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Anomaly of Household Cleaning Agents and their Impacts on Human Health and Environment

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Abstract
Cleaning agents consist of various chemicals; pose significant threats to aquatic ecosystems, the environment, and human health. Over time, there has been a notable increase in the production and consumption of these cleaning products. Housemaids are more susceptible to exposure compared to homemakers and men. Both housemaids and housewives experience greater adverse effects from cleaning agents, often due to a lack of knowledge regarding safe usage, appropriate dosages, and the health and environmental implications. This study investigates the inconsistent use of household cleaning products and their effects on human health, with a particular emphasis on housemaids and homemakers, as well as the environmental repercussions. The research was conducted in two distinct locations: a slum area in Vashantek and the Mohakhali Defense Officer's Housing Society. Data were gathered from 500 respondents (250 from each location) through semi-structured interviews and analyzed using statistical software. The study revealed a wide variety of cleaning products and brands. Respondents in Vashantek reported spending more time using cleaning agents than those in Mohakhali. Various detergents were identified as the primary cleaning agents. Medical expenses significantly increased with longer working hours and greater consumption of cleaning products. The research identified 25 different physical and mental health issues linked to the use of cleaning agents. Notably, skin and vision problems were significantly associated with detergent use, while bar soap did not present any associated risks. The use of hot liquid cleaning agents was found to pose potential risks to mental health, whereas bars showed no significant negative effects. Natural cleaning products may serve as a viable alternative for preventive health measures and environmental enhancement. It is crucial to promote widespread awareness and identification of sustainable cleaning solutions to mitigate associated risks. .

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1. Introduction

Cleaning agents are primarily formulated from a variety of chemicals and are commonly found in several forms, including liquids, powders, sprays, and granules. These agents are employed to remove various types of debris from surfaces and fabrics, such as dust, stains, odors, and clutter. The main purposes of using cleaning agents are to promote health safety, improve aesthetic appeal, eliminate unpleasant odors, and prevent the transfer of dirt and pollutants to individuals and their environments. Certain cleaning products are capable of killing germs, including bacteria that may reside on surfaces like door handles and countertops, while also serving cleaning functions. Nevertheless, the environmental and health impacts of these cleaning chemicals are not sufficiently explored. In Bangladesh, there has historically been a dependence on housemaids for cleaning duties. Due to a lack of knowledge and awareness, there is often an overuse of cleaning agents, which exacerbates their harmful effects. The chemicals found in cleaning products, such as laundry detergents, bleaches, dishwashing liquids, and other household cleaners, enhance cleaning efficacy, thus aiding in the upkeep of cleanliness in homes, workplaces, and various other settings. For many years, chemical-based household cleaning agents have contributed to toxicity that impacts both environmental and human health (Khalil *et al.*, 2021). In numerous nations, many hazardous household chemicals remain legal or are poorly regulated. A considerable number of companies manufacture such products that are integrated into everyday life. The use of these cleaning materials poses health risks, particularly to vulnerable groups such as fetuses and infants, and can negatively affect reproductive health. Additionally, these household chemicals have significant adverse effects on environmental quality. Cleaning products play a crucial role in modern society, being employed on a daily basis in both domestic and professional environments, especially in urban and peri-urban regions.

According to Wolkoff *et al.* (1998), these cleaning agents can pose occupational hazards, leading to heightened asthma symptoms among cleaning staff. This situation underscores the urgent need for systematic strategies to mitigate these risks. A thorough evaluation of the ingredients in cleaning products and the associated exposures in both home and workplace settings is essential. Identifying harmful components of these agents and investigating the potential risks of inhalation and skin exposure during cleaning activities is of paramount importance (Bello *et al.*, 2009). Bello *et al.* (2009) categorized cleaning tasks into three exposure levels: low, medium, and high, based on inhalation risks. Low exposure tasks primarily involve floor cleaning, while medium exposure includes activities such as cleaning windows, mirrors, sinks, and toilets. The highest exposure category pertains to bathroom cleaning tasks. Cleaning agents also pose significant risks for dermal exposure, particularly to the skin. Various exposures routes, including emission, deposition, and transfer, contribute to health and environmental hazards.

Emission routes present greater risks compared to transfer and deposition routes, particularly during the cleaning of mirrors and toilet bowls. Spraying tasks can generate liquid particles that may come into contact with the skin. Numerous adverse effects, including hand dermatitis, have been reported among workers (Bello *et al.*, 2009).Transmit risks are particularly pronounced during floor cleaning, where hands come into contact with mop handles contaminated with cleaning solutions. Hands are typically associated with the highest levels of dermal exposure across most tasks, while forearms represent the second highest risk during sink, toilet bowl, and mirror cleaning. Feet and lower legs are more exposed during floor cleaning activities. As the global population continues to grow, the demand for cleaning chemicals is steadily increasing.

Manufacturers are consequently urged to enhance the production of household cleaning products. Currently, a paramount concern revolves around sustainable development, which emphasizes the importance of environmental stewardship for the benefit of future generations. Therefore, suppliers are encouraged to create chemicals that minimize adverse environmental impacts. Every individual possesses the right to utilize resources while simultaneously ensuring their entitlement to a safe living environment. Human involvement in environmental initiatives is crucial, thereby granting future generations the right to access resources and inhabit a secure environment. Given the integral role of chemicals in daily life, their usage is widespread in contemporary society. These substances are essential for economic growth, sustainable development, poverty alleviation, and the realization of global development goals. However, without appropriate management practices, they can pose significant risks to both human health and the environment.

