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Analysis of the Effects of Face Masks Disposal in the Environment at the University of Santo Tomas

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***Abstract*: During the pandemic, there has been an increase in demand for face masks in the market which has affected environmental waste management. In this study, the researchers analyzed how the different types of facemasks (surgical, respiratory, and reusable masks) have an effect on the level of awareness of the proper disposal of facemasks. To know the impact of the usage of the type of facemask being disposed of daily on the environment in quantifying its Carbon emissions that affects the environment. And to know the methods of disposal if it has an effect on the level of awareness of the proper disposal of facemasks. The researchers examined the data using the chi-square test and ANOVA to determine the relationship between the variables. The result for the different types of facemasks shows that it doesn't affect the level of awareness of the proper disposal of facemasks. Using face masks that are disposed of daily produces carbon emissions that affect the environment. The methods of disposal have an effect on the level of awareness of the proper disposal of facemasks. This study recommends that the government build and implement advocacy to help the community have more knowledge and be aware of proper waste disposal of their used facemasks.**

***Keywords*: awareness, COVID-19, disposal, environmental effect, facemasks, methods, types.**

1. Introduction

The coronavirus disease was discovered in 2019, and it is now one of the known global threats that exist in the present year of 2023. It can affect our well-being, public health, and global economic and social stability. The government implemented several protocols in the Philippines; one of them is wearing a facemask as protection for the virus. Facemasks are medical equipment that help protect every individual from various diseases. Wearing a facemask is not only for protecting yourself from the virus but also for the affected individual to avoid the virus from spreading. It is essential to wear a facemask, mainly today, to cover an individual's nose and mouth. In Addition, it blocks droplets that carry viruses or bacteria. During the 19th century, people wore cloth face masks until they evolved into surgical masks, used from the 1960s until now. Surgical face masks are commonly used by medical professionals, ill individuals, and people who go to hospitals. Before, people were using it to avoid airborne pollution, but this time, since the pandemic began, it is not to prevent such but to obey the implemented protocols caused by the widespread COVID-19.

According to Saliu et al., 2021, wearing facemasks can affect the environment, especially regarding disposable facemasks. It contains several plastic fibers such as polypropylene; this may cause many problems, for it requires longer years to be micro and Nano-plastics. This year, there are millions of possible disposed-facemasks from a vast number of people who are using them. It may cause hazards and problems to every community, especially when people throw it into bodies of water. It is better to use reusable face masks than disposable ones. It can help you avoid disposing of and throwing non-recyclable materials.

A. Background of the Study

The outbreak of Coronavirus disease (COVID-19) was officially classified as a pandemic in December 2019, focusing worldwide initiatives on reducing the number of infections (Sangkham, 2020). That pandemic stands as the most catastrophic worldwide health disaster since the beginning of the 21st century and the most severe crisis the world has faced since

World War II (Cudjoe et al., 2022; Chakraborty & Maity, 2020). Several preventative measures were implemented to prevent the virus from spreading, including a safe physical distance from others, maintaining good personal hygiene, and using personal protective equipment (PPE) (Selvaranjan et al., 2021). Multiple nations launched localized initiatives to curb the transmission and spread of the COVID-19 outbreak (Al-kasbah, 2022). Face masks are in high demand as countries throughout the globe implement public health measures to minimize the cases of transmission (Rahman et al., 2022). During China's multiple lockdown regimes, the consumption of single-use face masks increased to around 900 million (Stewart et al., 2022). At the height of the pandemic, it was estimated that healthcare personnel in the United States of America would require around 89 million face masks every month.

Furthermore, an estimated 105 thousand tons of face mask garbage were produced monthly in Africa. Also, daily demand in Asia is predicted to exceed 2.2 billion face masks. According to these data, more than 3.4 billion disposable face masks are made and disposed of daily (Cudjoe et al., 2022).

In addition, aside from the waste management issue related to face mask disposal, the pandemic disrupted various industrial and commercial activities, resulting in a substantial reduction

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in the release of GHGs or greenhouse gasses and other associated waste production (Cornelio et al., 2022). During the pandemic, face masks were considered vital protective gear against COVID-19. However, a lack of awareness about proper disposal faced waste management issues, contributing to increased air pollution from their production and worsening the plastic pollution crisis.

