

ORIGINAL PAPER

Therapy area: Other

The use of cleaning products and its relationship with the increasing health risks during the COVID-19 pandemic

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Abstract

Objective: The present study aimed to determine the factors affecting the use of cleaning products at the home environment and the frequency of problems during the coronavirus disease-19 (COVID-19) pandemic.

Materials and methods: This cross-sectional research was performed online between 30 August 2020 and 15 September 2020. The population of the study consisted of adults aged between 18 and 80 years, affected by the COVID-19 pandemic. Data collection forms (introductory information and risk perception form and cleaning products usage characteristics form) were shared through Web2 tools. The questionnaire study was completed with 674 participants between the ages of 18 and 80 years in Turkey. Descriptive statistics and classification tree were used in the analysis of the data. Statistical significance was accepted as $P \leq .01$ in all analyses.

Results: During the pandemic period compared with the pre-pandemic period, it was observed that the frequency of cleaning (69.3%) and the amount of cleaning product usage (74.2%) increased significantly and the frequency of problems related to the use of cleaning products was found as 46.9%. The most commonly reported problems were skin disturbances (68%) and shortness of breath (23%). It was determined that the history of contact with the COVID-19 patient, the perceived risk of COVID-19 infection and risky cleaning behaviour were predictive in determining the risk of experiencing problems related to cleaning products. The amount of bleach consumed per month among who did experience problems was higher than those who did not experience problems and was associated with the perceived risk of COVID-19 infection.

Conclusion: In the COVID-19 pandemic, human beings have been found to increase the frequency of cleaning and using cleaning products. In order to reduce the negative effects of chemicals used for cleaning on human and environmental health, the trainings to be given by the teams providing primary healthcare services can be effective as well as general education activities for community groups.

1 | INTRODUCTION

Coronavirus disease-19 (COVID-19), reported from China on 31 December 2019 and identified as a pandemic by World Health Organization on 11 March 2020, is an important public health

problem that caused illness for ~54 million people, death of 1.3 million and serious economic losses on the world.^{1,2}

SARS-CoV-2, the causative agent of COVID-19, is an enveloped virus related to the corona virus family. The initial source is not known yet, but asymptomatic and symptomatic people infected with

the virus were reported to be the source of the disease. Although corona viruses are not very resistant to the external environment in general, it is reported that they can survive more than 5 days on plastic, 5 days on metal, 4-5 days on wooden surfaces, 4 days on glass cups, 2-3 days on steels, 2 days on clothes, 8 hours on latex gloves and more than 4 hours on copper items depending on factors such as the amount of organic material that is discharged, the humidity and temperature of the environment or the texture of the contaminated surface. The agent remaining on the surfaces for a long time poses a significant risk for the spread of the disease.^{3,4}

In addition to individual precautions in preventing the disease, environmental disinfection is also mentioned. It is stated that the use of regular cleaning products will be sufficient if there is no infected person in the home environment. It is recommended to disinfect frequently contacted surfaces with a solution of 0.1% sodium hypochlorite or a product containing 70%-90% alcohol after organic contamination. If there is an infected person in the house, it is recommended to separate the common areas, and after cleaning the toilet, bathroom and areas that come into contact with the patient's output, disinfect them with 1% bleach and wash their laundry at 60°C.^{1,5} Short information programs were organised by national and regional sources through the media on the environmental control of the disease, the good ventilation of the cleaning environment, the use of protective equipment and the usage of cleaning products in accordance with the label for the protection of health.⁶

In this process, almost all over the world, the increase in the time spent at home because of curfews or restrictions and the panic mood that occurred have brought along significant increases in the amount and type of cleaning products used in the home environment.⁷

Household cleaning products containing many different chemicals offer important contributions in preventing the disease. On the other hand, when not used properly, it is stated that it may cause indoor air pollution, dermatitis, allergic rhinitis, respiratory problems or increasing asthma. In fact, it is known that mixing different chemicals or taking them by swallowing can cause poisoning and result in death.⁸⁻¹⁰

During the COVID-19 pandemic, it has been stated that the number of chemical exposures reported to National Poison Data System, Centers for Disease Control and Prevention (CDC) and the American Association of Poison Control Centers increases compared with the same period of previous years, and this increase may be related to the COVID-19 pandemic.¹¹ In a study conducted in the USA, it was reported that there had been risky usage as well as the lack of knowledge and practice regarding the use of household cleaning products.¹² It is stated that the increased use of cleaning products and disinfectants is a significant threat not only to human health but also to environmental health.¹³

Turkey does not have adequate data on the use of cleaning agents before the pandemic period. The COVID-19 pandemic has created a mood of panic in societies in general. Although World Health Organization has published guidelines for environmental disinfection and personal hygiene practices, it is seen that individual and social disinfection practices that do not have scientific basis and that may harm natural life are performed.¹⁴

What's known?