Cleaning products often contain potentially harmful chemicals, including Acetone, Ammonia, Chlorine, Formaldehyde, Fragrance, Lye, Methylene Chloride, Monoethanolamine, Morpholine, Naphthalene, Parabens, Paradichlorobenzene, Petroleum Distillates, Phosphates, and Phosphoric Acid. A study has indicated that improper or excessive use of cleaning agents can lead to detrimental effects (Achaw & Danso, 2021). Many people do not realize the significant impact that cleaning chemicals have on environmental pollution. The use of these substances adversely affects air, water, and soil quality, creating risks for both human and animal health. A lack of awareness regarding the harmful effects of these products leads to substantial financial expenditures on cleaning agents. Consequently, it is essential to assess the volume of various cleaning chemicals utilized and the extent to which the population of Bangladesh contributes to a new form of pollution, along with its associated health risks and economic implications. The release of certain chemicals into the environment can have detrimental effects on both human health and ecological systems. Given that many individuals cannot eliminate these cleaning agents from their daily routines, it is crucial to develop strategies for managing their use and disposal (Reza & Aktar, 2014).

1.1 Literature Review

Understanding the repercussions and adverse effects of household cleaning products on the environment and human health is of paramount importance. Numerous studies have documented the specific impacts these agents have on both human health and environmental integrity (Table 1.1).

Table 1.1: Summary of literature review

Uses Area	Chemical Ingredients	Health Impact	Environmental Impact	Sources
Kitchen	Triclosan, SLS (sodium lauryl sulfate), Fragrance, DEA (diethanolamine), MEA (monoethanolamine), TEA (triethanolamine), Chlorine, Formaldehyde, Ammonia.	Endocrine disruptor - Allergies, Asthma, Eczema & dermatitis, kidney disease, Mucosal symptoms, Migraine headaches, Pulmonary edema, etc.	Harmful for aquatic animals Increase carbon monoxide, Water Pollution	(Lisa & Gosse, 2017);(Sickle *et al.*, 2009); (Portejoie *et al.*, 2002).
Floor	Phthalates, MEA (monoethanalomine), DEA (diethanolamine), TEA (triethanolamine), Sulphates and Phosphates, Triclosan.	- Allergy -Eye and Hair Problem - Coughing - Clog pores - Increase	- Toxic elements - Biodiversity loss - Water Pollution	(Moulin & Ponchon, 2018); (Sickle *et al.*, 2009); (Portejoie *et al.*, 2002); (Weatherly & Gosse,2017)

Uses Area	Chemical Ingredients	Health Impact	Environmental Impact	Sources
		acne - Diabetes - Neuro developmental Issues - Autism spectrum disorders, - Reproductive problem, etc.		
Laundry	Alcohol Ethoxylate (AE), Alkyl, EthoxySulphate (AES), Alkyl Sulphate (AS) Anionic surfactant, Amine Oxide. Amphoteric surfactant, Carboxymethyl Cellulose (CMC), Citric Acid, Cyclodextrin, Diethyl Ester Dimethyl Ammonium Chloride (DEEDMAC), Ethanol.	- Skin and Eye Problem - Toxicity -Repertory problem	- Indoor air pollution - Water pollution - Toxic effect for living organism	(Cardellini & Ometto, 2021); (Rappazzo & Hines, 2017);(Jang, 2016); (Ahmed, 1995).

Uses Area	Chemical Ingredients	Health Impact	Environmental Impact	Sources
Toilet	Hydrochloric acid (HCl), Sodium lauryl ether sulfate (or Sodium Laureth Sulfate, SLES), (CTAC), Sodium hydroxide (NaOH), Sodium Hypochlorite (bleach).	-ENT issues - Repertory Tract Irritation and inflammation. -Skin burn and irritation -Pulmonary edema - Stomach ache - Coughing - Diarrhea - Vomiting etc.	- Air Pollution - Water Pollution - Toxic to aquatic organisms - Water pollution	(Noecker, 2001)
Glass	Ammonia, Butoxyethanol, Chlorine, Fragrances, Isopropyl Alcohol, Monoethanolamine, Perchloroethylene.	-Bronchiolar and alveolar edema - Airway destruction resulting in respiratory distress or failure - Lower concentrations - Nose and throat	- Water Pollution - Air Pollution	(Portejoie *et al.*,2002);(Bello, 2013); (Sickle *et al.*, 2009)

Uses Area	Chemical Ingredients	Health Impact	Environmental Impact	Sources
		irritation. - Eye Damage - Shortness of breath		
Pet	Propylene glycol. Sodium laureth sulfate, Phthalates, Parabens, Methylparaben, Formaldehyde, Cocamidopropyl Betaine, Isopropyl alcohol.	- Seizures - Severe neurological symptoms - Carcinogen -Eye problem - Allergy	Indoor Air Pollution - Water Pollution.	(Kolatorova *et al.*, 2017)
Vehicle	Abrasives, HCL, Alkalies, Bleaches, Isopropyl Alcohol, Spirit Solvents.	- Allergic reactions -Breathing problems - Chronic Obstructive Pulmonary Disease (COPD) - Pneumoconiosis -Respiratory cancers	- Air Pollution - Destroyed soil microbes. - Water Pollution.	(Fay & Shi, 2012); (Kolatorova *et al.*, 2017)

Source, Authors compilation

1.2 Objective

It is critically important to evaluate the effects of household cleaning products on both human health and the environment. The specific aims of this study are to:

- Investigate the various types, brands, and increasing applications of household cleaning products.
- Examine respondents' perceptions regarding the safety and harmful effects of cleaning agents on human health and the environment, categorized by user demographics.
- Identify health risks associated with cleaning agents and explore methods for ensuring their safe usage and waste disposal.
- Assess the adverse environmental impacts of cleaning agents and strategies for mitigating pollution.
- Analyze the correlations between gender, education, and income levels in relation to the use of cleaning products.
- Propose recommendations to minimize the negative consequences of cleaning agents on human health and the environment

