



PUBLIC HEALTH CONFERENCE 2022

1-3 NOVEMBER 2022

BANGKOK, THAILAND

CONFERENCE PROCEEDINGS

Tomorrow People Organization

Dušana Vukasovića 73, Belgrade, Serbia

www.tomorrowpeople.org

Proceedings of international conference:

"PUBLIC HEALTH CONFERENCE 2022"

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Producer: Tomorrow People Organization

Publisher: Tomorrow People Organization

Quantity: 200 copies

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A Correlational and Retrospective Study Between the Lead Time of Rapid Antigen Nasopharyngeal Swab Testing Kits and the Sensitivity and Specificity of Results in Testing for SARS-CoV-2 Antigen

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ABSTRACT

The year 2019 introduced a novel coronavirus caused by SARS-CoV-2 virus, also known as COVID-19, and has affected millions worldwide. As the disease affects more people every day, the development of testing procedures has advanced to rapidly detect the SARS-Cov-2 antigen, a causative agent of COVID-19. This study aims to determine whether there is a significant relationship between the lead time of the rapid antigen nasopharyngeal test for the detection of SARS-CoV-2 antigen and its sensitivity and specificity. In this correlational and retrospective study, an archival data collection was employed, selecting patients who passed the inclusion criteria of having been tested for both rapid antigen nasopharyngeal swab test and a confirmatory RT-PCR test in the Multispecialty and Diagnostic clinic that served as the study setting. A total of 184 participants were chosen through purposive sampling for data retrieval, with 92 participants in each of the lead times included in the study, 5-10 minutes and 20-30 minutes, all employing the same lateral flow immunoassay principle. Data processing and analysis were done using the Chi-square test of association and a two-tailed Z-test for Two Proportions. The chi-square test of association showed a p-value of 0.368 ($\alpha = 0.05$), indicating no significant correlation between the two lead time groups in terms of sensitivity and specificity. The Z-test showed that there was no significant difference between the sensitivity and specificity of the two lead time groups showing a p-value of 0.208 and 0.211 ($\alpha = 0.05$), respectively. Since it has been found that the lead time does not have a significant correlation to the sensitivity and specificity of the test results, it presents that any of the test kits can be utilized since they can produce the same results with accuracy parameters having insignificant differences.

KEYWORDS: Lead Time, Lateral Flow Immunoassay, Rapid Test, SARS-CoV-2

A Cross-Sectional Study On The Factors Influencing Online Health Information Seeking Tendencies And Its Association On Health Care Behaviors Of Filipino Citizens In Metro Manila During The COVID-19 Pandemic

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ABSTRACT

As COVID-19 cases continue to rise, people's daily lives started to revolve around the internet. This cross-sectional study was conducted to explore the factors that influence the inclination of Metro Manila residents to seek online health information and its association with health behaviors during the COVID-19 pandemic. A total of 385 respondents were recruited via snowball sampling to answer an online questionnaire distributed through Google forms.

The study's findings revealed that 384 of the 385 respondents search for health information online. Among them, 90.6% search for symptoms while none search for healthy behaviors. The most visited websites were health portals or medical encyclopedias. Significant relationships between the inclination to seek online health information and health status ($p=.000$) and technological literacy ($p=.000$ & $p=.017$) were evident.

Respondents that seek online health information to resolve medical problems are more likely to have changed positive views and behaviors. Furthermore, individuals who prefer to search for health information online to resolve medical concerns will change their decisions and have high self-efficacy in deliberating the obtained data.

Overall, the findings of this study suggest that since online health information has a visible influence on health behaviors, the credibility of online health information must be evaluated thoroughly. The current research contributes to a better knowledge of health information acquisition via the internet as well as continuing public policy about the utility of online health information. Furthermore, healthcare professionals may assist their patients in medical decision-making by referring them to accurate and credible websites or sources.

KEYWORDS: *online health information seeking, health behaviors, Metro Manila, COVID-19*

1 INTRODUCTION

As of August 2021, the COVID-19 pandemic has brought over 216 million cases and 4.4 million deaths internationally (Hopkins Coronavirus Resource Center, 2021). The continuous increase of patients did not only cause international panic but has also led to the start of containment measures such as the initiation of lockdown, travel ban, and other restrictions. Given these barriers, people with health problems avoid going to the hospital due to the fear of acquiring the virus (Wong et al., 2020). The gradual shift to an online set-up has turned people's attention to the big web for gathering health information. With this, increased access to online health information has been reported (Varma et al., 2021). According to the National Cancer Institute (2018), more than 60% of the US population collects health information from the Internet. However, no recent study has tackled the prevalence of gathering health information among Filipino residents in Metro Manila.

The Internet is a powerful worldwide platform that provides easy access to health-related information in times of medical need. Recently, many research articles have stated that demographic factors influence one's inclination to conduct internet searches. A study done in Kuwait by Alkathlan et al. revealed that factors such as gender, nationality, level of education, and using a computer at work were proven to be significant determinants of searching the web for health data. Furthermore, numerous studies have also established the positive and negative outcomes of searching for health information online. As stated by Dameery et al. (2020) and Farooq et al. (2020), browsing the Internet for health-related information and making it the only source of health diagnosis can increase a patient's stress and anxiety. Moreover, excessive surfing has also led to the interruption of treatment and neglect in need of medical assistance, as many patients started treating themselves before visiting a physician leading to further worsening of their diseases (Hullur et al., 2020; Sharma & Khanna, 2019). On the other hand, Link et al. (2021) argue that seeking health information substantially affects one's self-efficacy and therefore have positive perceptions and attitudes.

Therefore, in light of this, the study aimed to identify the factors that affect one's inclination to seek online health information and the effect of searching for health data on one's health-seeking behavior among Filipino citizens in Metro Manila.

2 RESULTS

Table 1 Frequency Distribution of the Socio-Demographic Profiles

Variable	Parameter	n	%
Sex	Male	255	66.2
	Female	130	33.8
Age	18-24	301	78.2
	25-31	36	9.4
	32-38	16	4.2
	39-45	12	3.1
	46-52	13	3.4
	53-59	7	1.8
Highest Educational Attainment	High School Undergraduate	1	0.3
	High School Graduate	54	14.0
	College Undergraduate	248	64.4
	College Graduate	72	18.7
	Master in Graduate School	5	1.3

	Doctorate in Post Graduate School	5	1.3
Monthly Income	P10,000 or below P10,000	47	12.2
	Between P10,001 to P20,000	21	5.5
	Between P20,001 to P40,000	36	9.4
	Between P40,001 to P75,000	25	6.5
	Between P75,001 to P130,000	14	3.6
	Above P130,001	6	1.6
	Not applicable	236	61.3
Occupation	Support Staff and Manual Laborers	12	3.1
	Business and Finance	32	8.3
	Education	8	2.1
	Engineering, Health, Science and Technology	34	8.8
	Housewife/Unemployed	5	1.3
	Student	294	76.4

Table 1 shows the socio-demographic profile distribution of the research respondents. A total of 385 respondents were recruited from the general population. Among them, 66% were females, while 34% were males. The 18-24 age group accounts for about 80% of the respondents, followed by the 25-31 age group representing 9.4% of the total. About 64.4% of the respondents are college undergraduates, 18.7% are college graduates, 14% are high school graduates, 2.6% completed postgraduate school, and 0.3% are currently in high school.

Since the majority (76.4%) of the respondents are students, 61.3% do not have a source of income, only 12.2% have a monthly income less than the minimum wage, while 9.4% earn Php 20,000 to Php 40,000 monthly. As per the occupation of the remaining 23.6%, most (8.8%) are employed in the fields of engineering, health, science, and technology, followed by 8.3% in the business and finance sector.

Table 2 Frequency Distribution of Health Condition Search Patterns and Sources of Health Information on the Internet

	n	%
Have you ever used the internet to find health-related information?	384	99.7
What are the usual health-related information you search on the internet?		
Symptom	349	90.6
Disease	254	66.0
Service info (e.g., doctor, hospital)	148	38.4
Medication	218	56.6
Test	109	28.3
Treatment and procedure	241	62.6
Alternative medicine	113	29.4
Vitamins and supplements	168	43.6
Health insurance	32	8.3
Healthy behaviors (e.g., diet, exercise)	-	-
Others	-	-
What are the websites you visit to gather health-related information?		
Health portals/Medical encyclopedia (e.g., MIMS, PubMed, MedlinePlus, WebMD)	316	82.1
Hospital/Clinics	136	35.3

National and International Organizations Competent for Health (e.g., DOH / CDC/ WHO)	283	73.5
Online Encyclopedia (e.g., WikiPedia)	91	23.6
Physician/Medical Associations	100	26.0
Scientific Journals Database	155	40.3
Social Media	145	37.7
Q&A sites (e.g., Yahoo! Answers, Reddit, Quora)	125	32.5
Others	1	0.3

Table 2 presents the distribution of the respondents' health condition search patterns and sources of online health information. 99.7% answered 'yes' when asked if the respondents utilize the internet to search for any health-related information. The most searched health-related information is symptoms (90.6%), followed by disease (66%). Meanwhile, the respondents do not utilize the internet to search regarding healthy behaviors.

Regarding the websites visited to gather health-related information, 82.1% utilize health portals or medical encyclopedias such as MIMS, PubMed, MedlinePlus, and WebMD. 73.5% use national and international organizations competent for health like the DOH, CDC, and WHO. Meanwhile, 37.7% of the respondents rely on social media for information, while only 35.3% visit hospitals or clinics.

Table 3 Chi-Square Analysis of Socio-demographic Profiles, Health Status, and Technological Literacy to Inclination to Undergo Seeking Online Health Information

Variable	Parameter	Have you ever used the internet to find health-related information?		Chi-square Value	P-value
		Yes	No		
Sex	Male	254	1	.511	.475
	Female	130	0		
Age	18-24	301	0	.280	.998
	25-31	36	1		
	32-38	16	0		
	39-45	12	0		
	46-52	13	0		
	53-59	7	0		
Highest Educational Attainment	High School Undergraduate	1	0	.554	.990
	High School Graduate	54	0		
	College Undergraduate	247	1		
	College Graduate	72	0		
	Master in Graduate School	5	0		
	Doctorate in Post Graduate School	5	0		
Monthly Income	P10,000 or below P10,000	47	0	.633	.996

	Between P10,001 to P20,000	21	0		
	Between P20,001 to P40,000	36	0		
	Between P40,001 to P75,000	25	0		
	Between P75,001 to P130,000	14	0		
	Above P130,001	6	0		
	Not applicable	235	1		
Occupation	Support Staff and Manual Laborers	12	0	.310	.997
	Business and Finance	32	0		
	Education	8	0		
	Engineering, Health, Science and Technology	34	0		
	Housewife/Unemployed	5	0		
	Student	293	1		
Current Health Status	1	0	0	385	.000*
	2	7	0		
	3	93	0		
	4	210	0		
	5	74	0		
	Not Applicable (0)	0	1		
Chronic Disease	None	324	0	385	.000*
	One	44	0		
	Two or More	16	0		
	Not Applicable (0)	0	1		
Level of Computer Skills	Good/Excellent	201	0	191.99	.000*
	Accepted	150	0		
	Not bad	29	0		
	Do not know how to use	3	0		
	Not applicable (0)	0	1		
Use of Smartphone	Yes	382	0	31.417	.000*
	No	2	1		
Use of Computer or Laptop at Home	Yes	370	0	5.692	.017*
	No	14	1		

*p-value significant level at .05 level

Table 3 delineates the Chi-square analysis for the independence of socio-demographic profiles, health status, and technological literacy to the inclination to undergo seeking online health information. The result evidently shows a significant relationship between the inclination to seek online health information and the current health status ($p=.000$), as well as the technological literacy ($p=.017$) of the respondents.

Table 4 Correlation Analysis on Health behaviors based on Frequency of Seeking Online Health Information

		TOTAL	How often do you use the internet to find health-related information?
ITOTAL	Pearson Correlation	1	.298**
	Sig. (2-tailed)		.000
	N	385	385
How often do you use the internet to find health-related information?	Pearson Correlation	.298**	1
	Sig. (2-tailed)	.000	
	N	385	385

**Correlation is significant at the 0.01 level (2-tailed)

Table 4 depicts the strength of the relationship between the total behavior of respondents seeking online information and the frequency of seeking online health information. Based on the results, there is a positive low degree of correlation ($r=.298$) between the two variables. Hence, it cannot clearly conclude a direct relationship between the frequency of seeking online health information and health behaviors of the respondents.

Table 5 Linear Regression on the Frequency of Internet Use and the Total Score on Online Health Behavior

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	29.394	.827		35.559	.000
	How often do you use the internet to find health-related information?	1.075	.176	.298	6.109	.000

a. Dependent Variable: ITOTAL

Table 5 displays the change in the frequency use of internet and the total score on online health behavior using the linear regression analysis. The results of the linear regression analysis present the following equation where Online Health Behavior = $29.394 + 1.075 \times \text{Frequency use of internet} + \text{error}$. The table shows that the coefficient for frequency of internet usage is 1.075. Therefore, in every unit increase in the frequency use of internet, there is a 1.075 increase in the total score on online health behavior.