- During pandemic, human beings increased the frequency of cleaning and using cleaning products.
- It has been observed that the probability of developing problems is increased with cleaning products in this period.

What's new?

- The problems with cleaning products are higher in persons with high-risk perception, history of contact and risky cleaning practices.

As in the pre-pandemic period, it is seen that the effects of chemical used in houses could not be adequately evaluated during the pandemic period because of the factors such as environmental impacts depending on multiple causes, difficulties in revealing subjective effects and the occurrence of the effects many years after the exposure.¹⁵ However, it is important to reveal how to use the cleaning products, in order to reduce or prevent possible individual and environmental damages and to guide the public information to be made on the subject.

In this study, we aimed to determine the factors affecting the use of cleaning products at the home environment and the frequency of problems during the COVID-19 pandemic.

2 | METHOD

2.1 | Study design and participants

This cross-sectional research was conducted online between 30 August 2020 and 15 September 2020. The population of the study consisted of adults aged between 18 and 80 years, affected by the COVID-19 pandemic. Sample size and the cleaning product usage rate were calculated as 50%, the sampling error was calculated as 5%, and the confidence interval was calculated on 663 people as 99% by Epi-Info™ (CDC, Atlanta, GA, USA) for Windows (5.4.11). In determining the sample, the haphazard sampling method, one of the non-probability improbable sampling methods, was used. Data collection forms were shared through Web2 tools. The questionnaire study was completed by 674 participants between the ages of 18 and 80 years in Turkey.

2.2 | Data collection tools

The data were collected with "Introductory Information and Risk Perception Form" and "Cleaning Products Usage Characteristics Form," which are developed by researchers by scanning the literature and evaluated by four experts.^{5,11,12}

In the "Introductory Information and Risk Perception Form," there were five questions regarding the socio-demographic characteristics of the participants (age, gender, education, income and number of people living at home) and two questions about whether they had COVID-19 and contact history. The perceived risk of COVID-19 infection was assessed with a question on a scale ranging from 0 (none) to 10 (very high).

"Cleaning Products Usage Properties Form," which have four sections consisting of product types used in domestic cleaning, changes in use and expenditure compared with the pre-pandemic period, health problems related to use and evaluation of usage habits, has 58 questions in total. The questions used in the questionnaire are shown in tables and figures.

Usage habits were evaluated as "appropriate applications, risky applications and natural product preference." Eight expressions involving "appropriate practice" behaviours were scored as a five-point Likert scale with "5 for always" and "1 for never." A minimum of 8 and a maximum of 40 points could be obtained from this section. The higher the score, the better the correct cleaning practices. "Risky practices" were evaluated with five expressions, a minimum of 5 and a maximum of 25 points could be obtained from this section, and an increase in the score indicated that risky practices increased. A minimum of 3 and a maximum of 15 points can be obtained in the "natural product preference" section where three expressions are located, and the increase in the score was considered to be an increase in the frequency of natural product preference.

2.3 | Analysis of data

The data of the research were analysed by using SPSS version 20.0 for Windows. The suitability of the data to normal distribution was determined according to the kurtosis and skewness coefficient, together with descriptive statistics; χ^2 -test, t test and correlation analysis were used to compare groups' average.

The chi-squared automatic interaction detection model was used in the decision tree analysis, which was conducted to evaluate the variables predicting the problematic situation associated with cleaning products, 60% of the data set was used in the training data model and 40% was used for testing. At least one problem as a dependent variable and as independent variables: age, gender, contact history, risk perception, having COVID-19, usage habits scores, frequency of using bleach caused by the frequent use of bleach for cleaning use, change in the amount of bleach used at one time, the frequency of cleaning and the variety of materials used was added to the model. Statistical significance was accepted as $P \leq .01$ in all analyses.