Moreover, the observed attitude of carelessly discarding face masks in environments such as parks, streets, and coastal areas can contribute to their role as secondary pollution carriers, raising further health and environmental problems (Anastopoulos & Pashalidis, 2021). Likewise, improperly disposed face masks may disintegrate into micro- and nano-plastics. According to a previous study, microfibers made of medical-grade polypropylene can take up to 450 years to degrade in the natural surroundings (Alfarisi et al., 2022; Rathinamoorthy et al., 2022). In a recent investigation, Benson et al. (2021) emphasized the issue of plastic waste pollution in countries in the Global South. The disposal of face masks has worsened the challenges associated with plastic waste management, as Selvaranjan et al. (2021) noted. Additionally, microfibers tend to spread in the environment and undergo bio magnification, providing

Significant hazards to the environment and human health, as discussed by Holland (2016). Shruti et al. (2020) emphasized the significance of reusable face masks as part of the micro plastic problem. Cloth face masks, like single-use face masks, can contribute to marine and environmental pollution by releasing micro plastics into wastewater, harming aquatic life and interrelated ecosystems. These issues merit more investigation and attention due to their environmental repercussions.

Insufficient awareness of proper facemask disposal contributes to environmental and health risks. According to Ajaj et al. (2022), a significant proportion of participants (45%) acknowledged throwing worn face masks in any available trash can, while 44% stated discarding them in public areas like streets. These findings reveal a lack of awareness about appropriate disposal methods for used masks.

Facemask regulations have been implemented at universities and colleges because they are high-risk environments with many students, faculty, and staff personnel (Ajaj et al., 2023). The University of Santo Tomas (UST) in the Philippines is no exception, and it has enforced strict safety protocols to prevent the spread of COVID-19 on its campus. UST is known as one of the top educational institutions in the country, and it is located in the highly populated core of Manila, where waste management is of particular concern. With the ongoing pandemic, the use of face masks among the UST community has increased, necessitating an investigation of the awareness and environmental effects of face mask disposal.

B. Objectives of the Study

The objective of this Study was to determine the Types of facemasks that were considered as a factor of this Study as different types of facemasks composed of different (kgCo2 eq) contributed to the environmental effect. Usage of facemasks per capita in the University of Santo Tomas, as these numbers were the way to measure or quantify the environmental effect when it comes to disposing of facemasks. The Methods or practices of how the Thomasians dispose of their facemask is the last variable of this Study.

The level of Awareness in disposing of facemasks is one of the objectives of this study. The Department of Health (DOH) guidelines were used to determine their knowledge as their level of Awareness has contributed to the environmental effect of disposing of facemasks.

C. Significance of the Study

Analyzing the Awareness and effect on disposal of facemasks in the environment is significant in identifying the effect of the types, number of facemasks used, and methods/manners of disposal to the environment that individuals use. In knowing the Awareness of individuals regarding the proper disposal of face masks and their effect on the environment.

The generalization of the study would significantly mold the immense knowledge of a community towards associating the proper disposal of facemasks to behavior, knowledge, and understanding of a community.

Thus, this highly benefits the following:

Community: This study helps the community be aware of the proper ways to dispose of facemasks that can harm our environment. At the same time, it protects individuals in disposing of their face masks regarding their health. It helps to identify the cause of the negative effect of not properly disposing of facemasks to the environment. Thus helping to advocate for the community to propose possible solutions or recommendations.

University of Santo Tomas: This study helps the university establish more knowledge and practices in handling the number of facemasks being disposed of. Moreover, the proper way to dispose of the face masks on campus is to prevent the virus or any illness from spreading. At the same time, the impact of disposable facemasks on the environment is to prevent the waste it causes and take preventive measures to ensure the safety of our environment and the health of each individual on the campus.

D. Scope and Delimitation

In this study, 398 students, faculty members, and staff members from the University of Santo Tomas in Sampaloc, Manila, participated. These individuals were chosen at random, the other factors contributing to the awareness and effect of disposal of face masks in the environment that are not mentioned above are not within the scope of the research.