Table 6 Health Behaviors Towards Online Health Information-Seeking

Statements	Mean	Interpretation
After searching for online health information, I will change my views to align with the information I obtained.	3.88	Agree

After searching for online health information, I will change my decision, aligning it with the information I obtained about whether to see a doctor or medical expert.	3.79	Agree
After searching for online health information, I will change my judgments, aligning with the information I obtained, on personal medical issues.	3.77	Agree
Online health information is an important reference for me when making medical decisions.	3.83	Agree
I will discuss the health information I acquired online with a doctor or medical expert.	4.08	Agree
I am confident that I can find useful and reliable online health information.	3.85	Agree
I am confident that I can evaluate the accuracy and reliability of online health information for making medical decisions.	3.62	Agree
I am confident that I can make good use of online medical information.	4.00	Agree
I am confident that I can make correct medical judgements on personal medical issues based on online medical information.	3.36	Neutral

Table 6 summarizes the health behaviors of the respondents towards seeking online health information. Data shows that the respondents who are inclined to search for online health information are more subjected to have changed positive views and behaviors based on the information gathered online.

Table 7 Final Factor Analysis Matrix

Rotated Component Matrix^a			
Statements	Component		Source
	1	2	
After searching for online health information, I will change my views to align with the information I obtained.	0.188	0.806	CD
After searching for online health information, I will change my decision, aligning it with the information I obtained about whether to see a doctor or medical expert.		0.819	CD
After searching for online health information, I will change my judgments, aligning with the information I obtained, on personal medical issues.	0.264	0.821	CD
Online health information is an important reference for me when making medical decisions.	0.418	0.636	CO
I will discuss the health information I acquired online with a doctor or medical expert.	0.467		CO
I am confident that I can find useful and reliable online health information.	0.700	0.403	PS
I am confident that I can evaluate the accuracy and reliability of online health information for making medical decisions.	0.793	0.275	PS
I am confident that I can make good use of online medical information.	0.801	0.253	PS
I am confident that I can make correct medical judgements on personal medical issues based on online medical	0.781	0.150	PS

information.			
CD, Changing Decisions; CO, Consulting Others; PS, Promoting Self-Efficacy			

Table 7 highlights the final factor analysis matrix of the statements regarding the health behaviors of the respondents towards seeking online health information. Based on the analysis, there are two major factors involved: changing decisions and promoting self-efficacy. Consulting others is found to be a supporting factor of the two rather than being a standalone factor.

3 DISCUSSION

The increasing use of the Internet to seek health-related information has been reported in various studies (Bujnowska-Fedek et al., 2019; Stankova et al., 2020). In this study, among the 385 respondents, 99.7% or 384 reported scrutinizing the Internet for health information. Regarding the search patterns, results from this study are in line with the results presented by Cheung & Wong (2019), wherein the majority (81.50%) of the respondents reported that they frequently use the Internet to search for information related to symptoms of diseases. Symptoms of diseases appear as the most searched health-related information as it serves as a pre-consultation self-diagnostic tool and a deciding factor in physician consultation (Cheung & Wong, 2019).

In the study by Cheung & Wong (2019), the health portal/ medical encyclopedia was reported as the second most used health-related information reference since, most of the time, it belongs to the top results from the search engine. It may also be due to the convenience and clarity of content presentation. However, the reported significant source of online health-related information was the online encyclopedia. This contradicts the presented result since only 2 out of 10 respondents reported using an online encyclopedia to collect online health-related information. A possible reason for this is that since most of the respondents are undergraduate students, they are more likely to use scientific databases.

The study results are parallel to the findings from Jacobs, Amuta, and Jeon's (2018) wherein most of the respondents that exhibited higher technological literacy based on the questionnaire were more likely to gather online health information. In contrast, the respondents who admitted to having lower technological skills tend to gather health information from friends and family rather than on the Internet. The researchers reported a significant inversely proportional relationship between health information-seeking tendencies and technological literacy ($p < 0.001$).

Indeed, the necessity of media literacy is prominent in online health-seeking (Magsmen-Conrad et al., 2018). Most middle-aged adults have expressed that they find the Internet quite complex and experienced numerous struggles in accessing online health information. This may then be considered a possible factor in their reluctance to utilize the Internet for health information and instead use the Internet to reconnect with their loved ones.

Regarding the relationship between health status and online-seeking behavior, the study results also coincide with the findings of other researchers. Liobikiene and Bernatoniene (2018) have also declared that health status was a significant determinant in an individual's online health information-seeking tendencies. Based on the study's findings, those who regard their health to have a poor shape utilized the internet for health information more frequently than those who consider their health condition optimal.

In contrast to the present study, age, sex, and educational attainment significantly influenced Turkish participants' online health information-seeking behavior (OHISB) as presented in the study by Demirci et al. in 2020. A systematic review by Mirzaei et al. (2021) on the predictors of OHISB found age, education, sex, health condition, and financial income as central predictors. Regarding sex, numerous studies states that females use the Internet more to seek health information than males (Escoffery, 2018; Galeshi et al., 2018; Demirci et al., 2020). This may be because women

tend to take responsibility for health-related issues in families and relationships due to socialization and gender roles (Nölke et al., 2015).

In the study by Mirzaei et al. (2021), when age was examined as a factor determining one's OHISB, it was found that those ≤ 25 years old, 26–35 years, and 36–45 years all sought health information more frequently than the participants ≥ 46 years old. Younger populations have a greater inclination to access and use eHealth information than older populations, likely due to differences in the level of technological literacy and device accessibility (Reiners et al., 2019).

In the present study, it is possible that no significant difference was found because most of the sample belongs to the 18-24 age bracket (78.2%). According to Mirzaei et al. (2021), as the educational level increases, the tendency to search for health information online also significantly increases. Similar results were obtained in a study conducted by Massey (2016) in the United States and by Chu et al. (2017) in Hongkong.

Given that most of the respondents are college undergraduates, this may explain the lack of significant association between the involved variables. According to Alkhatlan et al. (2018), as monthly income increases, so is the proportion of the participants who obtain health-related information online; this may be due to better Internet access.

Furthermore, a study conducted among patients in Ghana (2019) revealed that monthly income is a positive predictor of online health information seeking. People who earn higher income tend to search the Internet for health-related information. This could be attributed to the assumption that having more income allows individuals to be more capable of using the Internet and acquiring internet-ready devices such as smartphones and laptops.

Consistent with the findings of our study, employment status positively affects health information seeking on the Internet. However, the effect is not statistically significant (Nölke et al., 2015; Li et al., 2016; Demirci et al., 2020). Noting that the sample was predominantly female, between ages 18-24, are college undergraduates, and have no monthly income, it is possible that some associations could not be detected because of the lack of variability in the study sample.

Having the skills and the means to utilize the internet in searching for health-related information has proven to be a significant factor in promoting appropriate health behaviors. Furthermore, the frequency of internet usage has also been sought to influence health-seeking behavior.

The results of the present study revealed that there is a weak correlation between the means of health behaviors among the frequency of use of the internet. The study's findings were in parallel with a paper conducted by Mitsutake et al. (2016) among Japanese adults, which revealed that frequent access to the internet, together with high eHealth literacy, is significantly associated with good health behavior.

The researchers used the Five-point Likert Scale to interpret the respondents' mean health behaviors. The statements were evaluated based on the respondents' level of agreement. Although the majority showed positive behaviors towards online health information seeking, the respondents were neutral regarding personal medical issues. This behavior exists due to the central tendency bias, the inclination to choose responses closer to the middle rather than the endpoints to avoid extreme response choices (Pimentel, 2019).

The study explored the hypothesis that online health information-seeking affects health behaviors. The study established that individuals who prefer to search health information online to resolve medical concerns will change their medical decisions and have high self-efficacy in deliberating the obtained information.

In the study of Chen et al. (2018), which was the basis of the health-seeking behavior component of the questionnaire of this study, three factors: (1) changing decisions, (2) consulting

others, and (3) promoting self-efficacy, were observed upon the analysis of the statements of their Online Health Information Utilization (OHIU) questionnaire. In contrast, analysis of the responses in the present study yielded two factors, (1) changing decisions and (2) promoting self-efficacy, negatively predicting Hypothesis 3.

The Internet is a valuable tool that could greatly influence patients' health decisions. In line with this, the present study has found that Changing Decisions is a significant dimension of health behavior observed in the respondents. The study's results showed consistent trends like recent articles on health decision-making due to information obtained from the Internet.

In a study conducted by Fedak et al. (2019), they found that health internet users often schedule for an appointment to consult a health professional and inquire information about the diagnosis or treatment of certain diseases under the influence of the Internet. After searching for health information on the Internet, patients also reported modifying their diet and increasing their physical activity.

Furthermore, certain features predispose respondents to health-related behaviors after searching for health-related information. A study conducted in 2019 showed that Internet use by endocrinology patients has positively influenced their decisions concerning their management plan (Kyriacou & Sherratt).

Moreover, Borges et al. (2021) revealed that the Internet also influences increasing autonomy on health-related decisions of pregnant women during their gestation period and prepares pregnant women for better communication with health professionals.

The present study provides evidence of the impact of the Internet on health decision-making behaviors in the general population in Metro Manila. It is worth noting that analyzing the relationship between the two provided a significant finding that could effectively promote an efficient diagnostic and therapeutic process for patients.

Another significant dimension observed in the respondents' health behavior is promoting self-efficacy. This study revealed that promoting self-efficacy is associated with seeking health information, given its significant role in shaping perceptions, judgment, and decision-making concerning medical and health-related information. Pourrazavi et al. (2022) emphasized that self-efficacy served as a strong, encouraging factor in information-seeking behavior, including health and medical information. The results revealed the likeliness of individuals shifting to a more positive view and behavior based on their acquired knowledge from the internet.

In their study, Link et al. (2021) argue that self-efficacy has a more substantial effect on positive perceptions and attitudes toward online health-seeking behavior, indicating that individuals who prove to be healthy assume that they benefit from seeking health information.

The present study revealed that 37.7% of the respondents utilized social media to search for health-related information, only ranking fourth behind health portals, national and international organizations, and scientific journal databases. In line with this, Niu et al. (2021) discussed a positive relationship between the use of social media to seek health information and self-efficacy. Their study discovered that participants who use social media for health have higher self-efficacy and thus would more likely show greater intentions to perform health behaviors on social media.

In another study by Tetri & Juujärvi (2022), self-efficacy contributes to the likelihood of individuals engaging themselves in the utilization of digital healthcare systems. This encompasses the online health-seeking information behavior of individuals, which enhances and promotes self-efficacy by receiving online health information that is credible, understandable, comprehensive, and accurate.

4 METHODOLOGY

4.1 Study Design

A quantitative research design is utilized in gathering and analyzing data. This employs the purpose of the correlational approach, which measures the variables and assesses their relationship without influencing the same variables.

4.2 Study Population

The study population included residents from Metro Manila, Philippines aged 18 to 59. In determining the sample size, the Cochran's Formula of finite population was used which indicates that:

$$n = \frac{\frac{z^2 pq}{e^2}}{1 + \frac{z^2 pq}{e^2 N}}$$

Where n is the sample size, z is the score of the confidence level, p is the proportion of the population, q is 1-p, and e is the margin of allowable error. With a population of 7,799,446, a total of 385 respondents were recruited for the study. People living outside Metro Manila, not within the age bracket of 18-59 years old, and are not literate in using Google forms were excluded from the sample collection. Additionally, people with mental health conditions, pregnancy, high vulnerability, and those who require special needs were automatically excluded. Participants who decided to withdraw were automatically excluded from the study.

4.3 Survey Instrument

The questionnaire was developed based on currently available studies. The tool used to gather the socio-demographic factors, health status, and technological literacy of the respondents, was based on the study of Alkhatlan et al. (2018) entitled Factors affecting seeking health-related information through the internet among patients in Kuwait. For the collection of data regarding the association of online health information seeking tendency on health care behaviors, the study of Chen et al. (2018) entitled Online Health Information Utilization questionnaire from the study Health Information Obtained from the Internet and Changes in Medical Decision Making: Questionnaire Development and Cross-Sectional Survey was used.

The questionnaire which was open from the last week of January until the last week of March consisted of five sections: demographic profile, prevalence and patterns of online health information seeking, quality of health, technological literacy and association between online health information seeking and health care behavior. The quality of health and technological literacy part allowed the respondents to rate their health status and technological skills. The association between online health information and health care behavior comprises 9 items which used a Likert scale ranging from 1 to 5, indicating the respondents agreement.

Questionnaires were deployed online through Google forms wherein a QR code was created that directed the participants to the questionnaire for easy accessibility.