3 | RESULTS

Of the participants in the study, 70.3% were women, 57% were 21-40 years old, 91.3% had a university or higher education, 55.6% had an income equivalent to their expenses and 47% were living with

TABLE 1 Distribution of socio-demographic characteristics of the participants

Variables	n	%
Age (y)		
18-20	10	1.5
21-40	384	57.0
41-60	261	38.7
61-80	19	2.8
Gender		
Female	474	70.3
Male	200	29.7
Education		
High school and below	59	8.7
University and higher	615	91.3
Income level		
Less than expenses	93	13.8
Income is equivalent to expenses.	375	55.6
More than expenses	206	30.6
Number of individuals living at home		
Alone	55	8.2
Two persons	317	47.0
Three to four persons	278	41.2
Five and above persons	24	3.6
COVID-19 diagnosis		
Positive	11	1.6
Negative	663	98.4
Contact with someone diagnosed with COVID-19		
No	512	76.0
Yes #	162	24.0
With a family member	15	2.2
With someone of his/her workplace	119	17.7
With someone of his/her social circle	28	4.2
COVID-19 catching risk perception		
Median (25%-75%)	7 (5-8)	

Abbreviation: COVID-19, coronavirus disease-19.

two people. In this study, 1.6% of the participants had COVID-19 and 24% had contact with an individual with COVID-19. The perceived median COVID-19 infection risk was 7 (25%: 5%-75%: 8; Table 1).

During the pandemic period compared with the pre-pandemic period, the frequency of the participants to clean their homes increased by 69.3%, the time they allocated for cleaning by 74.6%, the money they spent by 72.6%, the water they used by 83.1%, the amount of cleaning materials they use by 74.2%, the variety of cleaning products by 49.1% and the time allocated for personal cleaning by 84.1%.

While there was no change in 45.8% of the participants consuming carbonate, 49.6% acid and 44.4% ammoniac cleaning products consumption and the amount used at one time (48.8% containing acid and 50.9% containing ammonia), the amount used of hand sanitizer, soap, vinegar, detergent, surface disinfectant and bleach at one time increased at a rate varying between 92.7% and 53% (Figure 1).

While the average usage of cleaning products containing acid is less than 1 L monthly, ammonia-containing products, bleach, surface disinfectant, dish and laundry detergent, hand sanitizer and soap consumption average is more than 1 L monthly.

The present study revealed that 46.9% of the participants experienced at least one problem that they thought was related to cleaning products during this period. Among these participants, 68% of those with problems experienced itching, redness, scaling on the skin, 23% shortness of breath, wheezing, 3% asthma attack and 6% poisoning (7 people respiratory and 17 people through skin). While 71.3% of those who reported a complaint had only one problem, 23.5% had two, 4.3% had three and 0.9% had four problems (Figure 2).

While monthly bleach consumption amount (2.02 ± 1.54) for those who have problems with cleaning products is more than those

who have no problems (1.63 ± 1.46), there was no difference with other cleaning products ($t = 3.38, df = 672, P = .001$). There was a positive correlation between monthly bleach consumption and the perceived risk of COVID-19 infection ($r = 0.12, P = .002$).

“Appropriate cleaning practices” score average of participants is 30.98 ± 6.53 (min: 8, max: 40), “risky cleaning practices” score average is 9.07 ± 3.60 (min: 5, max: 25) and “Natural product preference” score average is 9.06 ± 3.00 (min: 3, max: 15). While the least done of the correct cleaning practices was the use of preservatives while using a cleaning product, the most common one of the risky cleaning habits was wiping the packaged foods with dish soap or bleach. People mixing different cleaning products with each other were 48.4% of the participants. Mixing bleach and vinegar was 16.4%, and wiping packaged foods with bleach was 49.3% of the participants. According to natural product preference, 10.5% of the participants were always using products such as vinegar and baking soda instead of chemical cleaning products (Table 2).

According to the classification tree, it was observed that there was a significant relationship between the problems associated with cleaning products and the history of contact with the COVID-19