2. Review of Related Literature

According to (Galido et al, 2021). Interest and queries about the different types of facemasks, such as reusable or disposable face masks, during the COVID-19 Outbreak is increasing relatively. Three months after the outbreak, the number of cases reached 500,000 global infections of the coronavirus disease. Reportedly, December 12, 2019, was the first case of an

unknown outbreak in Wuhan, China. The World Health Organization (WHO) characterized the outbreak on March 11, 2020, as a pandemic. According to the Department of Health, the confirmed cases in the Philippines reach 1,000 and are bound to increase as the outbreak spreads quickly.

Nonetheless, waste is improperly disposed of in open landfills in nations with insufficient waste management resources, such as Thailand, the Philippines, and India. The phenomenon harms the environment and public health (Sangkham, 2020). Disposing of garbage in landfills not only results in the emission of greenhouse gasses, but it also has the potential to produce micro plastics present in the leachates, which pose a threat to the environment. Plastic masks decompose in anaerobic landfills, resulting in the creation of micro plastics. Temperature

Moreover, pH fluctuations, physical strain, competition, and microbial organism activity all contribute to this degradation (Sliva et al., 2021). Compared to soil environments, the degradation process in open dumps accelerates due to exposure to sunshine and methanotrophic microorganisms (Arkatkar et al., 2009; Muenmee et al., 2015). Recycling PPE offers difficulties since it frequently necessitates prior cleaning treatments such as UV light (Hamzavi et al., 2020). Furthermore, PPE products comprise various polymers, making it difficult to separate them using standard grinding and remelting techniques. Alternative recycling techniques for masks are available. Due to the extensive adoption of reusable cotton or fabric masks in South Africa, disposable masks are now an insignificant contributor to COVID-related pollution (Ryan et al., 2020). Personal protective equipment (PPE) has adversely affected the condition of beaches, which initially improved during the early phases of the pandemic (Zambrano-Monserrate et al., 2020). PPE, which includes facemasks, makes up the majority of anthropogenic beach litter on Kenya's urban beaches, 55.1% of the total. It accumulates on beaches or sinks to the seabed because this waste rarely occurs in coastal surface travels (Okuku et al., 2021). 16% of PPE items, including facemasks observed in Jakarta rivers during March and April 2020, are transported by rivers (Cordova et al., 2021).

A. Related Literature and Studies

1) Awareness of disposal of facemasks and the type of facemask

According to Lee et al. (2020), regardless of the type of face masks used, they all have one common goal: to protect themselves and others. We used these in different cases, such as during flu seasons and diseases; moreover, when the pandemic happened, various types of facemasks appeared and had different components that may filter. The required use of disposable masks exacerbates environmental concerns, beginning with production and ending with disposal. Nonetheless, the environmental impact of reusable masks depends on various factors, including mask type, individual usage habits, and mask selection (e.g., reusability, frequency of reuse, washing technique, and filter inclusion).

The fabrication of reusable masks from synthetic materials like polyester facilitates emissions reduction and allows for extended periods of use. Furthermore, proper reusable mask usage and cleaning has been found to cut waste by 85%, have a 3.5 times lesser effect on climate change, and cost 3.7 times less (Allison et al., 2020). However, there is currently a lack of information on the release of fibers during washing and the proper disposal of masks (Shruti et al., 2020). Prata et al. (2021) recommended that masks, whether they are disposable or reusable, be disposed of similarly to other types of household garbage, with the preference for placing them in double bags. Moreover, it is either burnt or disposed of in landfills. Alternatively, a specific waste management system for collecting and treating personal protection equipment (PPE) can be devised to reduce the amount of litter that must be handled (Vanapalli et al., 2021).

Nonwoven materials, when exposed to environmental conditions, deteriorate and release synthetic micro- and nanofibers (Aragaw, 2020). The production of fibers and potentially ingesting such fibers can occur while wearing masks (Li et al., 2021). Plastics undergo environmental degradation primarily due to photo-oxidation caused by solar UV radiation. Biodegradation and hydrolysis also contribute to the degradation process at a slower rate. Subsequently, mechanical forces act on the degraded materials, leading to cracks, fragmentation, or delamination into smaller pieces. As a result of these processes, micro plastics accumulate in the environment (Andrady, 2017).