2. Methodology

The study was conducted in two locations: a slum area in Vashantek and the Mohakhali Defense Officer's Housing Society-DOHS (Figure 1.1). Both sites fall under the jurisdiction of the Dhaka North City Corporation (DNCC). Established in the mid-1980s, the Mohakhali DOHS was initiated as part of a government program to provide housing for defense personnel in Bangladesh, covering an area of 66.09 acres, which is overseen by the Dhaka Cantonment and the Cantonment Board. In contrast, the Vashantek slum, located in Mirpur 14, Dhaka, also lies within the DNCC's jurisdiction and encompasses 38.65 acres. This slum is home to approximately 17,215 residents across 3,600 households, with inhabitants engaged in various occupations, including rickshaw and van pullers, garment workers, transport workers, street vendors, agricultural laborers, porters, domestic workers, and construction laborers. The research aimed to identify the types, brands, and ingredients of cleaning products commonly used in households within these areas.

Data collection involved administering semi-structured questionnaires (with 500 respondents) to homemakers and female domestic workers, as well as reviewing cleaning products, safety data sheets, and their ingredients (Figure 1.2). Respondents were asked about the health impacts of cleaning agents and who is suffering more from the use. Furthermore, secondary data was gathered through a literature review that examined the health impacts on both humans and the environment. Occupational hygiene health risks were assessed based on observational data and the perceptions of the respondents. The primary goal was to evaluate potential exposure levels in the workplace by analyzing various types of exposures. Fisher exact test and Chi-square test were performed using data.

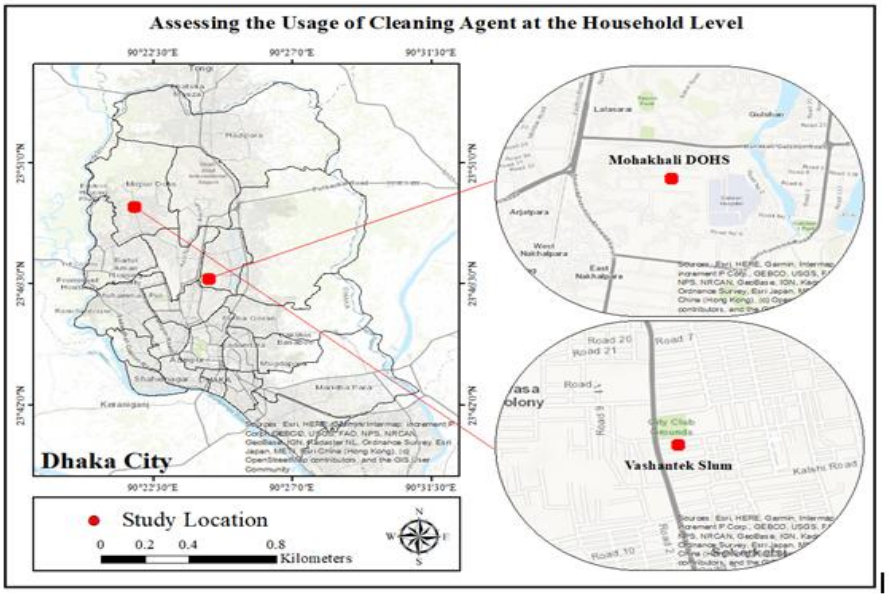

Figure 1.1: Geographical Location of Dhaka City (Google)

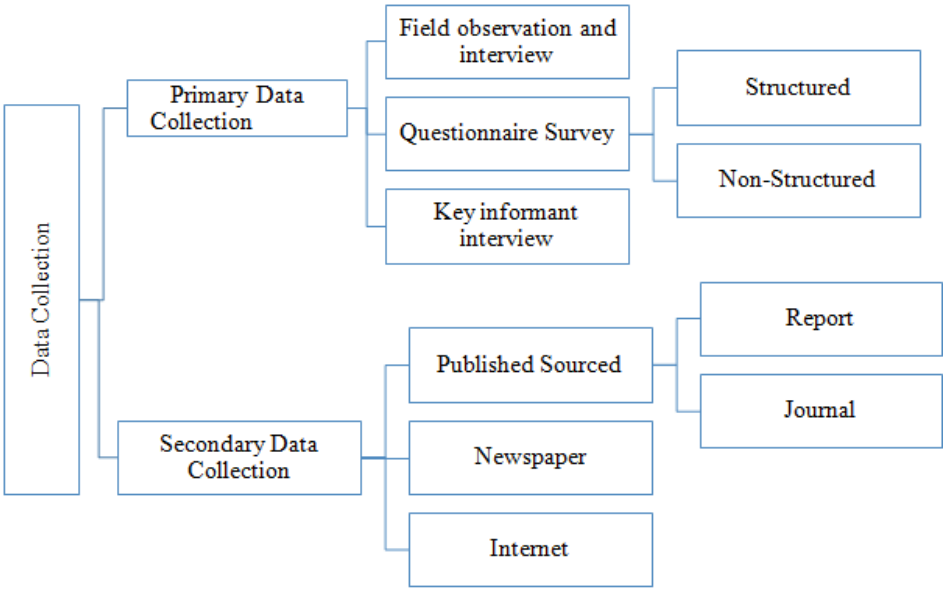

Figure 1.2: Flow chart of the research methodology (Authors)

3. Results and discussion

3.1 Working time with the household cleaning agents

Research findings reveal that cleaning agents are predominantly employed by housemaids and homemakers, with significant variations observed across different socio-economic strata. In the Mohakhali DOHS region, individuals from higher socio-economic backgrounds are more likely to hire housemaids for cleaning duties. In contrast, those residing in slum areas typically assume these cleaning responsibilities themselves. Both groups utilize cleaning agents during their household tasks. The data indicates that 22 percent of participants allocate 2 to 3 hours each day to cleaning, while the remaining respondents display comparable patterns in their cleaning durations (Table 3.1).