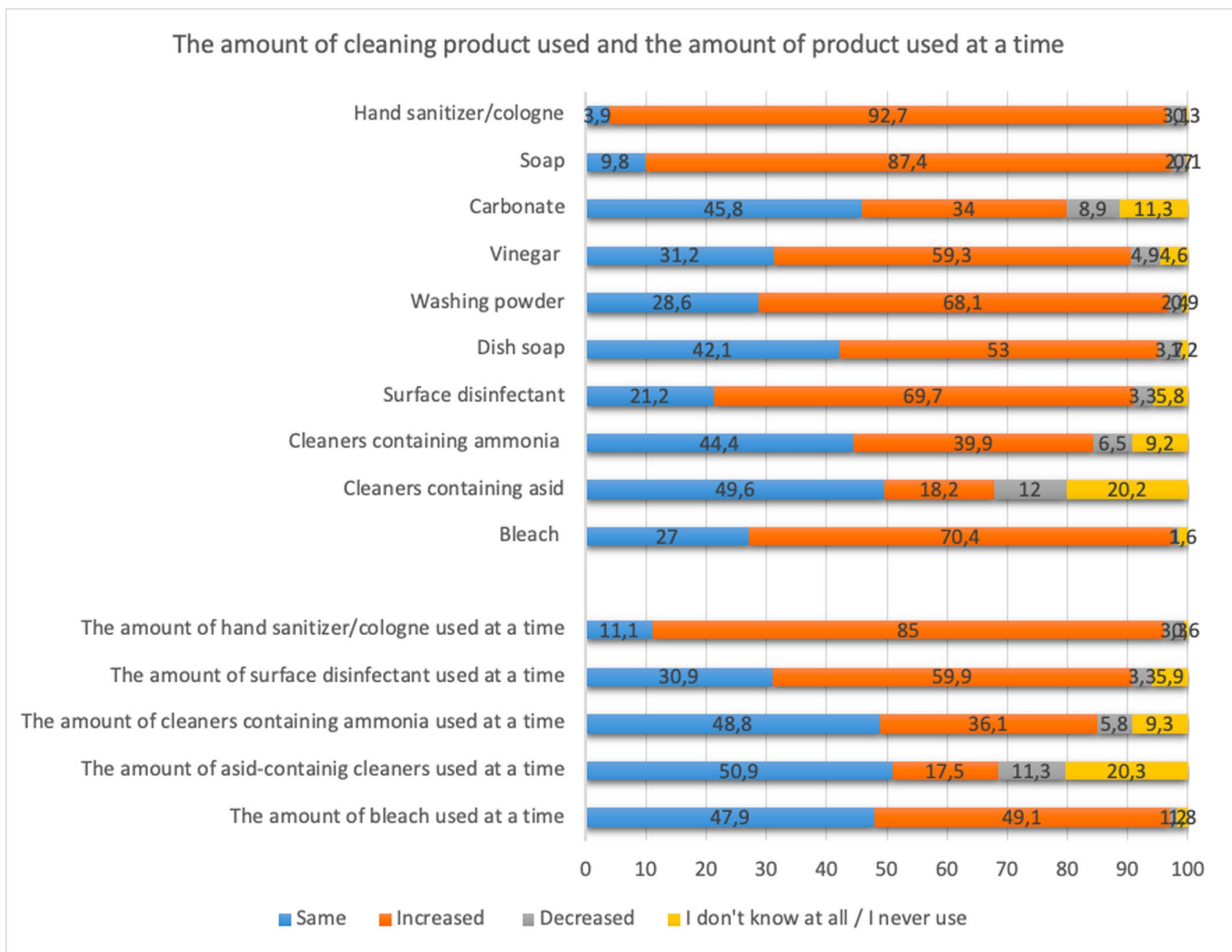


FIGURE 1 Comparison of the coronavirus disease-19 pandemic and the pre-pandemic period in terms of the amount of cleaning product use and the amount of product used at a time