H_01: The type of facemask used is independent of the awareness level of the respondent

2) Type of facemask and its carbon emission

Even though the Philippine government created specific guidelines for properly disposing of used facemasks, many individuals are still unaware and continue to improperly dispose of facemasks. The single-use face mask has a certain level of CO_2 that will negatively affect the environment, mainly if not correctly disposed of. A surgical facemask emits 0.059kg of CO_2 in a single usage as well as other three-layer Mask (a disposable mask that has three layers), N95 mask emits 0.05kg of CO_2 in a single usage, and other respirator masks like KN95 and KF94, and cloth (reusable facemask) emits 0.036kg of CO_2 in a single usage (Lunag et al., 2023).

Reusable masks have been proposed as a safe and environmentally friendly option (Makki et al., 2021). The required use of disposable masks exacerbates environmental concerns, beginning with production and ending with disposal. Nonetheless, the environmental impact of reusable masks depends on various factors, including mask type, individual usage habits, and mask selection (e.g., reusability, frequency of reuse, washing technique, and filter inclusion). Based on yearly mask use in the UK, Allison et al. (2020) estimated that reusable masks with filters and manual cleaning have a similar environmental footprint to surgical masks (approximately 1.50 × 109 kg CO2 eq). On the other hand, reusable masks that do not include filters and are machine-washable have less of an environmental effect (1.7 × 108 kg CO2 eq). Conversely, they consume more water during the washing process (7.5 × 108 vs. 1.4 × 108 m3) compared to disposable face masks. Cotton fabric masks emit almost the same greenhouse emissions as

surgical masks (~0.06 kg CO2 eq/pcs). When the washing utilization is considered, the emissions rise to 6.92 kg CO2 eq/pcs. It is significant to note that the estimation for cotton fabric masks does not include transportation emissions, unlike surgical masks, which do. However, suppose a reusable mask is worn 183 times (without disposable filters and laundered in a washing machine with regular clothing). In that case, its environmental effect is reduced to 0.04 kg CO2 eq (Kleme et al., 2020). Nonetheless, regular washing might add to the degeneration of the mask material and possibly reduce its efficiency in providing protection. On the other hand, washing reusable masks frequently might cause material degradation and reduce their protective capabilities.

$H_0$2: There is no significant difference in the carbon emissions by the type of facemask

3) Awareness of disposal of facemasks and the method of disposal

According to Xu and Ren (2015), the increasing cases of inappropriate mask disposal pose a serious environmental threat that must be recognized and dealt with to prevent the plastic problem from worsening. Disposable masks are not biodegradable since they are constructed of plastic and can break down into smaller plastic particles, including micro- and nano-plastics, which are prevalent in diverse ecosystems. Disposable masks that are not properly recycled might end up in the environment, particularly freshwater systems and seas. Weathering processes can cause the rapid creation of countless micro-sized particles (less than 5 mm) from these masks over time, and these particles can further fragment into Nano plastics (less than 1 micrometer) in a matter of weeks.

Likewise, the widespread and unintentional disposal of face masks poses significant risks to public health (Saliu et al., 2021). The increased global demand for disposable face masks during the pandemic has exacerbated this issue. The global trend has heightened the chances of improper disposal, leading to evident and immediate environmental damage.

The Worldwide Fund for Nature (WWF) recently published a report on the repercussions of incorrect mask disposal. Even if only 1% of all masks are disposed of mistakenly, nearly 10 million masks are left in the natural environment each month. It amounts to 30 to 40 tons of plastic waste (Kwak & An, 2021).

Disposable face masks are frequently disposed of alongside other plastic waste, resulting in mixed waste. These mixed waste mixtures are normally disposed of in landfills or burnt. However, because face masks contain plastic, these disposal methods may adversely affect the environment. Mixed plastic debris, when thrown in terrestrial systems, has the potential to clog sewage systems in urban areas. Furthermore, it can adversely affect soil aeration and water percolation in agricultural areas, resulting in decreased land productivity (Prata et al., 2021).

Before the COVID-19 pandemic started, the global management for the waste sector was already grappling with significant hurdles, particularly in managing plastic waste. The contamination of terrestrial and marine environments has recently become a significant issue of concern. With the ongoing pandemic, the utilization of plastic gloves, face masks, hand sanitizer bottles, and syringes has surged. It is crucial to ensure the appropriate treatment and disposal of these items, as they may still harbor infectious contaminants and pose substantial risks if not managed as hazardous waste.