Only 10 percent of the participants reported spending over 6 hours on cleaning activities daily. Notably, 44 percent of respondents from DOHS indicated using cleaning agents for about 2 to 3 hours each day, whereas 40 percent of those from the Vashantek slum reported engaging with cleaning agents for 5 to 6 hours daily. This observation implies that individuals in slum areas generally invest more time in cleaning tasks, whether in their own residences or while working as housemaids for others.

Table 3.1: Working time with cleaning agent

	Total Population		Mohakhali DOHS		Vashantek Slum	
Spend working time with cleaning agent						
30mins-1hrs	60	12.00	60	24.00	-	-
1hrs-2hrs	70	14.00	60	24.00	10	4.00
2hrs-3hrs	110	22.00	110	44.00	-	-
3hrs-4hrs	50	10.00	20	8.00	50	20.00
4hrs-5hrs	60	12.00	-	-	40	16.00
5hrs-6hrs	100	20.00	-	-	100	40.00
Above 6hrs	50	10.00	-	-	50	20.00

Source: field data, 2021(Authors)

3.2 Types and Forms of cleaning agents

The study indicates that the most favored cleaning agents are detergents, followed by abrasives, acids, and degreasers. It was observed that granules are predominantly preferred for laundry purposes, while bars are favored for cleaning kitchenware and dishes. Additionally, liquid forms are primarily utilized for cleaning tasks related to toilets, floors, windows, mirrors, vehicles, and pets, as illustrated in Figure 3.2.

Figure 3.2: Forms of Cleaning Agents (Authors)

3.3 Most used Cleaning products/ brand

A wide range of products and brands found including Vim, Kelly's dish cleaner, Finish, Trix, Jet; Sepnil, Expert, Lizol, Clorox, Surf Excel, Wheel, Chaka, Tibet, Ghari, Harpic, Vixsol, Domex, Rock Bleaching Powder, Rin, Fast Wash, Uniqe, Mr. Brasso, Lux, Detol, Lifebouy, Savlon, Dove, Palmolive, Pears, Nevea, Yardley, Mothers care, Kodomo Baby bath, Fa, Imperial leather, Keya, Cute, Sunsilk, Parachute, Treseme, Pantin, Miniso Moomin, L'Oreal, Everyuth, Himalaya as various forms such as, dishwashing bar, body wash, shampoo, body soap, laundry soap, glass cleaning agent, toilet cleaner etc. Every one of these items contains a variety of chemicals that are hazardous to both human health and the environment. According to the result, Vim is a popular dishwashing bar, while Harpic toilet cleaner liquid and powder are recommended bathroom cleaners. Harpic Toilet cleaner powder is a very common bathroom cleaner. On the other hand, Surf excels and the wheel are more familiar with laundry cleaning chemicals, while Mr Brasso is more famous for cleaning glass (Figure 3.3). Body wash bars such as Lifebuoy, Detol, and Lux are more popular than body wash liquids such as other brands.

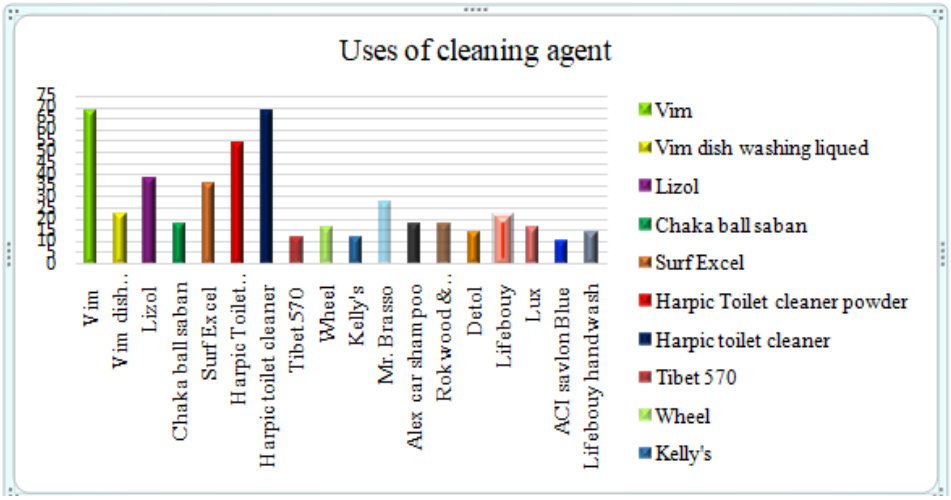

Figure 3.3: preferred brand of cleaning agent uses by respondents (Authors)

