer bottle if I store them in an unlabelled bottle	85 (55.5%)
I do not read signage alerts of the hand sanitizer bottle label whenever I use	98 (64.0%)
I regularly re-fill the hand sanitizer bottles	34 (22.2%)
I store sanitizer bottles together with food items	33 (21.6%)
I dispose sanitizer bottles to kitchen waste bin	49 (32.0%)

### Assessment of attitudes related to use of sanitizers

Sixty-three parents (41.1%) believed that soap and water are not a good substitute for sanitizer solution. Fifteen parents said that they will not

take any action if their child ingests sanitizers accidentally as they are harmless. Parental attitudes regarding use and storage of hand sanitizers are illustrated in Table 3.

Table 3. Parental attitudes regarding use and storage of hand sanitizers

Item relevant to assessment of attitudes related to use of sanitizers	Number (%)
I do not care about chemicals that are contained within hand sanitizers at time of purchase	108 (70.6%)
I buy hand sanitizers with no clear description about its containing chemicals	75 (49.0%)
I do not attempt to keep the sanitizer bottle out of reach of young children?	34 (22.2%)
Soap and water are not a good substitute for hand sanitizers	63 (41.1%)

Parents also admitted that they will practice home remedies if their child is to ingest hand sanitizers and they included: insertion of finger

in mouth (48,31.4%), induce vomiting by soap water (9,5.9%), cow's milk (7,4.6%), coconut milk (23,15%), and water (36,23.5%) (Table 4).

Table 4. Parental attitudes regarding harmful first-aid practices for induction of emesis following potential sanitizer ingestion

Method of emesis induction	Number (%)
Insertion of fingers	48 (31.4%)
Forceful administration of coconut milk	23 (15.0%)
Forceful administration of water	36 (23.5%)
Forceful administration of cow's milk	07 (4.6%)
Forceful administration of soap water	09 (5.9%)

A number of parents believed that following measures would prevent accidental ingestions

of sanitizers at home premises (Table 5).

Table 5. Parental opinion regarding preventive measures for potential sanitizer ingestion

Method of prevention	Number (%)
Making them taste bad	105 (68.6%)
Introducing screw capped lids	132 (86.3%)
Safe storage	143 (93.5%)
Using sanitizers only when soap is not available	103 (67.3%)

Mean attitude score was 9.3 (range: 6-16). Attitude scores positively correlated with parental education ( $p=0.002$ ) and socio-economic status ( $p=0.03$ ). The gender ( $p = 0.12$ ) and age of the parent (>35 years versus <35 years) ( $p = 0.07$ ) did not show a significant association.

### Discussion

Hand sanitizers are increasingly being used both in healthcare and household settings following the COVID-19 pandemic and concurrently with this practice worldwide, there were a number of reports of poisoning with hand sanitizer solutions [8,9,10]. In order to plan preventative measures for poisoning with hand sanitizers, specially by children, it is important that actions are taken to improve existing knowledge, attitudes and practices with regard to safe use and disposal of hand sanitizers by the general public.

The current study noted gaps in knowledge among the parents regarding possible clinical manifestations and complications of sanitizer poisoning and safe use of hand sanitizers. Further, the study noted that gender was not a determining factor for overall knowledge scores. Similar observations were made in a study performed in Ethiopia [11]. Although there are a number of studies performed to assess knowledge, attitude and practices of use and

disposal of hand sanitizers amongst health care workers and students, similar studies on general public are limited [12,13]. These studies have shown that both age and gender were not determining factors for overall knowledge or attitude scores. Interestingly, our study showed that knowledge scores negatively correlated with lower maternal education and lower socio-economic status.

Availability of reliable information sources are vital in informing the public about potential hazards of a toxic agent. Importantly, they should be available in native languages for easy access. Previous research has shown that videos published on social media can potentially give false information to the public. According to a study, most videos published on social media platforms failed to describe labelling storage containers, whilst others encouraged use of oils, perfumes and colouring agents to be more attractive for use among children specifically [14]. The current study observed that majority of parents had acquired knowledge on use of hand sanitizers from social media platforms highlighting the need for improved awareness regarding reliable and valid information sources. Practices with regard to unsafe storage of hand sanitizers seen in the current study were similar to studies conducted in developed

countries<sup>5</sup>. These studies have highlighted the importance of tailored communication strategies specially for those with poor understanding of safety.

The current study revealed several unhealthy practices and attitudes among parents regarding safe use and disposal of hand sanitizers. Over 40% of respondents believed that soap and water are not a good substitute for hand sanitizer and a notable proportion was having a higher threshold for action following a potential sanitizer ingestion. There was a high prevalence of unhealthy parental attitudes regarding harmful first-aid practices for induction of emesis following a potential sanitizer ingestion. It is therefore, important that the public is provided with accurate information in their native languages regarding potential harmful effects of these first aid measures and safety information of hand sanitizers. Promotion hand washing and increase of hand washing facilities important for preventing inadvertent harmful effects of hand sanitizers [15].

In the light of observations made in current study, the use of hand sanitizers in general needs to be revised in both children and adults. Other interventions on lowering the risk of adverse events because of misuse of hand sanitizer need to be encouraged more often. These include promoting washing of hands over sanitizers where possible, training children on how to use hand sanitizers and creating awareness of the dangers if ingested or in contact with the eyes.

## Conclusion

The findings of this study inform that knowledge in parents regarding safe use of sanitizers can further be improved specially, in areas of local and systemic effects of sanitizer poisoning and information resources of safe cleaning practices. As a number of parents used and disposed hand sanitizers unsafely, the effectiveness of awareness programs to improve safety practices among parents should be evaluated. Overall knowledge and attitude scores in parents were correlated with education level of parents and the level of socio-economic status.

## Declarations

### Authors' contribution

KD designed the study, performed literature survey, analysed data and wrote manuscript. HP collected data and wrote manuscript. EKND collected data and wrote manuscript. VT collected data and wrote manuscript. SJSD collected data and wrote manuscript. All authors approved the final version of the manuscript.

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None

### Conflict of interest

All authors declare that there are no conflicts of interest.



## Ethical approval

Ethical approval for the study was granted by the Ethical Review Committee of Sri Lanka College of Paediatricians.

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