Moreover, numerous Asian nations still face challenges in implementing efficient waste management practices, with a prominent concern being the insufficient availability of solid waste containers in public areas. This inadequacy leads to the contamination of the infectious waste within different containers. Most developing countries, such as Bangladesh, Cambodia, India, Indonesia, Malaysia, Palestine, even the Philippines, Thailand, and Vietnam, are at risk due to the limited resources for effective solid waste management. The developing Countries often dispose of their solid waste in a poorly regulated way (Ferronato & Torretta, 2019).

According to studies, individuals lack information about the potential environmental impacts and the best techniques for mask disposal (Nzediegwu & Chang, 2020). Similarly, Kaewchutima et al. (2023) conducted a study that revealed that respondents were unaware of facemask disposal, showing a lack of understanding. Although there were no significant differences in academic grades between male and female students, there were substantial variances in knowledge levels. Over 90% of the students identified the proper disposal containers for facemasks. Around 70% of students had no idea about the proper facemask disposal procedure, incorrectly supposing that used facemasks could be disposed of like common waste. Moreover, less than half of the students were aware of proper facemask disposal methods.

In contrast, Akkajit et al. (2020) studied an investigation and discovered that a substantial proportion of students were aware of the appropriate facemask disposal containers. They properly identified the labeled trash bins as "infectious waste" and understood that face masks should be stored in closed containers and placed in red bins. The percentages of students who responded correctly to these questions were 94.00%, 92.38%, and 92.38%. These findings are consistent with the Thai clinics' prior research conducted by healthcare professionals, in which 96.5% of the respondents used red color coding to identify infectious waste.

Similarly, Larebo and Abame (2021) conducted studies that showed a relationship between academic programs and knowledge levels. The result shows that students in different programs like law, natural and computational sciences, and social science are less aware of using facemasks than students studying health science and medicine. However, the knowledge levels between the academic years have no statistically significant changes, implying that students at different stages of their study received information similarly. Conversely, in a study conducted in the Philippines, Limon et al. (2022) discovered that the degree of education substantially impacted the comprehension of appropriate disposal methods for single-use facemasks.

$H_0$3: The manner of disposing of the facemask is independent of the level of awareness of the respondent

B. Synthesis

Various Studies conducted by Xu and Ren (2021), Saliu et al. (2021), Gallo Neto et al. (2021), Prata et al. (2021), Shen et al. (2020), Kwak & An (2021), Wright et al. (2013), Webb et al. (2012), Nzediegwu & Chang (2020), states that the major problem of improper disposal of facemasks is the lack of awareness that adverse environmental consequences.

In contrast, the study conducted by Makki et al. (2021), Allison et al. (2020), and Klemeš, et al. (2020) suggests that reusable masks are considered safe and environmentally friendly. They emphasize that reusable masks, especially those without filters and machine washing, have less environmental effect. Singh et al. (2020) have highlighted the severe environmental risks associated with improper facemask disposal. These studies emphasize that non-biodegradable facemasks can break down into smaller plastic particles, including micro- and Nano-plastics, which can be found in various ecosystems. Furthermore, the unintentional and widespread disposal of facemasks poses significant dangers to the general public, especially when discarded in the environment or bodies of water. This improper mask disposal has led to the extensive dispersion of plastic waste in different environmental settings, including public places, different types of bodies of water, natural reserves, and even mountain ranges.

Facemask disposal has significant environmental implications, with landfill disposal and incineration contributing to waste accumulation and air pollution. However, more environmentally friendly alternatives exist, such as recycling, biodegradable masks, and compostable masks. Implementing a range of methods is necessary to mitigate the environmental impact. Encouraging the use of recyclable, biodegradable, and compostable masks, along with the establishment of accessible recycling infrastructure, can effectively reduce landfill waste, minimize air pollution, and contribute to the development of a sustainable future.