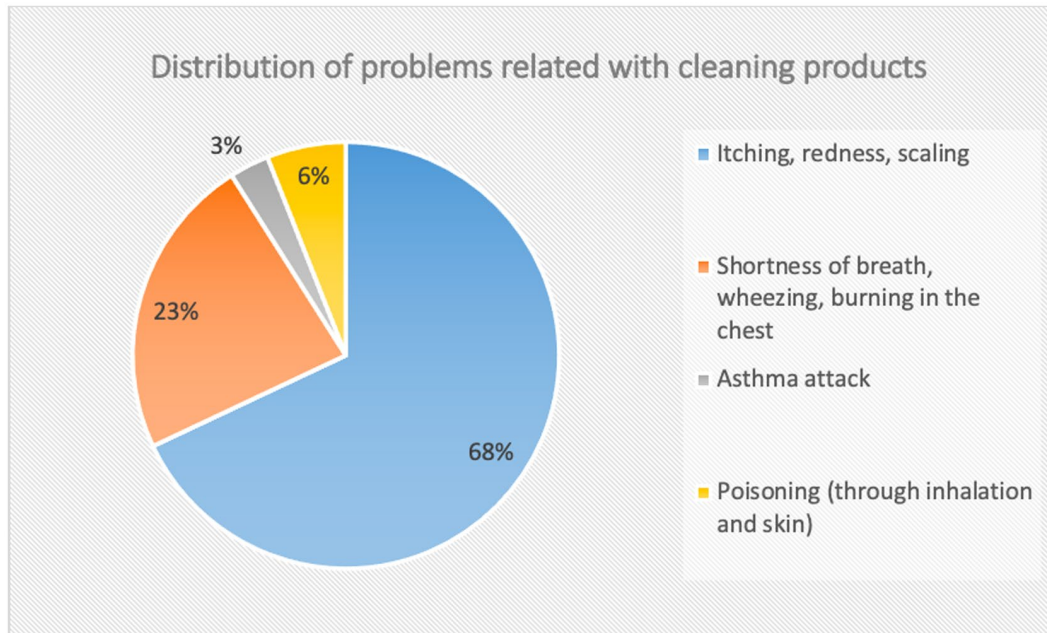


FIGURE 2 Distribution of problems related to cleaning product/cleaning behaviour during the coronavirus disease-19 pandemic period

patient, the perceived risk of COVID-19 infection and risky cleaning practices (Figure 3).

The correct estimation rate of the established model is 58.5%. Having more problems is highly probable for those who have history of contact with infection to those who do not, those with no contact but the perceived COVID-19 infection risk score above 7 to those with score 7 or below and those who have perceived COVID-19 infection risk and risky cleaning practice score above 7 to those who have 7 or less scores (Figure 3).

4 | DISCUSSION

In this study, the characteristics of cleaning product used during the COVID-19 pandemic period and the factors affecting the problems associated with these products were examined. It was observed that the frequency of personal cleaning and house cleaning, the amount and the variety of material used were increased. With this increase, it was detected that risky cleaning practices increased and risk perception and contact history had an important place.

It is an expected result that the frequency of cleaning will increase during the pandemic process, but this situation may cause undesirable consequences for the individual and environmental health in both short and long terms. In the report of the CDC, it was reported that more than half of the participants during the COVID-19 pandemic period increased the frequency of cleaning or disinfecting the house compared with the previous months.¹²

Nearly half of the participants in the current study reported at least one problem that they believed was associated with cleaning products during this period. Most of the reported complaints were skin problems that could be considered as mild, but serious problems such as respiratory distress and triggering an asthma attack had

also been reported. In studies conducted in different regions before the pandemic period, the frequency of problems associated with cleaning products varied between 13.2% and 27%.¹⁶⁻¹⁸ In the study conducted by the CDC throughout the USA during the COVID-19 pandemic period, one fourth of the participants reported at least one problem related to the use of cleaners and/or disinfectants; the problems were related to skin, eye, nose and sinus irritation, dizziness, headache, nausea and respiratory distress.¹² In another report of the CDC, it was stated that there were serious increases in the calls to National Poison Information Centers, which were related to the use of cleaners and/or disinfectants (118%) and bleach (62.1%) that might be associated with the increasing and risky use of cleaning/disinfection products during the pandemic period. Exposure has often been reported to be via inhalation and swallowing.¹¹ Although there were not enough data of the pre-pandemic period in Turkey, in the present study, problem notification rate is higher than the CDC's report and reported frequency (7.57%) to poison hotline in 2008 in Turkey before the pandemic period.¹⁹ In addition to differences in lifestyle and cleaning habits, it may be caused by panic mood during the pandemic.

In this period, it was seen that the history of contact with the COVID-19 patient and the perceived risk of COVID-19 infection were effective in predicting the problems thought to be related to cleaning products. It is reported that the perception of risk is an effective tool in the adoption of preventive measures during pandemics.²⁰⁻²² However, it is stated that, in newly emerging diseases such as COVID-19, people's objective risk information is insufficient, and it is not known exactly how this will reflect on adopting protective behaviours. It was reported that those with a high-risk perception of COVID-19 infection were more likely to apply protective behaviours, and this increase in the risk perception had also increased frequency of washing hands.²² Although there is a difference between