4.4 Statistical Analysis

The data gathered from this study were analyzed using descriptive and inferential statistical tools, specifically frequency and percentage, mean score analysis, chi-square test, Pearson correlation coefficient, regression analysis, and factor analysis. The researchers utilized (1) frequency and percentage to identify and describe the demographic characteristics of the participants, sort users of online self-diagnostic platforms from non-users, find out the platforms utilized and determine the type of health-related information searched on the internet. (2) Mean score analysis was used to find out the health behaviors that result from online health information seeking. (3) Chi-square tests for significant relationship or association between variables. Its usage determined the relationship between demographics, health status, and technological literacy and the inclination of the respondents to undergo online health information seeking. (4) Pearson correlation coefficient determined the strength of the relationship of the respondents' health behaviors and the frequency in seeking online health information. (5) Linear regression evaluated the effect of frequency of internet usage on the health behaviors of the respondents. (6) Final factor analysis was employed to describe the underlying factors observed in the responses of the respondents regarding their health behaviors toward seeking online health information. The researchers utilized the SPSS Statistics 25 software package for data entry and analysis.

5 CONCLUSION

The surge of COVID-19 cases in Metro Manila directly affected the lifestyle of Filipinos. People started to depend on the internet for their daily needs, including health information seeking. The objective of the research was to identify different factors associated with online health information seeking and its implications to the health-seeking behavior of Filipino citizens in Metro Manila. Specifically, the researchers aimed to: (1) identify the different demographic profiles of respondents; (2) determine the health condition search patterns and sources of health-information on the internet; (3) identify if there is a significant relationship between the socio-demographic characteristics, health status, and technological literacy to their inclination to undergo online health information seeking; (4) determine if there is a significant relationship between the frequency of acquiring online health information and health behaviors; and (5) determine the resulting health behaviors of the respondents that utilize online health information seeking.

The data gathered were statistically treated and analyzed using frequency and percentage, mean score analysis, Chi-square test, Pearson correlation coefficient, linear regression and final factor analysis. The study proved that online health information seeking was rampant in Metro Manila during the COVID-19 pandemic. Based on the findings, it was statistically proven that:

1. Majority of the respondents were females aged 18-24 years old, who are college undergraduates and do not have a monthly income.
2. The most searched health information was symptoms (90.6%), followed by disease (66%). The respondents mostly visit health portals or medical encyclopedias (82.1%) to gather health-related information.
3. A significant relationship was established between the inclination to seek online health information, health status and technological literacy, but none for sociodemographic factors.
4. The frequency of internet usage affected health behaviors as established by a positive low degree of correlation ($r=.298$).
5. The respondents exhibit positive views and behaviors after seeking online health information, but neutrality is seen regarding personal medical issues. They also tend to change medical decisions and have high self-efficacy in resolving medical concerns.

Overall, the findings of the study suggest that online health information-seeking tendencies can influence an individual's health care behavior. Thus, the credibility of online health information must be evaluated thoroughly, and healthcare professionals must assist patients in medical-decision making by referring to accurate and credible resources.

ACKNOWLEDGEMENT: The researchers would like to show their appreciation and gratitude to Ms. Kristina Villanueva, Prof. Zendel Rosario Taruc, The Faculty of Pharmacy Research Ethics Committee, Dr. Edilberto P. Manahan, and all the respondents who voluntarily participated in the study.

FUNDING: This study received no external funding.

CONFLICT OF INTEREST: The researchers declare that there is no conflict of interest in any form may it be personal, financial, propriety, or professional with the sponsor/grant-giving organization, the study, the co-investigators/personnel, or the site.

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A Cross-Sectional Study On The Socio-demographic Profile And Social Perceptions Towards COVID-19 Vaccines Among Residents Of Quezon City

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ABSTRACT

Amidst the current pandemic, the Philippine government is doing different approaches to understand the Filipino population on how to encourage them to partake in the vaccine rollout against COVID-19. It has been known that there were various socio-demographic factors that may affect the perception of the population in receiving the vaccine against the coronavirus. The study aimed to assess the relationship between socio-demographic profile and perceptions of the residents in Quezon City when it comes to COVID-19 vaccines. A total of 385 respondents were selected via convenience sampling technique to answer the questionnaire distributed through Google forms.

The respondents demonstrated that their willingness to get vaccinated is highly influenced by their age, educational attainment, employment status, marital status, and religion which garnered p-value of ($p < 0.05$). The data obtained can conclude that the main vaccine-related factors that influence their perception of COVID-19 vaccines are vaccine efficacy and vaccine brand. It was found that among the sociodemographic factors, educational attainment ($\mu > 4.0$) has the most positive outlook towards COVID-19 vaccines specifically post-graduate respondents while occupation has the most negative outlook specifically blue collared jobs ($\mu < 4.0$).

Overall, the data collected from the research would help aid the local government of Quezon City in determining which population is hesitant and in favor towards vaccines and guide them in implementing the appropriate intervention. It also serves as a reference material for future researchers who are interested in studying the perceptions of people towards the COVID-19 vaccines. The researchers would also like to recommend for future studies to involve respondents who have taken the second booster shot and those who have yet to receive a first booster shot. It is also encouraged to utilize other sampling methods to maximize study sample's heterogeneity.

Keywords: *COVID-19, vaccine efficacy, vaccine brand, sociodemographic factors, vaccine perception*

1 INTRODUCTION

For almost two years now, countries all over the world have made efforts to stop the coronavirus pandemic from spreading. The World Health Organization (WHO) has responded to this global crisis with vaccine development and research as their principal action. The priority of the WHO is achieving equitable access to safe and effective vaccines by tirelessly working with different pharmaceutical partners all over the world to develop and manufacture coronavirus vaccines which would play a critical role in the ending of the COVID-19 pandemic (WHO, 2021). The Philippine government, in particular the Department of Health, are trying different approaches in understanding the Filipino population on how to encourage them to participate in the vaccination program. Based on the current situation of the local governments here in Metro Manila, vaccination sites are always fully operational with at least 50% of NCR's eligible population fully vaccinated vs COVID-19 (Aguilar, 2021). However, there is still a part of the population that is quite difficult to encourage to be vaccinated because of several socio-demographic factors that could influence the acceptance and perception of COVID-19 (Echoru et.al, 2021).

The knowledge of the people about the efficacy and side effects of the vaccine may be a factor in the decision making of taking the vaccine. Their perceptions on taking new vaccines in general such as their beliefs, traditions, religion, and ethnicity may also affect their decision to get vaccinated. The distance of vaccination sites and vaccine availability might also be a consideration of the residents in partaking in the vaccination program. Exposure, distance, and risk can be given account in the vaccination process. Another factor that affects the perception of individuals to getting vaccinated are testimonies and feedback about their experiences during and after vaccination.

Everything stated in earlier paragraphs were considered and studied by the researchers in order to determine the socio-demographic profile, perceptions, and other health history factors that would greatly affect the decision of the residents in Quezon City, Philippines in taking the COVID-19 vaccines. This research study can help aid the local government of Quezon City in determining which population is hesitant or in favor of vaccines and guide them in implementing the appropriate intervention. The researchers sought to answer the relation of the socio-demographic profile and perceptions of residents in Quezon City regarding COVID-19 vaccines. Which among the population in terms of their socio-demographic factors are willing to get vaccinated in relation with the following socio-demographic variables in terms of age, sex, educational attainment, employment status, income, marital status, and religion. Which socio-demographic profile of the individuals displays the highest percentage in terms of positive outlook towards COVID-19 vaccines and negative outlook towards COVID-19 vaccines. What vaccine-related factors affect the perceptions of the individuals towards COVID-19 vaccines in terms of vaccine efficacy, vaccine availability, and vaccine brand.

The study will benefit the local government in identifying which population would be needing an enhanced approach to help in the distribution of vaccines in Quezon City, Philippines. The findings of the researchers about the vaccine perceptions of the residents in Quezon City may serve as a guide for the Department of Health in doing the right approach for the distribution of vaccines to other parts of the Philippines as well. The study primarily focuses on determining the socio-demographic factors and social perceptions of individuals residing in Quezon City, (NCR) Philippines towards COVID-19 vaccines. Specifically, the study only includes the perceptions of individuals residing in the said city who are 18 and above.

2 RESULTS

Table 1 Frequency Distribution of the Socio-demographic Profiles of the Respondents

Variable	Parameter	n	%
Age	18-29	186	48.3
	30-39	93	23.2
	40-49	49	12.7
	50-59	44	11.4
	60 above	13	3.4
Gender	Female	180	46.8
	Male	197	51.2
	Prefer not to say	8	2.1
Occupation	White collared jobs	103	26.8
	Blue collared jobs	110	28.6
	Student	146	37.9
	Unemployed	26	6.8
Educational Attainment	Primary	4	1.0
	Secondary	137	35.6
	Tertiary	226	58.7
	Post-graduate	18	4.7
Civil Status	Single	235	1.0
	Married	132	35.6
	Separated	9	58.7
	Widowed	9	4.7
Religion	Catholic	311	80.8
	Islam	1	0.3
	Buddhist	-	-
	Iglesia ni Cristo	26	6.8
	Protestantism	3	0.8
	Born Again	36	9.4
	Seventh Day Adventist	3	0.8
	Jehovah's witness	-	-
	Baptist	2	0.5
	None	3	0.8
Monthly Income	Php 14,000 below	55	14.3
	Php 14,001 - 24,000	66	17.1
	Php 24,001 - 47,000	42	10.9
	Php 47,001 - 82,000	37	9.6
	Php 82,001 - 140,000	19	4.9
	Php 140,000 above	21	5.5
	Not Applicable	145	37.7

Table 1 shows the frequency distribution of the socio-demographic profiles of the respondents. A total of 385 respondents were acquired randomly to be part of the study. The majority of the respondents' gender were female (46.8%), followed by male individuals (51.2%), while the rest preferred not to declare. The respondents' ages are mostly between 18 and 29 years old (48.3%), followed by 30-39 years old (25.2%), while the age group of 60 and above have the least number of respondents. Most of the respondents' occupation are

students (37.9%). It is then followed by blue collared jobs (28.6%) and white collared jobs (26.8%.) that have participated in the survey while only 6.8% are unemployed.

Majority of the respondent's highest educational attainment are tertiary level (58.7%) which consists more than half of the total respondents. It is also found that six out of 10 respondents are single while 3 out of 10 respondents are married. Most of the respondents are Catholics consisting 80% of the total respondents. The monthly income of the respondents is mostly not applicable, having around 37.7% of the total respondents, since most of them are students. There are only about 17.1% of the respondents that earn a monthly income between 14,000 pesos and 24,000 pesos, while 14.3% of the total respondents earn less than the said amount.

Table 2 Health Information

Statements	Yes	No
Have you or anyone in your family ever contracted COVID-19?	245	140
Do you have a current medical condition?	58	327
Do you have a past medical condition?	101	284

Table 2 above illustrated presents the health information background wherein 63% of the respondents stated that their family has contracted COVID-19. On medical conditions, 58 respondents appear to have current illnesses while almost twice of that had past medical conditions.

Table 3 COVID-19 Vaccine Information

Statements	Parameter	n	%
Have you been vaccinated?	Yes	384	99.7
If you have already been vaccinated, how many doses have you already received as of this day?	First dose	1	0.3
	Second dose	205	53.2
	Booster	177	46.0
If you have already been vaccinated, what under priority group are you registered?	A1	20	5.2
	A2	12	3.1
	A3	60	15.6
	A4	43	11.2
	A5	25	6.5
	ROP	225	58.4
If you have already been vaccinated, what is the brand of your vaccine?	Pfizer	75	19.5
	Moderna	44	11.4
	AstraZeneca	70	18.2
	Sputnik V	8	2.1
	Janssen	27	7.0
	Sinovac	156	40.5
	Sinopharm	3	0.8

Table 3 above displays the COVID-19 vaccine information of the study's respondents, and it shows that only one out of the 385 respondents are not vaccinated. For those who have been vaccinated, 5.2% belong in A1 priority group who are classified as healthcare frontliners, 3.1% belong in A2 which belong to senior citizens, 15.6% belong in A3 which

are persons with comorbidities, 11.2% belong in A4 which are frontliners in government service sectors, 6.5% belong in A5 which are the indigent class, while the remaining 58.4% are the remaining respondents under rest of the population. The most common brand vaccine is Sinovac which comprises 40.5% of the administered vaccine, followed by Pfizer with 19.5% and AstraZeneca with 18.2%.

Table 4 Willingness to Take COVID-19 Vaccines

	Mean	Interpretation
I like the idea of receiving the COVID-19 vaccines	4.09	Agree
If my friends, family, or peers will (NOT) take the said vaccine, I am likely to do so as well	2.17	Disagree
I am willing to take all the necessary shots (e.g., booster shots) for COVID-19 vaccines.	3.84	Agree
Reported cases of people experiencing side effects upon taking COVID-19 vaccines make me hesitant to take the vaccines.	2.50	Disagree
I am willing to take the COVID-19 vaccine because it is approved by the World Health Organization.	4.09	Agree
I will (NOT) take the COVID-19 vaccine because I think that it has (not) been well-studied by experts.	2.16	Disagree
I am willing to take any COVID-19 vaccine brand available in my locality	3.45	Agree
My culture, religion, or beliefs (DOES NOT) affect my decision in receiving the COVID-19 vaccines.	1.85	Disagree

Table 4 presents the mean score of the statements related to the respondents' willingness to take COVID-19 vaccines. On average, the respondents are positive in taking COVID-19 vaccines, most especially about the idea of receiving a vaccine. Regardless of the number of shots of vaccines and as long as it is approved by an authorized body, the respondents are willing to receive the COVID-19 vaccines. It is unlikely that the respondents would depend on their willingness to be vaccinated by external factors such as friends, family, or peers. Having side effects reported from news reports or direct people would not contribute to any hesitancy to take the said vaccine.