3.5 Use of cleaning agent in respect of quantity

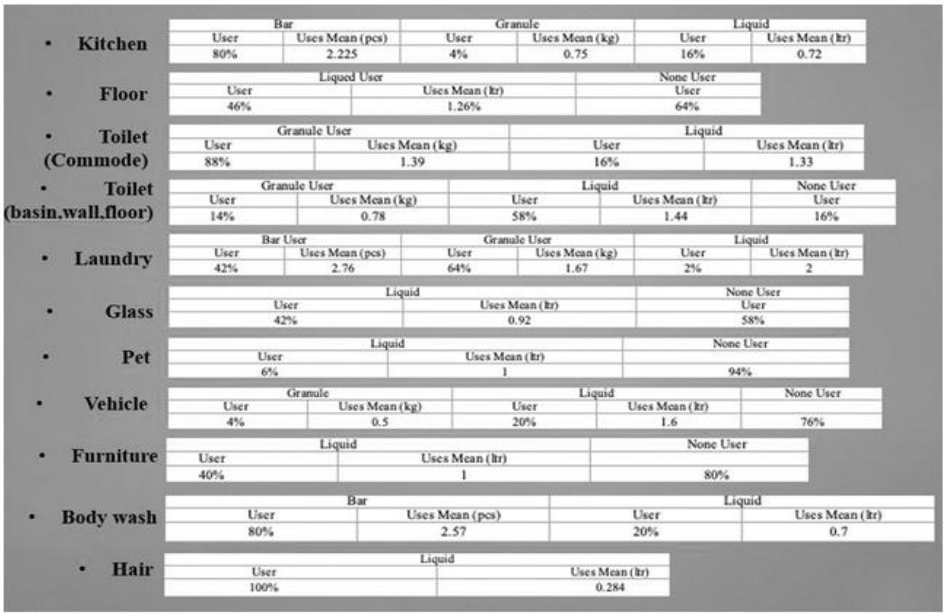

Figure 3.4: cleaning agent quantity used per month in a household

According to cleaning areas (authors) are shown in the Figure 3.4. Total of 16.80% of respondents reported using an average of 2.22 pieces of bar soap per month, while 4% utilized 0.75 kg of granules, and 16% employed 0.72 liters of cleaning agents for kitchen purposes. Traditionally, hand washing agents such as

ash and soil have been prevalent among the Bangladeshi population. Research indicates that 41% of individuals rely solely on water, 38% use dirt, 19% opt for soap, and a mere 2% utilize ash (Figure 3.4). Additionally, low-income communities across various countries have resorted to using ash, soil, or mud for hand washing as a cost-saving measure (Nizame, 2015).

3.5 Cost of Cleaning Agents

In the context of Bangladesh, a unique formulation and percentage of chemicals are available in the local market for the production of affordable laundry detergent. The cost of cleaning agents in Bangladesh is notably low. Figure 3.5 illustrates the monthly expenditure on cleaning agents, revealing that 40% of respondents from the Vashantek area spend less than 500 taka, while 10% allocate between 500 and 1000 taka. Conversely, in the Mohakhali DOHS area, 12% of respondents report spending between 1000 and 2000 taka, and 8% exceed 5000 taka for their cleaning agent needs each month.

Figure 3.5: Use of cleaning agents in respect of cost (Authors)

3.6 Family member and cleaning agent

A regression model was developed to forecast the utilization of cleaning agents, specifically bar soap, detergent, and liquid formats, with these agents serving as dependent variables and the independent variable being the total number of family members among participants. The coefficients were recorded as B = -0.109, -0.304, and -0.033, with corresponding p-values of 0.450, 0.032, and 0.819, as detailed in Table 3.2. Notably, the analysis indicated a significant increase in detergent usage correlated with a higher number of family members.

Table 3.2: Family member and cleaning agent cost

Cleaning Agent	B	Sig.	95.0% Confidence Interval for B	
			Lower Bound	Upper Bound
Bar	-0.109	0.450	-0.134	0.06
Detergent	-0.304	0.032	-0.138	-0.007
Liquid	-0.033	0.819	-0.466	0.371

Source: field data, 2021 (Authors)

3.7 Relationship with gender

Females are more vulnerable. Females are more affected than male by the use because in Bangladesh majority of the household works are done by female so they spend more time with it (Figure 3.6).

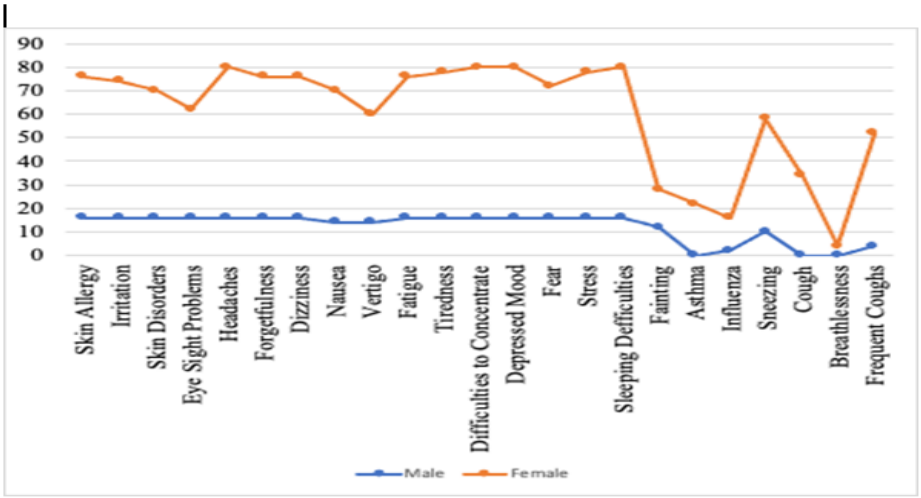

Figure 3.6: Relationship with gender with use of cleaning agents (Authors)

3.8 Cleaning agent uses circumstance with education level

Education plays a vital role in ensuring the appropriate amount of agents is utilized and that the guidelines provided in the packets for their application are adhered to. This can be observed in the data presented in the tables, which indicate a notable correlation between the excessive use of agents and educational background, with a p-value of 0.003 associated with the variable concerning adherence to the instructions outlined in the cleaning agents' packets.