TABLE 2 Distribution of the cleaning practices of the participants

	None n (%)	Rarely n (%)	Sometimes n (%)	Mostly n (%)	Always n (%)
Good cleaning practice habits (mean \pm SD) 30.98 \pm 6.53 (min: 8, max: 40)					
Looking up the expiration date when buying cleaning products/disinfectants	80 (11.9)	84 (12.5)	77 (11.4)	131 (19.4)	302 (44.8)
Reading the label of cleaning materials before use	58 (8.6)	87 (12.9)	89 (13.2)	166 (24.6)	274 (40.7)
Using cleaning products as much as the amount written on the label	41 (6.1)	65 (9.6)	103 (15.3)	288 (42.7)	177 (26.3)
Ventilation to home when using cleaning products	6 (0.9)	33 (4.9)	61 (9.1)	212 (31.5)	362 (53.6)
Using protection when using cleaning products (gloves, mask, goggles, etc)	136 (20.2)	232 (34.4)	156 (23.1)	95 (14.1)	55 (8.2)
Hand washing after contact with the cleaning product	31 (4.6)	39 (5.8)	66 (9.8)	123 (18.2)	415 (61.6)
Keeping the cleaning supplies out of reach of children	36 (5.4)	38 (5.6)	50 (7.4)	136 (20.2)	414 (61.4)
Keeping cleaning products in a cool and sunless place	30 (4.5)	29 (4.3)	54 (8.0)	125 (18.5)	436 (64.7)
Risky cleaning habits (mean \pm SD) 9.07 \pm 3.60 (min: 5, max: 25)					
Mixing different household cleaning products with each other	348 (51.6)	169 (25.1)	111 (16.5)	37 (5.5)	9 (1.3)
Keep waiting the vegetables, fruits and greens in water with bleach added	571 (84.7)	44 (6.5)	23 (3.4)	18 (2.7)	18 (2.7)
Mixing bleach and vinegar	577 (85.6)	41 (6.1)	20 (3.0)	21 (3.1)	15 (2.2)
Washing packaged foods with dishwashing liquid	214 (31.8)	150 (22.3)	96 (14.1)	121 (18.0)	93 (13.8)
Wiping packaged foods with bleach	342 (50.7)	135 (20.0)	72 (10.7)	74 (11.0)	51 (7.6)
Natural product preference and usage habits (mean \pm SD) 9.06 \pm 3.00 (min: 3, max: 15)					
Keep waiting the vegetables, fruits and greens in water with vinegar added	114 (16.9)	118 (17.5)	131 (19.4)	152 (22.6)	159 (23.6)
Using products such as vinegar and baking soda instead of chemical cleaning products	98 (14.5)	166 (24.6)	200 (29.8)	139 (20.6)	71 (10.5)
Buying organic/natural cleaning products	72 (10.6)	165 (24.5)	210 (31.2)	145 (21.5)	82 (12.2)