Table 5 Chi-Square results between the respondent's willingness to take COVID-19 vaccine and socio-demographic profiles

	S1		S3		S4	
	Age	p-value	Sex	p-value	Occupation	p-value
I like the idea of receiving the COVID-19 vaccines	107.316	.000*	32.655	.000*	138.413	.000*
If my friends, family, or peers will NOT take the said vaccine, I am likely to do so as well	102.526	.000*	25.762	.001*	115.536	.000*

I am willing to take all the necessary shots (e.g. booster shots) for COVID-19 vaccines.	123.320	.000*	22.081	.005*	128.587	.000*
Reported cases of people experiencing side effects upon taking COVID-19 vaccines make me hesitant to take the vaccines.	68.036	.000*	10.625	.224	77.404	.000*
I am willing to take the COVID-19 vaccine because it is approved by the World Health Organization.	108.660	.000*	10.986	.202	128.505	.000*
I will (NOT) take the COVID-19 vaccine because I think that it has not been well-studied by experts.	103.231	.000*	12.156	.144	133.947	.000*
I am willing to take any COVID-19 vaccine brand available in my locality	105.400	.000*	9.446	.306	85.468	.000*
My culture, religion, or beliefs (DOES NOT) affect my decision in receiving the COVID-19 vaccines.	44.901	.000*	6.447	.597	72.705	.000*

	S5		S6		S9		S10	
	Educational Attainment	p-value	Civil Status	p-value	Religion	p-value	Monthly income	p-value
I like the idea of receiving the COVID-19 vaccines	41.947	.000*	69.096	.000*	151.504	.000*	123.435	.000*
If my friends, family, or peers will NOT take the said vaccine, I am likely to do so as well	69.346	.000*	63.637	.000*	48.829	.000*	97.00	.000*

I am willing to take all the necessary shots (e.g. booster shots) for COVID-19 vaccines.	30.695	.000*	91.248	.000*	53.35	.003*	87.399	.000*
Reported cases of people experiencing side effects upon taking COVID-19 vaccines make me hesitant to take the vaccines.	45.407	.000*	50.958	.000*	43.241	.033*	63.985	.000*
I am willing to take the COVID-19 vaccine because it is approved by the World Health Organization.	34.781	.001*	74.967	.000*	84.687	.000*	86.678	.000*
I will (NOT) take the COVID-19 vaccine because I think that it has not been well-studied by experts.	50.456	.000*	73.496	.000*	47.932	.011*	105.44	.000*
I am willing to take any	28.821	.004*	77.520	.000*	71.624	.000*	93.245	.000*

COVID-19 vaccine brand available in my locality								
My culture, religion, or beliefs (DOES NOT) affect my decision in receiving the COVID-19 vaccines.	32.303	.001*	35.878	.000*	32.221	.266	80.496	.000*

Table 5 presents the chi-square results of respondent's willingness to take COVID-19 vaccine towards socio-demographic variables. For Age variable, all statements are statistically significant ($p < .05$). Hence, we can conclude that age and willingness to take COVID-19 vaccine are related to each other. For Sex variable, statements 1,2,3 are statistically significance ($p < .05$). We can summarize the following by concluding that the positive idea of receiving COVID-19 vaccines is related to sex. It is also found that peer pressure on taking COVID-19 vaccines is related to sex. Furthermore, the willingness to take necessary shots for COVID-19 vaccines is related to sex while all other statements are not related to sex. For the occupation variable, all statements are statistically significant ($p < .05$). Hence, we can conclude that occupation and willingness to take COVID-19 vaccine are related to each other. For the Educational Attainment variable, all statements are statistically significant ($p < .05$). Hence, we can conclude that educational attainment and willingness to take COVID-19 vaccine are related to each other. For the Civil Status variable, all statements are statistically significant ($p < .05$). Hence, we can conclude that civil status and willingness to take COVID-19 vaccine are related to each other. For the Religion variable, only the statement regarding culture, religion, and beliefs is not statistically significant ($p > .05$). Hence, we can conclude that we do not have sufficient evidence to say that culture, religion, and belief is independent of religion itself. For the Monthly Income variable, all statements are statistically significant ($p < .05$). Hence, we can conclude that monthly income and willingness to take COVID-19 vaccine are related to each other.

Table 6 Mean Scores on Vaccine Perception based on Socio-demographic Profile

Variable	Parameter	P1	P2	P3	P4	P5	P7	P8
Age	18-29	4.70	4.61	4.47	4.58	4.72	1.55	1.73
	30-39	3.77	3.71	3.52	3.51	3.70	2.34	2.83
	40-49	3.82	3.63	3.47	3.35	3.67	2.49	3.10

	50-59	3.89	3.70	3.50	3.48	3.77	2.25	3.09
	60 above	3.92	4.08	3.77	3.92	3.92	2.08	3.15
Gender	Female	4.33	4.25	4.11	4.09	4.32	1.84	2.19
	Male	4.17	4.06	3.86	3.94	4.10	2.08	2.54
	Prefer not to say	4.25	4.13	4.00	4.13	4.25	1.75	2.25
Occupation	White collared jobs	4.38	4.23	4.13	4.18	4.34	1.64	2.28
	Blue collared jobs	3.47	3.35	3.17	3.13	3.41	2.72	3.25
	Student	4.77	4.72	4.53	4.61	4.77	1.50	1.66
	Unemployed	4.04	4.00	3.65	3.73	3.85	2.58	2.96
Educational Attainment	Primary	4.50	3.50	3.00	4.25	3.75	1.50	2.00
	Secondary	3.87	3.77	3.50	3.59	3.85	2.36	2.70
	Tertiary	4.42	4.33	4.22	4.21	4.38	1.78	2.22
	Post-graduate	4.83	4.83	4.72	4.67	4.72	1.22	1.89
Civil Status	Single	4.54	4.45	4.32	4.38	4.52	1.72	1.97
	Married	3.80	3.70	3.48	3.47	3.74	2.20	2.92
	Separated	3.33	3.00	2.89	2.78	3.11	3.22	4.00
	Widowed	4.00	4.00	3.44	2.67	3.67	3.33	3.11
Religion	Catholic	4.37	4.26	4.10	4.16	4.34	1.83	2.24
	Islam	3.0	3.0	2.00	2.00	3.00	4.00	4.00
	Buddhist	-	-	-	-	-	-	-
	Iglesia ni Cristo	3.50	3.42	3.27	3.15	3.27	2.50	2.92

	Protestantism	3.33	3.00	2.67	2.67	3.33	3.33	4.67
	Born Again	3.89	3.92	3.64	3.61	3.81	2.17	2.67
	Seventh Day Adventist	3.00	2.33	2.00	2.00	3.00	4.00	4.00
	Jehovah' witness	-	-	-	-	-	-	-
	Baptist	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(3.00)	(3.00)
	None	4.33	4.33	4.67	4.33	4.33	3.00	3.00
Monthly Income	14,000 below	3.56	3.53	3.35	3.29	3.49	2.64	2.93
	14,001 - 24,000	3.64	3.42	3.45	3.45	3.73	2.56	3.06
	24,001 - 47,000	4.33	4.14	4.07	3.90	4.10	2.17	2.40
	47,000 - 82,000	4.49	4.35	4.14	4.00	4.22	1.70	2.08
	82,001- 140,000	4.32	4.21	3.81	4.21	4.32	1.63	2.63
	140,001 above	4.38	4.10	3.76	4.24	4.48	1.81	3.05
	Not Applicable	4.66	4.66	4.43	4.52	4.66	1.50	1.78

Table 6 displays the mean scores on vaccine perception per socio-demographic profile. For each socio-demographic variable, we can interpret it as the following. On the age variable, it is found that across all vaccine perception statements, the ages 18 to 29 years old obtained the highest mean scores. Thus, they have the most positive outlook towards COVID-19 vaccines. Meanwhile, ages 30 years old and older are indifferent towards the statement “COVID-19 vaccination is NOT necessary since having a healthy diet can suffice to combat the virus”. In terms of the *Gender* variable, it is found that females are most likely to have positive outlook compared to males, based on their mean scores, but neither gender has a negative outlook towards COVID-19 vaccines. In terms of the *Occupation* variable, it is found that across all vaccine perception statements the respondents who are students have obtained the highest mean scores compared to white, blue collared jobs and to those who are unemployed. This means that students have positive insight when it comes to COVID-19 vaccines. In terms of the *Educational Attainment* variable, it is found that across all vaccine perception statements, the respondents who had post-graduate studies gathered the highest mean scores. Thus, they are considered to have the most positive outlook when it comes to COVID-19 vaccines. On the other hand, those who had finished only primary school are neutral in terms of having knowledge and information about COVID-19 vaccines and those who had finished only secondary school are indifferent when they are asked about the

necessity of the COVID-19 vaccines to combat the virus. In terms of the *Civil Status* variable, it is found that across all vaccine perception statements, the respondents who are single have the highest mean scores. Hence, they have the most positive outlook on COVID-19 vaccines. Meanwhile, those who are married, separated, and widowed are neutral in terms of the necessity of the vaccine to fight the virus, and at the same time, the separated and widowed are indifferent about the vaccine being titled as a hoax. In terms of the *Religion* variable, it is found that across all vaccine perception statements, on the average, Roman Catholic respondents obtained the highest mean scores. Thus, they have the most positive outlook on COVID-19 vaccines. Religions like Islam, Iglesia ni Cristo, Protestantism, and Seventh Day Adventist are indifferent towards the necessity of the COVID-19 vaccines. Consistently, Protestantism and Seventh Day Adventist are neutral about the idea of COVID-19 vaccine being a hoax. In terms of the *Monthly Income* variable, across all vaccine perceptions, respondents who are not yet earning income have obtained the highest mean scores among other categories. Meanwhile, those who earn 24,000 pesos below and 82,000 pesos above are indifferent about the necessity of COVID-19 vaccines to fight the virus.

Table 7 Frequency Distribution on Vaccine-Related Factors

	Vaccine Efficacy	Vaccine Availability	Vaccine Brand
Which among the following factors affects your perception the MOST about COVID-19 vaccines?	277	34	74
Which among the following factors will you consider the MOST in accepting COVID-19 vaccines?	175	111	99
Which among the following factors will you consider the MOST in rejecting COVID-19 vaccines?	145	52	188

Table 7 represents the frequency distribution on vaccine-related factors. It shows that the vaccine efficacy has the highest percentage among the factors that affect the respondents' perceptions. Consequently, the vaccine brand has the least percentage relating to the perceptions of the individuals.

Table 8 Frequency Distribution of COVID-19 brand awareness and willingness

	Pfizer	Moderna	AstraZeneca	Sputnik V	Janssen	Sinovac
Are you aware of the following COVID-19 brands? Please check the box accordingly.	341	305	302	175	215	324

If all vaccine brands mentioned previously are available to the public, which vaccine brand are you willing to take? You may choose more than 1 preference.	317	248	160	40	103	112
Willingness Percentage (aware/willing)	92.96 %	81.31%	52.98%	22.86%	47.91%	34.57%

Table 8 presents the frequency distribution of COVID-19 brand awareness and willingness of the public to take a certain brand of COVID-19 vaccine. Results show that the top brand that people are aware of is Pfizer, followed by Sinovac and Moderna. The least option is Sputnik V and Janssen. The ratio of willingness to awareness is high in Pfizer (92.96%) and Moderna (81.31%). However, there is a low turnout of the ratio of willingness to awareness in Sinovac with only 34.57%. AstraZeneca has a little more than 50% turnout, while Sputnik V and Janssen are consistent with the brand awareness result which gives 22.86% and 47.91% ratio respectively. In conclusion, the highest percentage brands in willingness to receive the vaccines are as follows in order; Pfizer, Moderna, AstraZeneca, Janssen, Sinovac, and Sputnik V.

Table 9 Interpretation Table

Likert Scale	Range	Interpretation (Positively stated statements)	Interpretation (Negatively stated statements)
1	1.00-1.79	Strongly Disagree	Strongly Agree
2	1.80-2.59	Disagree	Agree
3	2.60-3.39	Neutral	Neutral
4	3.40-4.19	Agree	Disagree
5	4.20-5.00	Strongly Agree	Strongly Disagree

3 DISCUSSION

The results from the survey show that most of the respondents like the idea of taking the COVID-19 vaccine. Other countries in the Southeast Asia preferred to get vaccinated like in Malaysia (Mohamed et.al, 2021) and Bangladesh (Islam et. al, 2021). Majority of the respondents are also willing to take all the necessary shots for the said disease which is similar to the findings of a study conducted in China wherein 80% of the respondents accepted COVID-19 boosters amid the increasing COVID-19 variants (Lai et.al, 2021).