Furthermore, Tables 3.3 and 3.4 elucidate the level of awareness regarding the application of cleaning agents and their environmental impact. The findings demonstrate a statistically significant relationship between these two factors, evidenced by a p-value of 0.000. Results showed that the education level of homemakers at DOHS is higher than Vashantek slum. They are able to assess the can read the packet label and inform the housemaids to refrain from using excessive cleaning agents.

Table 3.3: Cleaning agent uses circumstance with education level

	No	Yes	p
Follow the instructions written in the cleaning agents packet			
No formal education	170	20	0.003
Some level of formal education	150	160	
Using excess amount			
No formal education	20	170	0.170
Some level of formal education	90	220	

* Fisher exact test was performed. Source: field data, 2021 (Authors)

Table 3.4: Cleaning agent uses circumstance with education level

	Agree	Neither agree nor disagree	Disagree	Strongly disagree	p
Environmental Impact					
No formal education	20	0	160	10	0.000
Some level of formal education	260	10	20	20	

* Chi square test was performed. Source: field data, 2021(Authors)

3.9 Working hours and Cost of cleaning agent with medical cost

Table 6 illustrates that medical costs, treated as dependent variables, were predicted through a regression model utilizing independent variables B=-0.483 and 0.654, with both p-values equal to 0.000 for the total number of participants' working hours and the total cost of cleaning agents. In contrast, the findings indicate a significant increase in medical costs correlated with the rise in working hours and cleaning agent expenses (Table 3.5). The independent variables included working hours and cleaning materials cost, with coefficients B = 0.654 and B = -0.483 respectively, both statistically significant p = 0.000.The coefficient for working hours was positive and statistically significant (B = 0.654, p = 0.000),indicating that longer

working hours are associated with increased medical costs. This suggests that prolonged work exposure may contribute to adverse health effects, thereby raising medical cost. In contrast, the cost of cleaning materials demonstrated a significant negative association with medical cost (B = –0.483, p = 0.000), implying that higher spending on cleaning agents is associated with a lower medical cost. This may indicate that good hygiene can help prevent health problems, spending more on cleaning supplies might lower exposure to harmful substances or germs which can reduce the need for medical cost.

Table 3.5: Working hours, cost of cleaning agent and medical cost.

	B	**Sig.**	**95.0% Confidence Interval for B**	
			Lower Bound	Upper Bound
Cleaning materials cost	-0.483	0.000	-1212.679	-376.708
Medical cost	0.654	0.000	0.727	1.461

* Fisher exact test was performed. Source: field data, 2021 (Authors)

3.10 Monthly Expenditure with monthly agent and medical cost

Table 3.6 illustrates that medical costs and agent costs are modeled as dependent variables through a regression analysis that utilizes monthly expenditure as the independent variable, yielding coefficients of B = -0.855 and 0.668, respectively, with both p-values equal to 0.000. This indicates that an increase in monthly spending correlates with higher medical and agent costs. The strength and statistical significance of the coefficients indicate that both predictors contribute meaningfully to variations in monthly expenditure.

Table 3.6: Monthly Expenditure with monthly agent and medical cost

Cost	B	p	95.0% Confidence Interval for B	
			Lower Bound	Upper Bound
Monthly Agent Cost	0.855	0.000	0.049	0.07
Monthly Medical Cost	0.668	0.000	0.008	0.017

Source: Field data, 2021 (Authors)

3.11 Impacts of cleaning agents to the environment

When purchasing industrial cleaning products, consumers typically expect these items to deliver effective cleaning performance. The marketplace provides a wide array of options, including soaps, detergents, bleach, fabric softeners, polishes, and

specialized cleaners designed for various surfaces such as bathrooms, glass, drains, and ovens. These chemical substances are employed for cleaning tasks involving dishes, clothing, toilets, and countertops. However, it is important to note that they can also contribute to indoor air pollution, present toxicity risks if ingested, and pose hazards through inhalation or skin contact. In fact, certain cleaning agents are classified among the most dangerous household chemicals. Alternatively, a mixture of soap, water, baking soda, vinegar, lemon juice, and a coarse sponge can effectively meet most household cleaning requirements, potentially resulting in considerable cost savings by decreasing dependence on commercial products.

As a result, many cleaning recipes have become increasingly popular. While industrial cleaning solutions provide convenience and effectiveness, it is crucial for consumers to consider specific criteria that can assist in selecting products that reduce negative impacts on health and the environment (Sabharwal, 2015). The related study reveals that 56% of individuals are aware of water quality issues, 28% recognize air quality concerns, and 42% are informed about soil problems, while a notable 44% remain uninformed (Figure 3.7). Additionally, Figure 3.8 demonstrates that all respondents dispose of packaging in regular waste, with none participating in separation, reuse, or recycling efforts.

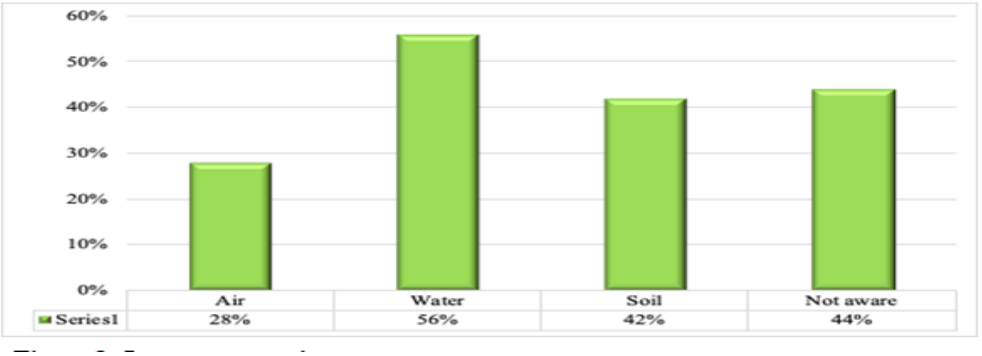

Figure 3.7: Impacts on environment (Authors)