C. Theoretical Framework

The Health Belief Model (HBM) by Rosen stock (1974) is being utilized by researchers to provide a theoretical model for comprehending the factors that impact individuals' health-related behaviors. The HBM suggests that several factors play a role in influencing an individual's health behavior. These factors include their perception of how vulnerable they are to a health risk, the severity of the perceived threat, the perceived benefits and barriers to action, and cues that encourage people to act.

This theoretical model has been widely used to investigate and predict health behaviors, especially those associated with infectious diseases. The HBM has been used by researchers to forecast COVID-19 preventative behaviors (Zewdie et al., 2022) and to describe the public acceptance of preventive practices during the COVID-19 outbreak (Alagili & Bamashmous, 2021).

The utilization of face masks has become essential in preventing virus transmission. Face masks that are not properly disposed of can cause pollution, endangering the wellness of human beings and the environment. Therefore, the Health Belief Model (HBM) can be employed to analyze the behavior of face mask disposal within the different factors during the COVID-19 pandemic.

Above is the mentioned theoretical model that will support the investigation to analyze the awareness and impact of facemask disposal in the environment at the University of Santo Tomas. HBM helps determine students' perceived susceptibility to environmental effects, comprehension of the severity, the benefits and hurdles involved with proper disposal, and the cues that encourage action. Focusing on these aspects makes it possible to raise awareness and promote proper facemask disposal, resulting in a beneficial effect on the environment.

D. Simulacrum

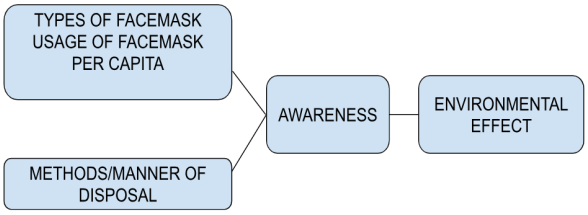

Fig. 1. Research simulacrum

3. Research Method

A. Method of Research Used

The measurements of the subject are used in a descriptive-quantitative research design to close the known gaps between variables and among the population. The researchers observed a certain portion of the sample target population to produce the needed inferences of the different variables in a descriptive approach. Additionally, quantitative approaches are made to gather and statistically analyze the data. Using statistical analysis, descriptive-quantitative research will be essential for this study because it entails the data gathering relevant to address the study's main objective. This will identify the influence of the level of awareness and the effect of the disposal of facemasks in the environment at the University of Santo Tomas Sampaloc, Manila.

B. Research Setting

The study's setting will revolve around the University of Santo Tomas Sampaloc, Manila, in the Philippines. University of Santo Tomas (UST) is a campus with a large population of respondents on how UST students, faculty, and staff dispose of their used facemasks.

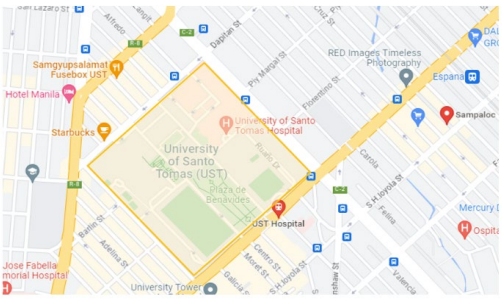

Fig. 2. The vicinity map of the University of Santo Tomas (UST) Sampaloc, Manila

C. Survey Instrument

Several parameters are established to ensure that the study's findings are objective and that only minimal errors are made in order to establish the validity, which will determine if the instrument can measure what needs to be measured. The researchers will establish a survey instrument through various related literature and journals with the information needed in the study.

The first part of the questionnaire determined the profile of the respondents, which consists of 2 questions that include the respondents' name and age (which is answerable in a multiple choice). The second part consists of 3 questions about the usage of facemask daily (which is answerable in a multiple choice), The type of facemask (which is answerable by Dichotomous that uses two indicators of whether the type of facemask is disposable or reusable), and method in disposing of the used facemask (which is answerable in a multiple choice). The last part is about the awareness of the proper disposal of facemasks (answerable on a Likert scale).

The researchers followed The Data Privacy Act of 2012 (Republic Act 10173), ensuring that all respondents' information will be kept private or confidential.