In taking the vaccines, most of the respondents agreed as well that their willingness to get vaccinated is not affected by external factors such as friends, family, or peers. Although parents and friends are key leveraging points in promoting adolescents' uptake of the COVID-19 vaccine (Rogers et.al., 2021), if an individual has access to reliable, evidence-based and trusted sources of vaccination information that are easy to comprehend, higher

vaccine acceptance will still be seen (Bolsewicz et.al., 2021) as the individual will be able to make informed choices for himself. Thus, it is evident that the information campaign conducted by the local city government of Quezon City regarding COVID-19 vaccines is effective.

Information campaigns also consist of the possible side effects that the COVID-19 vaccines may bring. Reported side effects in the news or direct people, however, does not contribute to vaccine hesitancy among the majority of the respondents. The same results are seen in the study conducted by Islam et. al. (2021). In their study, 90% of their respondents believed that they would experience side effects upon taking the COVID-19 vaccines, but the majority are still willing to get inoculated with the said vaccine. Willingness to get vaccinated against COVID-19 is mostly attributed to the people's trust in the healthcare system (Al-Mohaithef et.al., 2021) and the risk of contracting the virus and its severity (Al Qudeimat et.al., 2021).

In the Philippine setting, a survey revealed that about 77% of Filipinos have high trust towards scientists and medical professionals (Philippine Trust Index, 2021). With that, most of the respondents agreed that they are willing to take the COVID-19 vaccine since it is approved by the World Health Organization. The majority of the respondents believe that the vaccines are studied well by experts, and they are also willing to take any COVID-19 vaccine brand available in their locality as every vaccine available in the country is authorized by WHO (WHO, 2021). On the other hand, with regards to religious and cultural beliefs, these factors do not negatively affect the perception of the majority of the respondents against vaccines. In a similar study by Hafizh, M. et., al. (2021), the statements section of their survey measured the responder's willingness and hesitancy in taking the vaccine which also enquired about the responder's beliefs and attitudes toward the COVID-19 vaccine based on their previous history with vaccines, religious and social influences.

The researchers' finding that age and willingness to take COVID-19 vaccine are related to each other is consistent with a study conducted by Marzo et al. (2022) where it was found that younger people (aged 30 below) tend to be more willing to get vaccinated as they are more likely to stay updated on the latest information about COVID-19 since they are exposed to information and engage on online platforms such as the internet and social media. The results on peer pressure and taking COVID-19 vaccines is also consistent with relevant literature. Social influence has a high impact on COVID-19 vaccine acceptance. Low understanding and knowledge of the general population on COVID-19 and consequently its vaccines may confuse people and increase their reliance on recommendations from others, such as family members, biologists, doctors, or governments (Pelegrín-Borondo et al., 2021).

The positive association between occupation and COVID-19 vaccines is also consistent with other studies conducted. This is because employed individuals are more likely to have higher educational attainment as compared to unemployed individuals (Marzo et al., 2022). Moreover, the finding that educational attainment and COVID-19 vaccines are related to each other is in agreement with other research. Individuals with higher education are significantly more likely to get vaccinated for COVID-19 (Syan et al., 2021).

Education may influence these important health seeking behaviors, and in turn affect overall health. (Park et al., 2018). Relationship between civil status and COVID-19 vaccine willingness agrees with the findings of other studies. Married individuals are less likely to be willing to get vaccinated for COVID-19 (Marzo et al. 2021). However, this is also contrasted by the findings of a different study which noted that married individuals were more likely to be willing to get vaccinated as compared to single individuals (AL-Mohaithef et al., 2021). A possible explanation for the disparity between findings is that a majority of our respondents are single (61%). Findings between the relationship of income and willingness to get COVID-19 vaccines is consistent with other studies. Low-economic families are less willing

to be vaccinated compared to higher-income families. Limited health literacy and information among lower-income individuals may be the reason for reduced COVID-19 vaccine willingness (Marzo et al., 2022)

Socio-demographic profiles of the individuals have a significant relationship in their positive or negative outlook on COVID-19 vaccines. It is found that younger demographics have a more positive outlook in taking the vaccine because they are more knowledgeable in vaccine information due to their exposure in digital information and social media. Females tend to have a more positive outlook in taking the vaccine because females use health services more and that males are less likely to seek care due to masculine norms that males must be perceived as tough (Ungar, 2021). Students are found to have more trust in the healthcare system where they are more likely to have a positive outlook in taking the vaccine (Qiao, 2020). It is also found that students are more knowledgeable in health information since they are more exposed to social media. Post graduate studies educational attainment population have the most positive outlook towards vaccines since higher education levels are associated with increased vaccine agreeability, while individuals' lower education levels are associated with increased hesitancy. This type of respondents are thought to be well-informed in society since they are presumed to be aware of the consequences of not being vaccinated (de Figueredo et.al, 2021).

In terms of civil status, it has been found that the single population has the most positive outlook however it contradicts in a previous study which states that married individuals have better health experiences and outcomes (Hughes, 2009). This may be due to the fact that the majority of the respondents are single. People with a religion of catholicism have the most positive outlook because the majority of the respondents are catholics since the Philippines is known as a catholic country. Lower income groups tend to have a more negative outlook in vaccines which may be due to the population's lack of access to high-quality information and low health literacy (Bono et. al, 2021).

It has been found that vaccine brand, availability, and efficacy have a great significance for respondents in their perception about taking COVID-19 vaccines. Vaccine efficacy has the highest percentage in people's perception since it contributes a vital role in vaccine hesitancy of the individuals (Sirikalyanpaiboon et. al, 2021) where it states that efficacy is the most important factor in accepting the vaccine (Kaplan and Milstein, 2021). Vaccine acceptance of the individuals improved when the efficacy increased beyond 70% (Amit et al, 2021). Lack of confidence in the safety and effectiveness of COVID-19 vaccines contributed to vaccine hesitancy due to their doubts about the research and development of vaccines given their short clinical trials and use of new bioscience technologies (e.g., mRNA vaccine) for the first time in human vaccines (Han et al., 2021). Vaccine brand has a great influence for people taking the vaccine where the brand's ethical considerations, drug approval, and unintended side effects are part of their decision (Amit et. al, 2021).

The survey showed that Pfizer and Moderna are the most preferred and informed vaccine brands of the respondents where it can be rooted to vaccine's efficacy rate. As shown in clinical trials, the COVID-19 vaccine that had the highest efficacy is Pfizer-BioNTech (95%), followed by Moderna (94.1%), Gamaleya Sputnik V (91.6%), AstraZeneca (70.4%), Janssen (66.9%), and Sinovac-CoronaVac (65%) respectively (DOH, 2021). People's awareness and willingness to vaccines are also contributed to the vaccine's country of development where it was found that the country of development US-developed vaccines (Pfizer and Moderna) was preferred compared to vaccines produced in China and Russia (Sinovac and Sputnik) most likely due to geopolitical concerns (Kawata & Nakabayashi, 2021). It has also been found that the brand Sputnik V and Janssen garnered the least amount of people's awareness and willingness of the vaccine. This may be due to the issues of distribution with Sputnik V where there is a delivery discrepancy and vaccine expiration

problem (Gonzales, 2022). While in Janssen, it has been one of the brands being least distributed here in the Philippines where people are also found to be hesitant since it has multiple side effects like rare cases of blood clots combined with low levels of blood platelets occurring within three weeks of vaccination (DOH, 2021). Sociodemographic factors have an effect in the respondent's decision in taking the COVID-19 vaccines but also their willingness has been influenced by their perception on the vaccine brand, availability, and efficacy.

4 METHODOLOGY

4.1 Study Design

The researchers have adopted a correlational research design and data is collected through the use of surveys. A correlational research design is selected because it involves the measurement and assessment of the relationship between two or more variables (Stangor 2019). In the case of the study, the variables that the researchers want to assess are the socio-demographic profile and perceptions of the residents of all 142 barangays in Quezon City regarding COVID-19 vaccines. The results of the online survey quantitatively assessed the relationship between the said variables.

4.2 Study Population

The study population included residents from Quezon City, Philippines aged 18 and above. In determining the sample size of our study, the researchers used the Cochran's formula of finite population to calculate the sample size:

$$n = \frac{\frac{z^2 pq}{e^2}}{1 + \frac{z^2 pq}{e^2 N}}$$

Where n = sample size, z = score of the confidence level, p = proportion of population, q = 1-p, and e = margin of error. With that formula, the computed value for the sample size is 385. From the sample size, an acceptable 80% of the sample size can be used as a minimum to make the samples valid. The computed value of the minimum size is 308, the said value is backed up by our statistician. The population of 1,861,910 was from the Philippine Statistics Authority 2015 census and the age groups considered were age groups 18 and above. Due to the current situation of the country, no updated consensus was available. Thus, the researchers used the recent census data of the year 2015.

4.3 Survey Instrument

A convenience sampling technique was used to select respondents who are 18 years old and above in Quezon City, Philippines to answer an online questionnaire via Google forms, an online survey administration software. The questionnaire used in the study was modified and adopted from the study of Echoru, I. (2021) entitled "Sociodemographic Factors associated with acceptance of COVID-19 vaccine and clinical traits in Uganda: A Cross-

Sectional Study in Western Uganda. Prior to the dissemination, the researchers conducted a pilot study to determine the statistical soundness of the questionnaire made. It acquired a Cronbach alpha value of 0.7, which according to the studies of Taber (2017), is an acceptable, sufficient, or satisfactory level. Data collection proceeded immediately after which took approximately one month, March-April 2022.

The survey consisted of the following sections namely, sociodemographic details, health information, willingness to take COVID-19 vaccines, vaccine perception, and vaccine-related factors affecting COVID-19 vaccine perceptions. It is disseminated through different social media platforms as well as volunteers and different barangay officials of Quezon City for referrals. The researchers also made sure that the respondents have given their informed consent to participate in the study before answering the survey.

4.4 Statistical Analysis

The data is collected via google forms; it is collated in a separate google spreadsheet to extract the data per respondent. The anonymity and personal data of each respondent are safeguarded by assigning each respondent with a unique identifier accessible only to the researchers. The processing of personal information and the rights of each respondent are treated in accordance with RA 10173 (Data Privacy Act of 2012).

The data that the researchers have gathered from the study was analyzed using descriptive statistics, chi-square test, and percentage distribution. The software IBM SPSS Statistics version 25 was used for data entry and statistical analysis. According to Chin & Lee (2008), Descriptive statistics paint a picture of a situation, providing a concise numerical or graphical summary; while inferential statistics allows you to draw conclusions based on extrapolations and suggest explanations for a situation or phenomenon. Descriptive statistics such as the mean and standard deviation were determined per socio-demographic variable. With the use of inferential statistics, a Chi-Square test was used for the determination of which among the individuals have the highest vaccine acceptance in relation to their socio-demographic status. The said data was used to determine the relationship of the socio-demographic status to their perceptions. The computed data was interpreted also to determine the relevancy between the study's objectives and hypothesis.

5 CONCLUSION

The study conducted found that the respondents' sociodemographic profile has an impact and relation with their perception towards COVID-19 vaccines. The respondents also demonstrated that their willingness to get vaccinated is highly influenced by their age, educational attainment, employment status, marital status, and religion. The results showed that respondents who are in the age group of 18 to 29, has a high educational attainment, employed and stable income, single, and Catholic have positive outlook towards the COVID-19 vaccines while those who are in the age group 30 and above, primary level education attainment, unemployed and below minimum wage income, married, and other religion than Catholic showed a negative outlook towards the vaccine. Lastly, the data obtained can conclude that the main vaccine-related factors that influence their perception of COVID-19 vaccines are vaccine efficacy and vaccine brand. Vaccine availability did not greatly affect the perceptions of respondents compared to the vaccine efficacy and brand.

Based on the findings of the study undertaken and the conclusions formulated, the researchers of this study would recommend future researchers to conduct similar studies in different settings (e.g. other regions especially that are/were hotspots for COVID-19 cases).

The investigators of this study would also like to recommend for future researchers to conduct a study involving respondents who have already taken the second booster shot and those who have yet to receive a first booster shot, and correlate findings between the two respondent categories. Finally, the researchers also recognize that the study has its limitations. Snowball technique used to recruit respondents could restrict the study sample's heterogeneity. Also, the study population represented a high proportion of students who had more access to online surveys. The researchers recommend that the limitations mentioned be taken into consideration.

ACKNOWLEDGEMENTS: The researchers of this study would like to express their sincere gratitude to the following: Ms. Kristina Villanueva, The UST Faculty of Pharmacy Research Ethics Committee, Dr. Edilberto Manahan, and the Almighty God for giving us perseverance to conduct and complete this study especially during these difficult times.

FUNDING: This research received no external funding

CONFLICT OF INTEREST: Authors declare no conflict of interest.