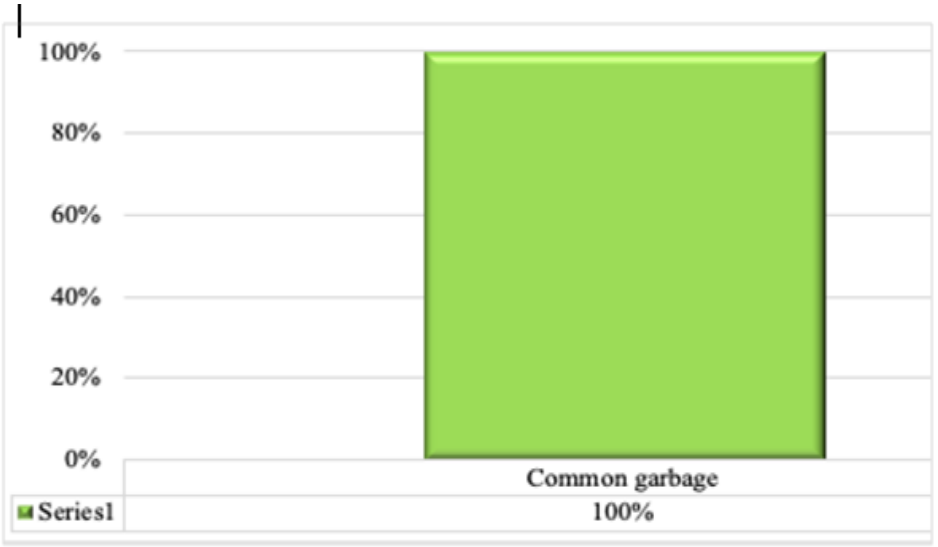

Figure 3.8: Disposal after use of cleaning agents (Authors)

Surfactants are commonly utilized as agents for cleaning purposes. However, their overuse can lead to significant waste generation and potential environmental contamination. For more than three decades, research has focused on the treatment of surfactants, the exploration of biodegradable alternatives, and the assessment of their environmental impacts. Although certain surfactants may not pose immediate risks, elevated concentrations in soil can act as catalysts for the release of harmful pollutants, such as polychlorinated biphenyls (PCBs). This study aims to analyze recent advancements in understanding surfactant toxicity, their environmental fate, and remediation strategies. Additionally, the degradation of linear alkyl benzene sulfonate in aquatic environments will be examined (Venhuis, 2004).

3.12 Cleaning agent and health problems

This study reveals that the utilization of cleaning chemicals, alongside 25 identified physical and psychological challenges, has been evaluated through stiffness analysis, as presented in Table 3.7, which details the physical and mental barriers are encountered. While bar soap usage did not show any correlation with physical ailments, certain health issues were found to be linked to the use of detergents, including skin conditions (B 0.38, p 0.020) and visual impairments (B 0.432, p 0.010).

Furthermore, the use of liquid cleaning agents was associated with five specific challenges: forgetfulness (B -0.5, p 0.002), nausea (B -0.45, p 0.028), low mood (B -0.5, p 0.015), stress (B 0.45, p 0.015), and sleep disturbances (B 0.45, p 0.002). In a separate cross-sectional study, participants reported their use of cleaning

products along with any respiratory and dermatological issues through a questionnaire (Table 3.7). The odds ratios (ORs) were adjusted for age and gender to explore the relationships between occupational exposures and respiratory and skin health outcomes, as depicted in Figure 3.9. Notably, bleach was identified as the sole cleaning agent significantly linked to hand dermatitis, with an adjusted odds ratio of 2.54 (95% confidence interval: 1.32–5.13; p 0.001) (Whittaker, 2013).

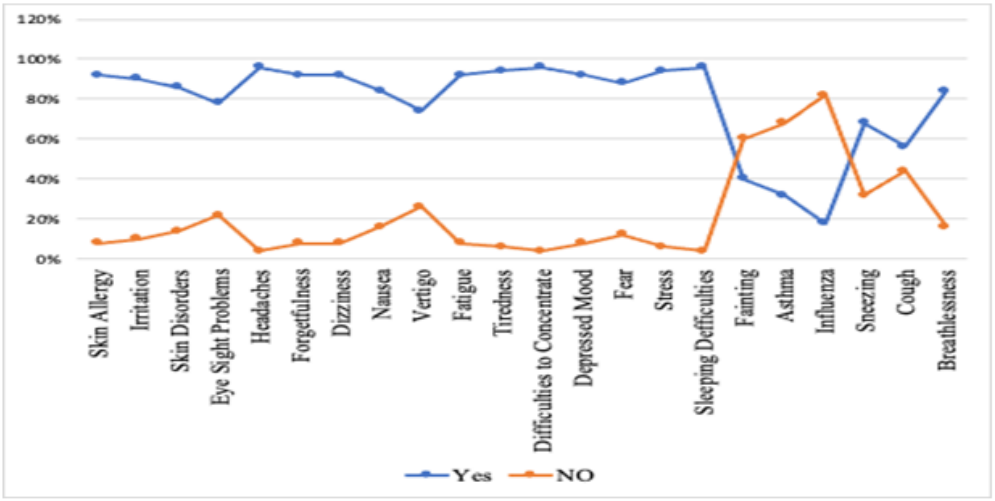

Figure 3.9: Physical difficulties (Authors)