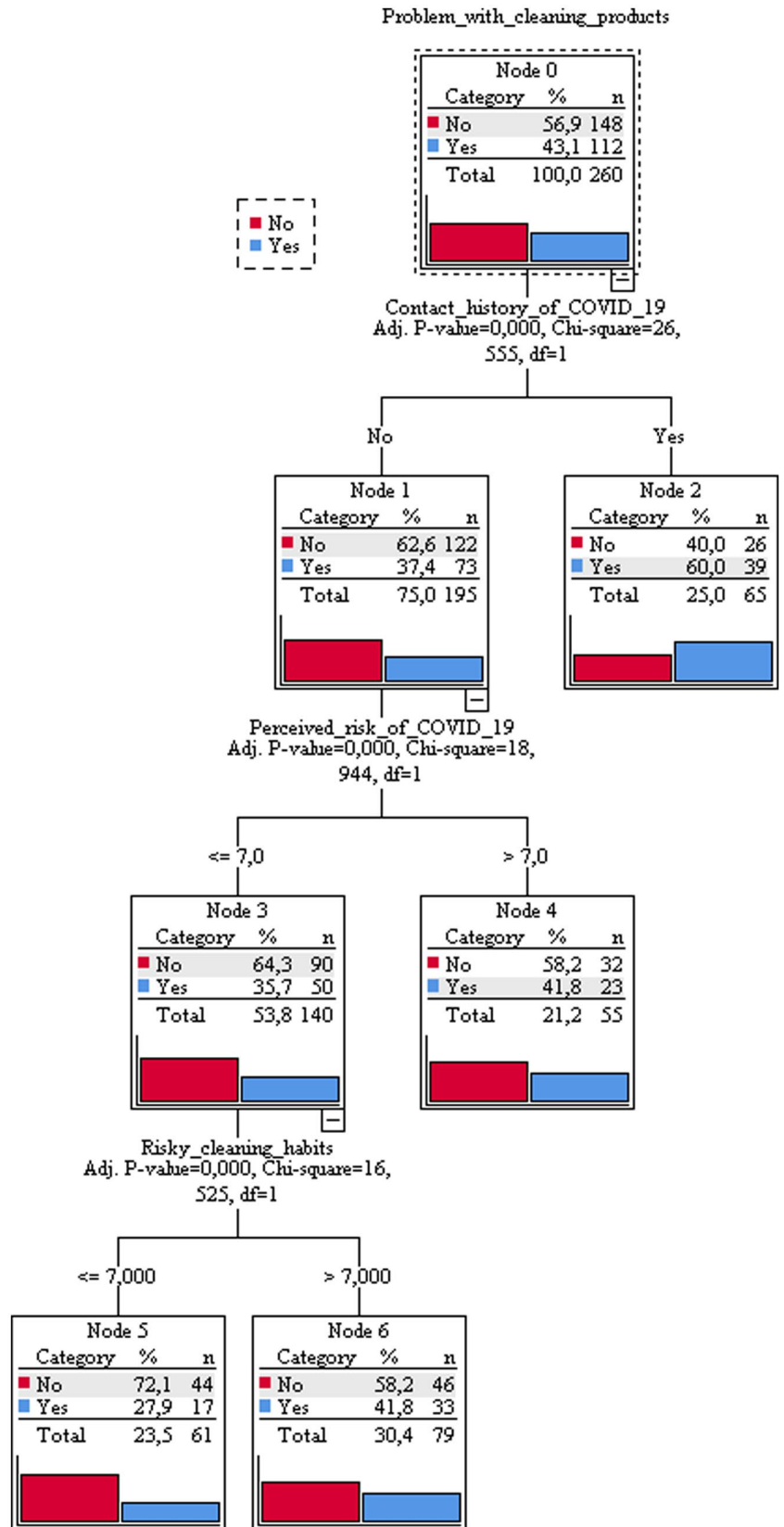
Abbreviation: SD, standard deviation.

countries in risk perception, it is stated that the most important determinant of risk perception in many countries is direct experience with the virus.²¹ In the present study, the history of contact with the sick individual may have increased the severity of the risk, created panic and increased risky cleaning behaviours such as excessive cleaning and product use.

Behaviours such as using more than the recommended amounts on the label of cleaning products, outside the area of use (foodstuff, skin cleaning, etc), and mixing different products are stated as risky behaviours.^{12,16} Similarly to the studies in the literature, in our study, it was determined that risky cleaning behaviours were predictive of problems related to cleaning products. Washing packaged foods/products with bleach or detergent may increase the risk of chemical contamination of food and therefore the risk of further problems.²³ The CDC states that the contact of foodstuffs with bleach should be prevented.¹² Although the antimicrobial activity of bleach as a vegetable and fruit disinfectant has been proven, it is not recommended for food disinfection because of its high residue risk.²⁴

Another risky cleaning behaviour is mixing different cleaning products, which is performed by almost half of the participants. Toxic products may arise as a result of chemical reactions caused by mixing products containing different chemicals.²⁴ Bleach is a powerful disinfectant used in disinfection of COVID-19, which is composed of sodium hypochlorite active ingredients. In order to avoid the toxic effects of bleach, it is recommended not to mix it with any chemicals, use it diluted, ventilate the cleaning environment and use preservatives to prevent skin contact.^{25,26} However, it is observed that those who always use the ventilation are limited to half of the participants and their regular use of protective is very low. The CDC's report states that the participants have limited knowledge of not mixing cleaning products.¹² In the present study, although it was a group with a high level of education, it was observed that compliance with the recommendations was low. This situation may have resulted from the continuation of habits before the pandemic period, as well as the fear and panic environment created by the pandemic period.

FIGURE 3 The classification tree for the problems that related to cleaning products



Prolonged exposure to bleach or in high concentrations may cause skin irritation or damage, dermal hypersensitivity and burns.²⁷ Similarly to the literature, in the current study, it was observed that bleach had a significant effect on problems related to cleaning

products. Besides inadequate knowledge of bleach usage may be effective in the problems associated with bleach, risk perception can also be effective, as seen in the current study. In this period, the perception of risk can be evaluated as it may affect the cleaning habits

as well as the knowledge level in determining the people with high risk of experiencing problems related to cleaning products.