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A Meta-Analysis on the Effectivity and Efficiency of Bacterial Cellulose in Wound Healing Compared to Conventional Methods of Wound Management in Adult Patients with Venous Ulcers

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ABSTRACT

Bacterial cellulose (BC) has shown competence against plant cellulose as a structural component. Porosity and increased surface area makes BC a material of interest in wound management. Recent studies have investigated the use of BC as an alternative wound dressing to conventional wound management methods. The general objective of this study is to assess the effectiveness and efficiency of BC in wound healing compared to conventional methods in adult patients with venous ulcers (VU). The primary objective compared the reduction of mean ulcer area between experimental and conventional treatments in patients, while the secondary objectives compared pain intensity, appearance of scar formation, and wound healing tissue. Data was identified and screened through PRISMA and the ROB-2 Assessment Tool. The researchers identified four studies from which data was analyzed using DerSimonian and Laird Random Effects Model. The data revealed no significant differences between the mean ulcer area reduction before and after treatment in both groups. The BC group showed a better outcome, presenting an increase in wound healing and in patients reporting mild to no pain. BC's scar formation reported a decrease in partial skin loss prevalence rate. Despite these claims, the differences in BC and conventional treatment in terms of pain intensity, scar formation, and wound healing are not statistically significant. This concludes that BC and conventional methods are both viable for treatment of VUs in adult patients. The authors recommend that other parameters be investigated and compared, i.e. cost, production, availability of materials, allergies, and sustainability.

KEYWORDS: Bacterial cellulose; venous ulcers; Wound management

1 INTRODUCTION

Cellulose, commonly identified as a structural component in plants, also has the same properties in bacterial cell walls. This cellulose-producing bacterium in its natural habitat uses synthesized cellulose to protect itself against chemical, biological, and physical disturbances. There are several gram-negative and gram-positive bacteria that produce cellulose, however *Acetobacter* is described to be the primary source of microbial glucose in research studies (J. Wang et al., 2019). Bacterial cellulose (BC) is also described to be a virulence factor (Römling & Galperin, 2015). The model organism for understanding cellulose biosynthesis would be *A. xylinum*. Figure 1 completely describes the mechanism of synthesis from uridine diphosphoglucose (UDPGlc) to the cellulose polymer (Lustri et al., 2015; Phruksaphithak et al., 2019).

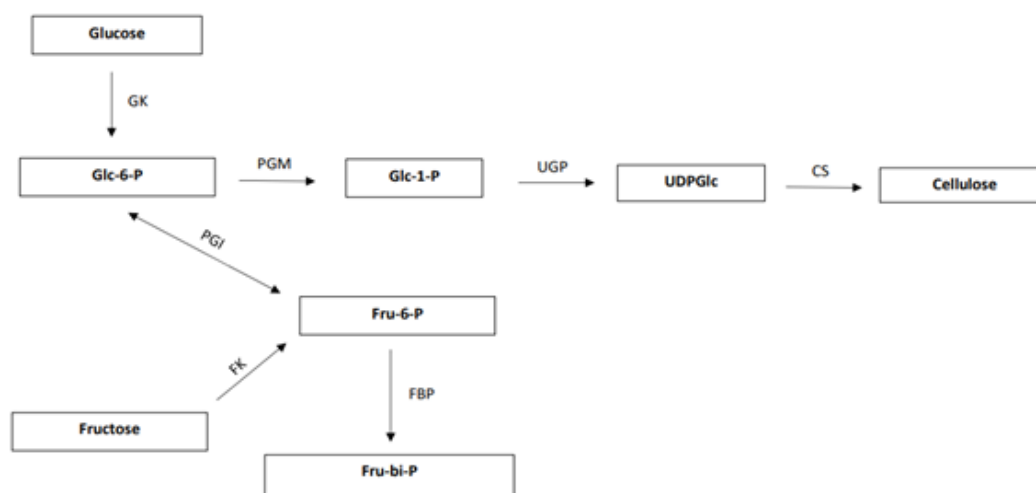


Figure 1. The biosynthesis of cellulose by *A. xylinum* species. (Lustri et al., 2015).

Gayarthry & Gopalaswamy (2014) compared the differences in structure of bacterial and plant cellulose and observed that the microfibrils of BC are narrow, giving rise to the material's porous structure and increased surface area. This property makes it a polymer of interest not only for engineering and industrial processes, such as edible food packaging, but also for biomedical applications in managing and treating patient wounds (Cazón & Vázquez, 2021). Innovations in wound management are not new; over the millennia, civilizations have continued to develop and discover desirable criteria for materials used in wound dressings (Shah, 2011, as cited in Dhivya et al., 2015; Daunton et al., 2012, as cited in Dhivya et al., 2015). Wound dressings are designed to contact the wound. Wounds closed with dressing are exposed to complement & growth factors, proteinases, and chemotactic, which are lost if the lesion is left open (Dhivya et al., 2015).

The attempt to close superficial areas of the skin via skin glue or sutures is known as "primary intention wound healing" (Singh et al., 2017). The wound is normally repaired with sutures or synthetic adhesive closure materials using sterile procedures to have a functional

scar that heals entirely after the operation (Salcido, 2017). However, by primary intention, there is only a small window to close the wound, usually 4 to 8 hours, and the clinician's skill to approximate the wound margins is one issue, as well as contamination may cause wound closure to be delayed (Salcido, 2017).

Healing through secondary intention is the next best choice in these situations; the skin cannot be sutured right away because it must first fill connective tissue in the affected area (McCaughan et al., 2018). In addition, lesions present in this type of wound healing cannot be stitched since techniques for closure are impossible due to motility. Secondary wound healing relies on the body's natural healing processes. Frequent dressing changes and wound packing are needed in some cases. Different dressing options are available such as simple non-adherent dressings to more sophisticated options like foam, hydrocolloid, alginate, and negative pressure dressings (Dumville et al., 2014, as cited in Chetter et al., 2019).

Tertiary intention wound healing is considered the last degree and is intentionally left open to manage infection before closing the wound. The wound-closing process is delayed because microorganisms may be trapped if the wound is closed immediately (Ilankovan & Sayan, 2021). It is for infected or harmful wounds with a high bacterial content, wounds that have been infected for an extended period, or wounds with a severe crush component (Gupta et al., 2016; Salcido, 2017).

Wound dressing is considered a part of conventional wound healing and encompasses Traditional and Modern dressings (Dhivya et al., 2015). Traditional wound dressings are directly applied to cover and protect a wound by preventing the possibility of wound contamination or infection. Examples of these are gauzes, lint, plasters, bandages, and cotton wool. Modern wound dressings are also directly applied to the wound while actively preventing wound dehydration. These modern wound dressings are synthetic materials consisting of semi-permeable film, semi-permeable foam, hydrogel, hydrocolloid, and alginate (Tan et al., 2019).

Ideal wound dressings are characterized by maintaining high humidity and removing excess exudates. Additionally, they are non-toxic and non-allergenic, comfortable for patients, and cost-effective. Moreover, they can prevent the infection of microbes and allow for the exchange of oxygen. (Dart et al., 2019; Jannesari et al., 2011; Rezvani Ghomi et al., 2019; Felgueiras et al., 2020, as cited in Zheng et al., 2020).

A routinely used treatment for Chronic Venous Ulcers (CVU) is the use of substances such as essential fatty acids (EFAs) or substances containing medium-chain triglycerides (MCT), and are covered with a secondary dressing where the feet and legs are covered with gauze and bandages (Cavalcanti et al., 2017). Current treatment of CVU includes the management of secondary symptoms such as pain, edema, cramps, and limb heaviness (Bignamini & Matuška, 2020).

A similar study used a cellulose acetate mesh impregnated with EFAs called Rayon® (Silva et al., 2021). It was mentioned in the same study that collagenase dressings, sunflower oil, Unna boots, and silver sulfadiazine coverings are more commonly used in Family Health Units because of their availability and cost-effectiveness (Abbade et al., 2020; Cavalcanti et al., 2017; Colenci et al., 2019; Elizabeth, 2010; Farina-Junior et al., 2017; Maia et al., 2019; Nornan et al., 2018; Sant'Ana et al., 2012; Sharp et al., 2014; Scotton et al., 2014, as cited in, Silva et al., 2021).

The gold standard treatment for venous leg ulcers is considered to be Compression therapy. (Alvarez et al., 2012; Falanga, 1996; Phillips et al., 1991; Moffat et al., 2003; Partsch, 2005, as cited in, Amsler et al., 2009). Single compression improvements have been made by using occlusive dressings to create an environment where fibrin is dissolved, enhancing epidermal migration, and increasing blood vessel growth. Most therapies for the treatment of CVU are directed on lowering venous hypertension, increasing wound cleansing, and enhancing tissue vascularization or oxygenation from the blood (Moffat et al., 2003, as cited in, Alvarez et al., 2012).

Non-adherent contact layer and compression treatment were used in the study of Alvarez et al. (2012) as the control group, where it was also mentioned that compression therapy with modified Unna's boot or a four-layer bandage system is accepted as standard care for the treatment of venous leg ulcers in the USA (Falanga, 1996; Phillips et al., 1991; Moffat et al., 2003, as cited in, Alvarez et al., 2012).

BC as wound dressings has been found to be sustainable, biocompatible, and biodegradable, with characteristics such as high surface area, flexibility, and capacity for chemical modification (Xianyu et al., 2014; Connor and Broome, 2018, as cited in, Zheng et al., 2020). BC's flexibility enables it to mold onto areas or wounds where it is applied (Cavalcanti et al., 2017; Ferreira et al., 2017; Lima et al., 2015; Martins et al., 2013; Pinto et al., 2016; Pita et al., 2015, as cited in, Silva et al., 2021; Vilar et al., 2016).

BC's high surface area can be attributed to its unique fiber network structure. This provides a large liquid loading capacity compared to plant-derived cellulose and cotton yarn (Meftahi et al., 2010, as cited in, Zheng et al., 2020). Subsequently, the fiber structure with a high aspect ratio and high surface area of BC leads to easier removal of the dressing (Chen et al., 2019, as cited in, Zheng et al., 2020). In addition, BC is characterized to have high tensile strength, permeable to gas and liquid, and has good compatibility with living tissue (Bielefeld et al., 2013; Sinno & Prakash, 2013; Das and Baker, 2016, as cited in, Zheng et al., 2020). It is also noted to not have any cytotoxic effects and adverse reactions to occur either short or long term when in contact with human skin (Zheng et al., 2020). Because of BC's chemical modification compatibility, it can be modified to meet the requirements of being an ideal wound dressing (Zheng et al., 2020).

Apart from BC as a promising wound dressing material, various modifications and developments were created to improve wound healing outcomes (Orlando et al., 2020; Zheng et al., 2020; Zmejkoski et al., 2018). BC is known for its outstanding properties such as low toxicity, thermal stability, biodegradability (Awadhiya et al., 2017), high tensile strength, and degradability (Portela et al., 2019). However, it lacks antimicrobial properties (Orlando et al., 2020; Sajjad et al., 2019; Savitskaya et al., 2019; Sulaeva et al., 2015; Zheng et al., 2020). For this reason, chronic wounds are highly prone to complications and may lead to excessive exudate production and inflammatory reaction due to the contamination of foreign bodies like bacteria (Lindsay et al., 2017; Wiegand et al., 2015). In addition, substantial loss of the skin's physical barrier also permits the entry of bacteria, thereby needing a new development of wound dressing that can promote healing and reduce bacterial infection (Rumbaugh et al., 2015; Zheng et al., 2020). The drawback is that BC synthesis is restricted to downward pellicle growth, which traps all microorganisms. There's also the drawback of BC culturing media, which is inefficient and costly (Kucińska-Lipka et al., 2015; Pinto et al., 2016).

Some studies have incorporated silver sulfadiazine (SSD) as an antimicrobial agent to compensate for the BC's lack of antimicrobial properties. SSD is an antimicrobial agent that can inhibit a broad spectrum of bacteria, including *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*, which are the chief causes of wound infection (Faisul Aris et al., 2019; Shao et al., 2015; Wen et al., 2015). Results have shown that the stability of BC impregnated with SSD is more remarkable than BC alone (Faisul Aris et al., 2019), and the impregnation of SSD exhibited suitable antibacterial activities and biocompatibility (Shao et al., 2015). Increasing the increment of SSD concentration incorporated into the BC also increases its tensile strength while directly reducing the BC membrane's porosity by filling up the porous matrix with SSD (Faisul Aris et al., 2019).

A study by Orlando et al. (2020) shows that chemical changes to functionalize BC could reduce bacterial growth by approximately one-half. Consequently, bio-cellulose adapted with blue nanosilver treatment is also effective in treating diabetic ulcers with good healing rate outcomes and minimal care requirements (Chansanti et al., 2020). Multiple studies have shown that bacterial cellulose successfully exhibited antibacterial properties and good biocompatibility with various modifications and wound dressing formulations (Faisul Aris et al., 2019; Chansati et al., 2020; Orlando et al., 2020).