D. Data Collection

The study focused on the awareness and effect of facemasks in the environment at the University of Santo Tomas. The researchers used both the social media platform and in-person survey to manage the required population. The respondents included the individuals who are the students, faculty, and staff of the University of Santo Tomas within the vicinity of Sampaloc, Manila, in the Philippines. Thus, the researchers' social media profiles are used to promote the approval and instructions for the questionnaire.

E. Study Population

The individuals in the University of Santo Tomas (UST) of Sampaloc, Manila, in the Philippines, are the study's respondents regardless of status, age, gender, and their disposal of facemasks. This will determine the usage of facemasks in the environment.

F. Sample Size and Techniques

To compute the sample size for the population of individuals in the University Santo Tomas (UST)- it is found on The Varsitarian (2019 and 2023), Philstar (2019), NowServing (2023), and University of Santo Tomas (2023). The population is 57,785, using Slovin's Formula, an error margin of 5% and a confidence level of 95%.

$$n = \frac{57{,}785}{1+57{,}785\ (0.05)^2} = \frac{57{,}785}{1+144.46}$$

$$n = \frac{57{,}785}{145.46} = 397.25 \simeq 398$$

Fig. 3. Slovin's formula computation

The non-probability sampling is the method used in this study. The subjective method is a method of selecting units from a population. The researchers used a combination of convenience, snowball, and accidental sampling methods. The subjective method is a method of selecting units from a population. The easiest way for the researcher to access is convenience sampling, where the units are selected for inclusion. For more additional data, the snowball sampling is where the new units are recruited by other units that the researchers already gathered to form a part of the sample. Moreover, the accidental sampling is when. The researchers collect data for those who are present at the time of research to gather more data.

G. Data Analysis

The descriptive statistical analysis was one of the study's sample group populations. It aims to be a free-biased paper. The data gathered from the online and in-person surveys was statistically processed to achieve this. The data was sorted and coded using statistical software for the social sciences after it was tabulated and graphed. It is a sort of analysis known as descriptive statistics that aid in describing, illuminating, and summarizing the fundamental characteristics of the dataset used in the study. It is summarized in a way that describes the data sample and its measurements, which will aid the researchers in having a better understanding of the data.

H. Treatment of Data

The Chi-square test of independence is used to determine whether two categorical or nominal variables are likely related. The researchers used ANOVA, examined if the averages of the treatment levels differ from the overall average of the dependent variable might help determine whether groups with varying levels of independent variables differ. To determine if the types of facemasks, usage of the facemasks, and the method/manner of disposal are related to the respondents' level of awareness and their environmental effect. That gives a way to decide if the idea is plausible or not.

4. Results and Discussion

A. Awareness Level of Respondents to the Type of Facemask Used

Table 1
Chi-square Test: Awareness level of respondents to the type of facemask used

overall chi-square value	**0.819452763**
degrees of freedom	**1**
p-value of chi-square	**0.663831862**

The p-value of the chi-square test (0.66) is higher than the 0.05 level of significance. The level of awareness of the respondents for the proper disposal of facemasks is independent of the type of facemasks they are using.

When choosing a face mask, it is essential to consider its effectiveness, comfort, and the environment in which it will be used. Some masks may be more effective at blocking respiratory droplets than others but may be less comfortable. Similarly, some masks may be more environmentally friendly

but may not provide the same level of protection (Riley, 2023). According to (Petrescu et al.) most of the time, people did not realize that masks could harm the environment because they thought of them as pieces of clothing, not pieces of plastic. The lack of awareness led to a significant problem of mask waste. However, it does not affect the level of awareness or knowledge of users on how to dispose of the type of face mask used because the purpose of different kinds of masks help protect the respiratory system of the users, whether it is reusable or disposable masks, and whether the users know how to dispose correctly or not It will invariably have some kind of effect on the environment.

B. Types of Facemask used and Carbon Emissions

Table 2
Anova: Single Factor- Types of facemasks used and carbon emissions

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.029993236	2	0.01499662	10.6914526	3.00663E-05	3.01856761
Within Groups	0.55405606	395	0.00140267			
Total	0.584049296	397				

The result shows that since the p-value of F (0.00003) is lower than the 0.05 level of significance. There is a significant difference in the CO_2 Emission per type of facemask used by the respondents in which it affects the environment.