Table 3.7: Problems of cleaning agents use

Difficulties	Bar				Detergent					
	B	p	95.0% Confidence Interval for B		B	p	95.0% Confidence Interval for B		B	p
			Lower Bound	Upper Bound			Lower Bound	Upper Bound		
Skin Allergy	0.332	0.104	-0.095	0.985	0.281	0.090	-0.086	1.147	-0.2	0.274
Irritation	0.118	0.578	-0.374	0.662	0.098	0.570	-0.424	0.759	-0.2	0.270
Skin Disorders	0.316	0.122	-0.115	0.941	0.38	**0.020**	0.097	1.304	-0.2	0.321
Eye Sight Problems	0.227	0.259	-0.292	1.059	0.432	**0.010**	0.258	1.8	-0.3	0.159
Headaches	-0.04	0.865	-0.618	0.521	-0.14	0.390	-0.93	0.37	-0.3	0.095
Dizziness	-0.04	0.833	-0.504	0.408	-0.21	0.210	-0.847	0.194	-0.3	0.091
Nausea	-0.08	0.709	-0.65	0.446	0.026	0.880	-0.577	0.675	-0.4	**0.028**
Depressed Mood	-0.13	0.515	-0.679	0.345	-0.13	0.430	-0.818	0.352	-0.5	**0.015**
Stress	0.301	0.134	-0.107	0.772	0.262	0.110	-0.095	0.91	0.45	**0.015**
Sleeping Defficulties	0.309	0.115	-0.114	1.011	0.292	0.070	-0.047	1.239	0.49	**0.008**
Asthma	-0.02	0.941	-0.483	0.449	-0.08	0.650	-0.652	0.412	0.23	0.246
Sneezing	0.267	0.218	-0.21	0.894	0.113	0.520	-0.426	0.835	0.01	0.974
Cough	-0.05	0.823	-0.855	0.684	-0.1	0.560	-1.134	0.624	-0.1	0.661
Breathlessness	-0.15	0.481	-0.422	0.202	-0.18	0.300	-0.543	0.17	-0.2	0.297
Dryness of Nose	-0.27	0.211	-0.944	0.214	-0.17	0.340	-0.976	0.347	-0.1	0.519

*Fisher exact test was performed.

Source: field data, 2021(Authors)

The main ingredients of cleaning products are disinfectants, surfactants, solvents, and fragrances. A wide range of chemical such as ethers, alcohols, and acids that have volatilities and other chemical properties (Nielsen et al., 2007).

4. Conclusion

Chemicals that inherently induce sensitization upon dermal exposure constitute a significant, albeit narrow, segment within the field of chemistry. It is essential to recognize the potential for allergic responses to fragrances and to assess the related health risks, while also establishing effective risk management protocols. Compounds that possess appealing aromatic properties may concurrently provoke contact allergies and other health complications. As consumer expectations rise, spending habits are becoming increasingly prudent.

The integration of innovative technologies has led to a surge in the demand for cleaning products. Nevertheless, the predominant cleaning agents available in our nation are predominantly synthetic, lacking organic or natural formulations. These synthetic substances present considerable hazards to human health, the environment, and atmospheric conditions. Moreover, the potential detrimental impacts of cleaning chemicals on health and ecological systems remain insufficiently understood. Traditionally, households relied on domestic help for cleaning tasks; however, the inadequate training and awareness among these individuals can lead to improper handling of cleaning agents, exacerbating adverse effects.

This research seeks to explore the long-term implications of cleaning chemicals and evaluate consumer knowledge regarding their application. A significant volume of chemicals from cleaning products ultimately contaminates aquatic ecosystems, including rivers and streams. Certain compounds are persistent in the environment and can traverse the food chain. The presence of volatile organic compounds (VOCs) in cleaning products can adversely affect indoor air quality and contribute to outdoor environmental pollution. Additionally, transportation, especially via trucks, significantly contributes to greenhouse gas emissions. Frequently, the packaging of these products is not fully recyclable, resulting in considerable waste, including packaging materials and discarded containers, which ultimately end up in landfills. In situations involving hazardous materials, it is essential to consider additional factors, including the energy necessary for their transport and disposal.

These chemical substances ultimately contribute to global warming through various pathways, notably the emission of greenhouse gases. Research reveals that individuals often possess a limited comprehension of the harmful consequences associated with cleaning chemicals. A significant numbers remain unaware that these products are formulated from various hazardous substances linked to severe health risks and environmental harm, which further intensifies global warming. This

investigation emphasizes the health risks associated with these chemicals and highlights a considerable deficiency in knowledge and awareness among users.

In summary, existing research indicates a variety of health hazards related to cleaning agents, with users being particularly vulnerable to these substances, potentially resulting in serious health issues such as respiratory, neurological, and cardiovascular disorders. Although solid detergent bars have not been associated with major health risks, hot liquid cleaning agents carry their own set of dangers. The accompanying graph illustrates the percentage of individuals experiencing physical difficulties, represented by the blue line, in contrast to the orange line, which depicts those without such difficulties.

The improper utilization of various chemicals poses significant health risks, particularly for domestic workers. The indiscriminate use of diverse cleaning agents leads to substantial environmental pollution, affecting air, water, and soil. Furthermore, the haphazard application of these cleaning products not only drains financial resources but also contributes to climate change concerns. Providing well-informed informational materials such as handbills or brochures, and emphasizing the importance of precautions before use can effectively safeguard both human lives and the environment. The policy issues are also important to make people aware through social and mass media on excess use of cleaning agents and how it drains money and caused health impacts (skin problems, respiratory diseases) and impact the environment.

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Conflict of interest

The authors confirm that there are no potential conflicts of interest associated with the publication of this work. Furthermore, the authors have fully acknowledged and addressed ethical concerns, including plagiarism, informed consent, misconduct, data fabrication or falsification, as well as issues related to double publication or submission and redundancy.

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