2 RESULTS AND DISCUSSION

2.1 Mean Ulcer Area Reduction

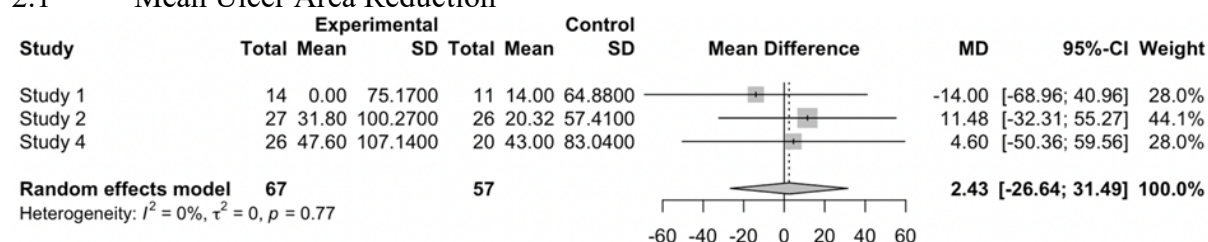


Figure 2. Forest Plot of the Meta-Analysis of the Effects of Bacterial Cellulose in Mean Ulcer Area Reduction

Combining the studies of Cavalcanti et al., Silva et al., and Dini et al., with 58 participants, the average ulcer area before and after treatment was 26.47 cm² for the experimental group and 25.77 cm² for the control group. This produced a 2.43 cm² mean difference. The researchers are 95% confident that the average mean difference will fall between -26.64 and 31.49. The findings are statistically insignificant because the interval contains 0.

In terms of mean ulcer area reduction, the BC experimental group outperforms the conventional controlled group. This means that BC reduced the ulcer area after its application compared to the conventional treatment. Nonetheless, the results are said to be statistically insignificant because the confidence interval contains the null value (zero). Thus, there is no significant difference between both conventional and experimental treatments despite a “better” reduction seen in the experimental group. These findings coincide with the RCTs of Napavichayanun et al. (2018), Maurer et al. (2021), and Silveira et al. (2016). They deem no significant difference between BC and conventional treatments, despite having varied wound natures and definitions for conventional methods. These studies focused on split-thickness skin grafts, thermal injuries, and tympanic membrane perforations, yet all three note statistical insignificance between BC and conventional treatments in wound healing. Therefore, both methods are applicable for the reduction of mean ulcer area.

2.2 Pain Intensity

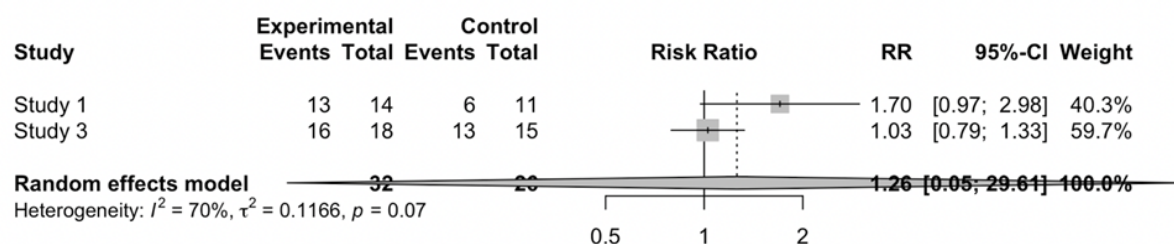


Figure 3. Forest Plot of the Meta-Analysis of the Effects of Bacterial Cellulose in Wound Pain Intensity

Combining Cavalcanti et al. and Alvarez et al., the prevalence of zero to mild pain in BC patients is 90.63%. Comparatively, 73.08% of respondents who received conventional treatment experienced mild pain. RR was 1.2583. This indicates a 25.83% increase in zero to mild pain prevalence when respondents receive BC treatment versus conventional treatment. The researchers are 95% confident that RR will be between 0.0535 and 29.6147. The findings are statistically insignificant since the confidence interval contains one (1).

Compared to the conventional treatment, the BC experimental group had a higher prevalence rate of zero to mild pain. Thus, individuals who received the BC treatment were more likely to experience less or no pain than those who received the conventional treatment. Similarly, lesser pain scores for the BC group are also noted in the clinical trials of Napavichayanun et al. (2018), Maurer et al. (2021), Silveira et al. (2016), and Oliveira et al. (2020), despite having different wound etiologies. However, there was no statistically significant difference between the two treatments, indicating that both can treat patients without inflicting excessive pain.

2.3 Appearance of Scar Formation

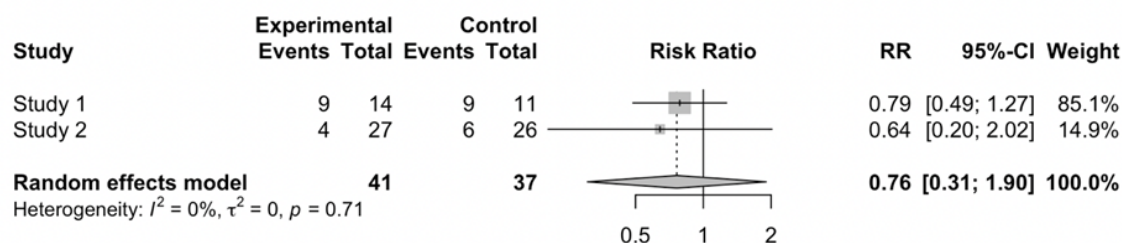


Figure 4. Forest Plot of the Meta-Analysis of the Effects of Bacterial Cellulose in Appearance of Scar Formation

Combining the studies of Cavalcanti et al. and Silva et al., the partial skin loss prevalence rate of respondents who received BC treatment is 31.71% and 40.54% for conventional treatment. RR = 0.7624. This indicates a 23.76% decrease in partial skin loss prevalence when using BC treatment versus conventional treatment. The researchers are 95% confident that RR will fall between 0.3054 and 1.9034. The findings are statistically insignificant since the confidence interval contains one (1).

Because a decrease is noted in the partial skin loss prevalence rate of the BC group compared to the conventional group, otherwise denoted as “a decrease in the absence of scar formation,” the conventional group seems to have a better result in this outcome. The results show that the conventional group is more likely to present with only partial skin loss or simply without scar formation. However, given that the findings are statistically insignificant,

there is no difference between BC and conventional treatments in this outcome. Thus, both methods can lessen scar formation or skin loss after treatment.

2.4 Wound Healing Tissue

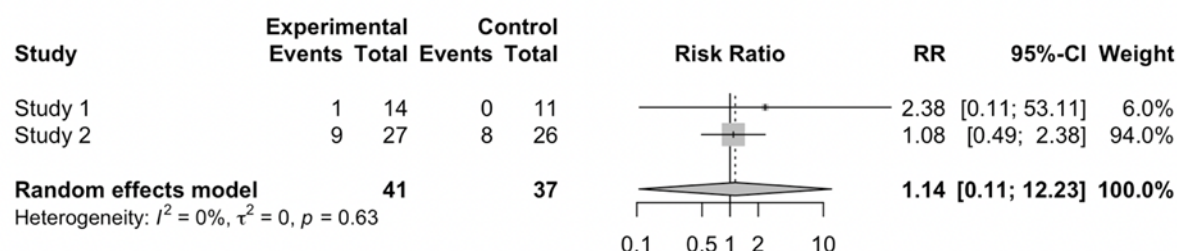


Figure 5. Forest Plot of the Meta-Analysis of the Effects of Bacterial Cellulose in Wound Healing Tissue

Combining the studies of Cavalcanti et al. and Silva et al., the wound healing prevalence rate of respondents who received BC treatment is 24.39% and 21.62% for conventional treatment. This resulted in an RR of 1.1358, which means that respondents receiving BC treatment had a 13.58% higher wound healing prevalence rate than those receiving conventional treatment. The researchers are 95% confident that RR will fall between 0.1055 and 12.2284. Despite these claims, the confidence interval contains the null value of one (1), meaning the findings are statistically insignificant.

Since the wound healing prevalence rate of the experimental BC group is increased compared to the conventional group, the BC group seems more likely to present with fully healed wounds than the conventional group. This means that the BC group is more likely to display completely healed and closed wounds. However, since the findings are also statistically insignificant, there is no difference between BC and conventional methods regarding wound healing tissue. Therefore, both methods may promote healthy tissue-type wounds after treatment.

Several studies have compared other wound treatment methods with bacterial cellulose-based wound dressings. Various authors used variables such as time to epithelialization, wound healing rate, pain intensity, presence of inflammation, scar appearance, and exudate quality to compare the outcomes. Napavichayanun and company's (2018) randomized clinical trial (RCT) compared the safety and efficacy of BC and commercial Bactigras® dressing in the treatment of split-thickness skin graft patients. The authors concluded that the formation of wound scars in the BC experimental group was of higher quality than the Bactigras® control group when comparing erythema and melanin values, Vancouver Scar Scale (VSS), and Transepidermal Water Loss (TEWL). Pain scores were also significantly lower in the experimental group. Maurer and company's (2021) RCT results coincide with those of Napavichayanun et al. (2018) since both studies' authors noted either lessened pain intensity or the absence of increased pain. Maurer et al. (2021) studied variables such as length of stay in the hospital, anesthesia procedures, and wound healing in pediatric victims of thermal injuries. Thirty-nine (39) patients received polyurethane foam as the control group, while 33 patients received bacterial nanocellulose as the experimental group. The authors concluded that bacterial nanocellulose offers more effectiveness in a pediatric population in terms of hospital stay and treatment with general anesthesia. It allows lessened hospitalization durations and faster surgeries under anesthesia. In addition to improvements in pain, scar quality, and hospital stay, Silveira et al. (2016) highlighted BC's superiority in cost-effectiveness and surgical time. The RCT by Silveira et al. (2016) was composed of tympanic

membrane perforation patients. Twenty (20) patients received BC grafts, while the other 20 received autologous temporal fascia grafts. The experimental BC group took an average of 14.06 minutes to perform surgical procedures, while the fascia control group took 76.50 minutes. The fascia group's total hospital expenses cost approximately R\$7,178.00 more than the BC group's total expenses. Factors that affected this decrease in costs could be the BC's features of lessened laboratory testing, needless general anesthesia and specialized surgical procedures, and shortened hospital stay.

However, while the studies mentioned above displayed improved conditions with BC in terms of pain, wound quality, hospitalization, and practicality, the wound healing rate or time to epithelialization was generally deemed statistically insignificant. Napavichayanun et al. (2018), Maurer et al. (2021), and Silveira et al. (2016) see no significant difference between wound healing, despite having different wound natures and definitions for conventional treatment. Colenci et al. (2019) seem to further reiterate this statistical insignificance in treating chronic venous ulcer patients. The RCT by Colenci et al. (2019) focused on comparing BC dressings and collagenase dressings, with its primary outcome centered on wound closure rate. While a more significant reduction in the wound size was apparent in the BC group, statistical analysis proved this insignificant.

The researchers of this study observed a pattern of statistical insignificance in the difference between the wound healing of the control and experimental groups, along with significant differences or improved conditions in other parameters such as pain, wound quality, hospitalization, and practicality. Despite the variety between these studies regarding wound nature, methodology, and conventional treatment, consistent findings are shared across all studies and authors. Thus, emphasis is put on the significance of this meta-analysis as it gathers relevant data on a defined group. It aims to find these behaviors of bacterial cellulose in previous literature and examine whether venous ulcer patients also experience similar effects when treated with BC. Once these observations are successful, the authors may recommend the clinical use of BC as an alternative for wound dressings.

3 METHODOLOGY

3.1 Study Design

This study is a meta-analysis done by systematically pooling results and data from existing studies. The data were treated with one statistical treatment to provide a conclusion with the highest level of evidence and greater statistical power.

Data collection was done by searching online databases for potentially related studies as primary data. The keywords entered on the online databases were as follows: bacterial cellulose, wound dressing, chronic venous ulcer, and Randomized Controlled Trials. Inclusion and validation of the studies identified were done using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) model as (see Fig. 2), and the Risk of Bias 2 (RoB2) Assessment tool to counter-check for the validity and quality of the studies included.