The present study revealed that the amount of use of vinegar, an alternative for those who do not want to use chemical cleaning products, had also increased. It is known that acetic acid in the compound of vinegar has virucidal effects for SARS-CoV-2.²⁸ Vinegar, which is frequently used in the disinfection of fresh vegetables and fruits, is also used in floor and surface cleaning.²⁵ Although the use of vinegar is perceived as more natural and safer, acetic acid is an organic abrasive and is important in terms of causing chemical reactions and unwanted effects when mixed with alcohol, bleach or carbonate.^{25,29} While informing the society, explaining the safe use methods of products that are accepted as natural will decrease the possibility of experiencing problems.

One of the main strategies in preventing the spread of the disease is to provide hand hygiene with water and soap or hand antiseptics.^{1,5} In our study, as expected, alcohol-based hand sanitizer and soap usage frequency and amount increased. Although this shows the importance given to hand hygiene, it may cause an increase in the negative effects of alcohol content in the compound of hand antiseptics on human and environmental health. Alcohol-based hand disinfectants recommended by World Health Organization consist of different combinations of ethanol, isopropyl alcohols and hydrogen peroxides.^{1,5} Concern has been expressed that intensive use of antiseptics may develop resistant microorganisms and increase other viral infections, and it is stated that non-standardised and insufficiently controlled antiseptics made by using/mixing methyl alcohol may also cause toxic effects. It is stated that products containing methyl alcohol have been removed from the market as a result of the audits carried out in some countries.^{30,31} For safe hand hygiene, when purchasing hand sanitizer, it is important to read the label information and to choose products that pass safety controls.

Similarly to the literature, in the current study, the increase in the use of surface disinfectants can be considered as a risk in terms of human and environmental health. Surface disinfectants consist of different chemical compounds. It is stated that exposure to quats, sodium hypochlorite, hydrogen peroxide, alcohol and glutaraldehyde increases the risk of chronic obstructive pulmonary disease, asthma and eye irritation as well as polluting the indoor air by the disinfectant residues on the surfaces.²⁴ It should not be forgotten that disinfectants used have some long-term effects as well as short-term effects, and unnecessary and excessive use should be avoided.

During the pandemic period, it was observed that the amount and variety of materials used for both personal and house cleaning increased. In the literature, it has been reported that there is a significant correlation between having problems related to cleaning products and the number of cleaning products available at home and used daily.¹⁶ The increasing amount and variety of chemicals can cause both indoor air pollution and increased chemical exposure as well as harming nature. While the chemicals mixed with water cause water pollution and harm aquatic creatures, besides, it is worried

that the increased use of water in homes can have serious consequences.^{8,32-35} In addition to water pollution, the increasing amount of packaging waste poses an important problem.³⁶ As can be seen during the pandemic period, it is important to raise awareness of communities about developing correct cleaning behaviours and avoid of using unnecessary chemicals in order to protect both human health and environment.

4.1 | Limitation suggestion

Because of the fact that this study used the haphazard sampling method and done online, the results could not be generalised; besides, it provides important findings on a subject with information gap.

Because the study was conducted online, the differences in education and socio-economic levels could not be fully revealed.

The data of the research were collected by self-reporting method. Participants may have exaggerated the problems they experienced with the cleaning product, or less mild problems may not be reported.

Because a definite cause and effect relationship cannot be presented in a cross-sectional study, the reported problems cannot be said to be directly related to cleaning products. Prospective studies can be designed with chemical exposure indexes.

The research data reflect the cross-section of time they are collected. The behaviour of society/people may change over time. The study can be repeated at regular intervals during the pandemic to see the trend of change in the society.

In the study, we worked only with adult individuals. Children's exposure to cleaning products is an important problem. It is recommended to carry out studies to reveal the effects of children from cleaning products during the pandemic process.

5 | CONCLUSIONS

The present study revealed that people had increased the frequency of cleaning and using cleaning products, and it had been observed that the probability of developing problems with cleaning products was higher, especially in those with high-risk perception, history of contact and risky cleaning practices, in the COVID-19 pandemic. In order to reduce the negative effects of chemicals used for cleaning on human and environmental health, the trainings to be given by the teams providing primary healthcare services can be effective as well as general education activities for community groups.

ETHICS AND PERMISSIONS

Necessary permissions were obtained from the Ministry of Health and Mersin University Clinical Research Ethics Committee before the study. Participation in the study was on a voluntary basis. Ethics committee number: 19/08/2020 17-593.

DISCLOSURES

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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