Allison et al. (2020) estimated that reusable masks with filters and manual cleaning have a similar environmental footprint to surgical masks (approximately 1.50 × 109 kg CO2 eq). The single-use face mask has a certain level of CO_2 that will result in a negative effect on the environment, especially if not properly disposed of. A surgical facemask emits 0.059kg of CO_2 in a single usage as well as other three layers Mask (a disposable mask that has three layers), N95 mask emits 0.05kg of CO_2 in a single usage as well as other respiratory masks like KN95 and KF94, and cloth (reusable facemask) emits 0.036kg of CO_2 in a single usage (Lunag et al., 2023).

C. Awareness Level of Respondents to the Manner of Disposing Facemask

Table 3
Chi-Square Test: Awareness level of respondents to the manner of disposing facemask

overall chi-square value	**18.68481298**
degrees of freedom	**1**
p-value of chi-square	**1.54206E-05**

The p-value of the chi-square test (0.000015) is lower than the 0.05 level of significance. The level of awareness of the respondents for the proper disposal of facemasks is dependent on their manner of disposing of facemasks.

According to Xu and Ren (2021), the increasing number of cases of inappropriate mask disposal poses a severe environmental problem. Kaewchutima et al. (2023) conducted a study that revealed that respondents were unaware of facemask disposal, showing a lack of understanding. Over 90% of the students identified the proper disposal containers for facemasks. Around 70% of students had no idea about the proper facemask disposal procedure, incorrectly supposing that used facemasks could be disposed of like common waste. Moreover, less than half of the students were aware of proper facemask disposal methods. Akkajit et al. (2020) studied an investigation and discovered that a substantial proportion of students were aware of the appropriate facemask disposal containers. They properly identified the labeled trash bins as "infectious waste" and understood that face masks should be stored in closed containers and placed in red bins. The percentages of students who responded correctly to these questions were 94.00%, 92.38%, and 92.38%, respectively.

5. Conclusion

A. Summary

Individuals started using face masks during the outbreak of COVID-19. This caused much waste to be generated from using different types of face masks; each individual's usage and the methods they disposed of affect the environment because of individual awareness level. The researchers aimed to identify if the different types of facemasks and disposal methods affect the level of awareness of each individual. Moreover, it aims to identify if using facemasks has an environmental effect. The results stated that the types of facemasks of the respondents are not affected by their level of awareness of the proper disposal of facemasks. The type of facemask the respondents used has an environmental effect with the estimated quantity of carbon emission it creates. Moreover, the disposal methods have no effect on the level of their awareness of the proper disposal of the facemask.

B. Conclusion

$H_0$1 is accepted as the result shows that the p-value of the chi-square test (0.66) is higher than the 0.05 level of significance, which implies that the level of awareness of the respondents for the proper disposal of facemask is independent by the type of facemask they are using.

$H_0$2 is rejected as the result shows that the p-value of the chi-square test (0.000015) is lower than the 0.05 level of significance, which implies that the level of awareness of the respondents for the proper disposal of facemask is dependent or is affected by their manner of disposing of facemask.

$H_0$3 is rejected as the result shows that the p-value of F which is (0.00003) is lower than the 0.05 level of significance, which implies that there is a significant difference in the CO_2 Emission per type of facemask used by the respondents in which it affects the environment.

C. Policy Implementation

The significance of the study is to analyze the level of awareness of how Thomasians dispose of their face mask properly and their effect on the environment.

The socioeconomic issue that can address the lack of awareness of the respondents about the proper disposal of face masks and their effect on the environment. For the community, the government should build advocacy to educate the officials, as the Philippines have a law to protect our environment, the

CLIMATE CHANGE ACT (RA9729). In the survey that the researchers gathered, most respondents lacked knowledge on how to dispose of facemasks properly. With the help of the leaders, the potential of helping the community to be knowledgeable is high and effective. Moreover, having knowledge and awareness can lead the community to prevent negative environmental effects and promote positive environmental effects. Using social media platforms can be one of the instruments of social media. The University of Santo Tomas should help Thomasians engage in the practice of the proper way of disposal. To create a learning experience for individuals inside and outside their premises so that they can advocate the effect of using the facemask and their disposal methods on the environment. Most are aware of global warming yet unaware of the different methods and practices to avoid it.

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