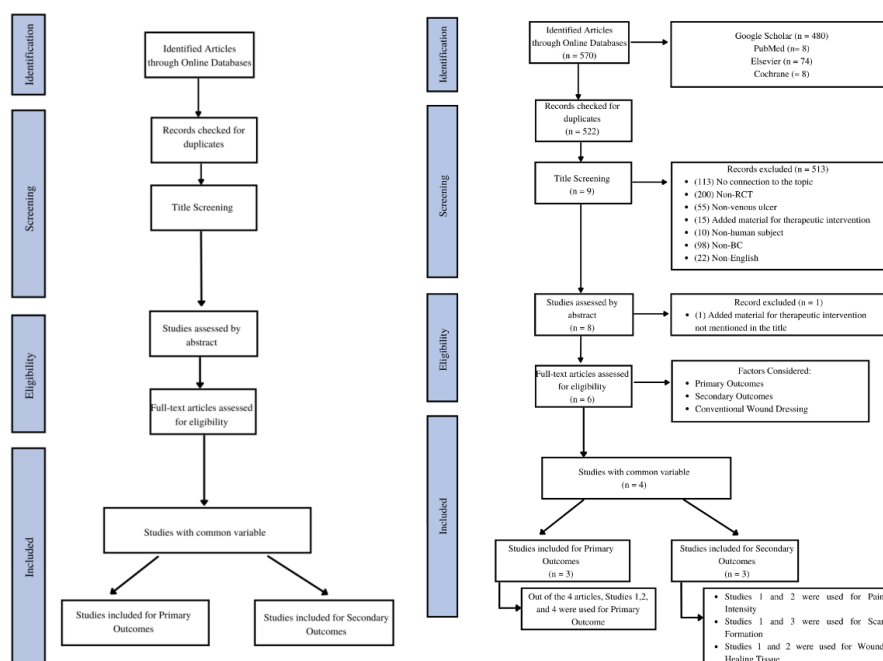


Figure 6. Flowchart showing the PRISMA Model. The PRISMA Model was used to verify inclusion into the meta-analysis

3.2 Selection Criteria

Table 1 shows the criteria that aided in the selection of the articles for this study. These were used to standardize the primary data and minimize variability in the included studies that ruled out possible extraneous factors that may skew the meta-analysis. Interventions in the randomized control trials that compared BC to conventional wound dressings were included in this study. It is important to note that some of these studies used commercially available cellulose. In contrast, others synthesized their BC membrane to impregnate certain chemicals that the retrospective authors deemed necessary. Investigations were limited to adults aged 40 - 95 years. In these studies, the retrospective authors explicitly excluded pediatric patients due to the unpredictability of the intervention outcome. Based on observation, there is variability in the kinds of wounds included in online and offline clinical trials. Because of this, inclusion criteria were narrowed to venous leg ulcers, whether of diabetic or non-diabetic etiology. The decision was made because most studies focused on this specific wound type in the treatment of BC. Studies with no primary outcome but with secondary outcome/s were still included to supplement information regarding the efficiency of the BC treatment

Table 1. Inclusion and Exclusion Criteria for the Selection of Articles.

	Inclusion Criteria	Exclusion Criteria
Bibliographic Databases	Elsevier (Elsevier, The Netherlands), PubMed (National Center for Biotechnology, Bethesda, Maryland, USA), Cochrane Library (Cochrane, London, United Kingdom), and Google Scholar (Google LLC, California, USA).	Databases outside these mentioned sites
Study Design	Randomized Controlled Trials	Meta-analyses similar to this study

Participants	Adult patients with chronic venous ulcers	Children or adolescents; Wounds caused by other diseases aside from chronic venous ulcers
Intervention	Bacterial Cellulose	-
Comparison	Bacterial Cellulose compared to a commercialized bandage	-
Outcome	Similar standard unit of measurements	-
Article Time Frame	No time constraint	-
Language	English	-

3.3 Data Extraction

Two independent reviewers (L.A.A & J.A.B) collected all published articles using a Google spreadsheet. The reviewers were assigned to extract data and mine relevant information about the studies, which were then entered into the spreadsheet. Information that was included were the title, author, email of the primary author, affiliated university, year published, database used, country of origin, language, study design, sample size, race/ethnicity, age group, gender, primary outcomes, secondary outcomes, and form of a conventional wound dressing. A third reviewer (C.A.C.P.) settled the conflict and reduced any possible bias in the extraction process in cases where there was disagreement on the data extraction process between the two independent review authors

3.4 Quality Assessment

Table 2. Summarized ROB-2 evaluations for each domain and overall evaluation.

	D1	D2	D3	D4	D5	Overall
Study 1: Cavalcanti et al., 2017						
Study 2: Silva et al., 2021						
Study 3: Alvarez et al., 2012						
Study 4: Dini et al., 2013						

Domains

D1: Bias due to randomization

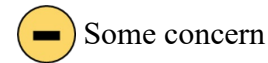
D2: Bias due to deviations from intended intervention

 Low

D3: Bias due to missing data

D4: Bias due to outcome measurement

D5: Bias due to selection of reported result



In Table 4, the evaluators summarized the individual evaluations of each of the five studies included. While some studies were evaluated to have a high risk of bias, the authors opted to include the studies nonetheless into the meta-analysis to broaden the point of view from various perspectives.

The study conducted by Calvacani et al. (2017) was assessed and showed a low risk of bias. While the study had a low risk of bias in most domains, the main issues found by the evaluators include (1) lacking information with regards to the blinding and (2) the difference in the BMI of the control and experimental groups. As for the lacking information on the blinding to both participants and carers in the study, the authors were able to compensate by using standardized randomization procedure with software, strict adherence to procedure, consistent patient compliance, and meticulous measurements; blinding offers little to nonsubstantial risk for bias. The authors accounted for the issue of the possible interference on the BMI difference of participants by proper randomized allocation and assignments of intervention minimizing any risk of bias that may arise with regards to the confounding factor. The methodology utilized by the authors was also sound and based on existing validated frameworks. As guided by principles of the assessment tool, despite having the latter issues discussed, the study showed little to no bias as per other factors such as measurements, compliance, and monitoring was accurate and precise, showing pure objectivity of the study.

Similarly, the study conducted by Silva et al. (2021) also showed a minimal to low risk of bias. Following the risk assessment tool, the only issue that the evaluators have pointed out was the (1) lack of blinding to both the participants and the assigned carers administering the interventions and (2) differences in the frequency of the changing of the dressings. The lack of blinding shows little to no bias, given that the measurements were done through imaging software following the strict adherence to the purely objective framework. The authors counteracted any potential biases that may arise due to the differences in the frequency of bandage change by using a standardized measurement tool that was used across all groups. Subsequently, the study may have included a potential source of interference and bias through the participants' usage of several medications for the confounding comorbidities such as silver sulfadiazine, yet the yielded data has shown that these medications showed no significance ($p>0.05$), confirming that this factor was not an issue nor may be a potential contributor for any biases. Despite the problems discussed, the study showed minimal to no bias.

Contrary to the previous studies, the study of Alvarez et al. (2012) was evaluated to be of high risk of bias due to having a domain with "some concerns" and another with "high risk." Specifically, these domains were due to deviations from the intended interventions (Domain 2) and missing outcomes data (Domain 3), respectively. The randomization process of the study has a low risk of bias since the allocation sequence for bio-cellulose dressing (BWD), and the control group was based on the block randomization schedule. The randomization was done using sealed envelopes. However, the participants in the study are possibly aware of the allocated treatment regimen since sealed envelopes were opened after confirming that these patients are eligible for inclusion in the trial. Subsequently, in domain 3, a high risk arose from the missing outcome data caused by the high percentage of withdrawn patients in

the control group with 35% (n=8) and the BWD-treated group with 28% (n=7). Although most withdrawals for both groups were due to non-concordance and protocol violations (n=3 BWD, n=4 control), there are still several withdrawals due to loss of follow up (n=3 BWD, n=2 controls) and infection (n=2 controls) that is beyond the scope to be evaluated but deemed to be possibly not related to the treatment given.

The following study, Dini et al. (2013), was also evaluated to have a high risk of bias due to the missing outcomes data domain. The study was unable to meet the minimum required of patients (n=50) to obtain a statistically significant difference due to 4 patients who could not complete the study because of protocol violations. On the other hand, the randomization process domain was assessed to have a low risk of bias since the allocation sequence was based on a computer-generated randomization schedule. No information was provided for deviations from the intended intervention domain if the patient's assigned intervention remained concealed during the trial. However, this was overruled by other signaling factors since the evaluation of the treatment was performed blinded, and non-protocol interventions were balanced across groups. Similarly, the measurement of the outcome domain and selection of the reported result domain was evaluated to have a low risk of bias. Parametric or nonparametric statistical analyses were appropriately performed using the Mann-Whitney U test, 2-way analysis of variance, and W2 test. At the same time, Statistical Package for Social Sciences (SPSS version 16.0) was performed for the intention-to-treat analysis. Although the risk of bias may be pertinent due to the exclusion of 4 patients, the study was able to show a trend using objective parameters (TEWL, Chroma Meter, Corneometer) that consistently aligned with one another. Lastly, the result reflects the multiple initial measurements without omitting a particular calculation that may lead in the direction of favoring a specific outcome measurement.

Journal articles were assessed further using the RoB-2 software. This tool validated the relevance and applicability of the journal articles selected using the inclusion and exclusion criteria. The authors aligned the basis of judgment with RoB-2's signaling questions matched with the study's research design. Three authors were assigned to validate the quality using RoB-2. Validation was done mainly by S.J.P. and T.Y.L., while a third reviewer, J.C.C., resolved conflicts between the two.

4 CONCLUSION

Despite the results being in favor of the BC group in terms of pain intensity and wound healing tissue, this meta-analysis found no significant evidence that bacterial cellulose as a wound dressing has efficiently improved wound management among adult patients with venous ulcers. Specifically, BC did not significantly demonstrate a better result in mean ulcer area reduction, pain intensity, scar formation, and wound healing tissue than conventional methods. Therefore, the authors suggest that one may use either the BC or the conventional methods as these do not significantly differ. Furthermore, it is essential to note that this analysis has only included four RCTs, two of which are deemed to be of considerable risk of bias, which may affect the reliability and accuracy of the results. Given that the scarcity of RCTs included may negatively affect the results, the authors recommend that more RCTs of the same subject matter be conducted so more data can be analyzed. Moreover, since the authors supposedly conclude no significant difference in mean ulcer area reduction, pain intensity, and wound healing tissue, other parameters may be explored. Thus, future systematic reviews and meta-analyses can further compare BC and conventional treatment

methods in terms of infection rate, allergy prevalence, exudate quality and quantity, wound edge type, cost and production, availability of materials, convenience or ease of dressing change, and sustainability. Furthermore, BC may be applied to other wound types, such as burns, skin grafts, and ischemic wounds.

ACKNOWLEDGEMENTS: The researchers would like to extend their warmest and deepest gratitude to the following for their instruction and unwavering support towards the completion of this research proposal:

First and foremost, the Almighty God, for providing the researchers with strength, inspiration, and guidance. It is through Him that this research is possible.

The University of Santo Tomas Faculty of Pharmacy, for the institution's support in this endeavor.

Ms. Sherill D. Tesalona, RMT, MSMT, for her patience, guidance, and encouragement throughout the whole process of this research. Her steadfast belief in the researchers' capabilities is a massive factor in the pursuance of this undertaking.

Dr. Ronald P. Cabral, for offering his invaluable expertise as a collaborator. His vision for this study as a potentially helpful tool in the practice of evidence-based medicine deeply inspired the researchers to push through with this topic.

Ms. Debra Hope Timog, their statistician, for her guidance and wisdom, as well as the time she has generously provided for the researchers. Her understanding of study design and statistical tools was very helpful as she was able to guide the researchers by giving the authors knowledge on how to better improve the research.

Friends and family, for their support, prayers, and sacrifices for educating and preparing the researchers for their futures and for continuing this research.

The researchers are very thankful for all these people. Without them, continuing this research would have been a lot more difficult, if not impossible.

FUNDING: The partnership between the two parties under this MOA will not involve financial commitments of any kind. It was agreed upon by both parties during the first meeting that the Collaborator shall contribute in exchange of acknowledgement in the writing of the thesis paper. Apart from such fulfillment, there will be no transfer of funds between the researchers and the Collaborator. This research received no external funding.

CONFLICT OF INTEREST: Authors declare no conflict of interest.

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A Recovery-based Assessment of Disease Severity and Comorbidities Utilizing Hematological, Clinical Chemistry, Inflammatory, Coagulation and Arterial Blood Gas Biomarkers among Filipino COVID-19 Patients in a Secondary Hospital in Isabela, Philippines

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In the Philippines, a lack of data was observed on the investigation of laboratory biomarkers as effective prognostic predictors for COVID-19 patients with underlying conditions. This study aimed to evaluate hematological, clinical chemistry, inflammatory, coagulation, and arterial blood gas biomarkers and related signs and symptoms in assessing survival based on COVID-19 severity of Filipino patients with hypertension and diabetes mellitus as comorbidities.

A retrospective approach was utilized for the selection, analysis, and evaluation of 85 severe COVID-19 patients. Forty-one have diabetes mellitus and forty-four have hypertension, of which 9 from each group are nonsurvivors. Data collected between January 2021 and February 2022 included patients' baseline laboratory results and signs and symptoms. All were subjected to statistical analysis and interpretation.

Findings showed that COVID-19 hypertensive patients, upon admission, presented a significant elevation of white blood cell count ($p=0.012$), creatinine ($p=0.003$), and procalcitonin ($p=0.002$) and a significant decrease in hemoglobin ($p=0.039$), hematocrit ($p=0.009$), bicarbonate ($p=0.016$), and base excess ($p=0.032$). Those presenting with difficulty in breathing were seen to have a higher chance of survival. Meanwhile, COVID-19 diabetes mellitus patients presented a significant elevation of white blood cell count ($p=0.022$), creatinine ($p=0.006$), and procalcitonin ($p=0.005$) and a significant decrease of hematocrit ($p=0.032$), partial pressure of carbon dioxide ($p=0.045$), and bicarbonate ($p=0.027$). These findings were seen to be associated with a higher risk of no survival.

Certain areas of the study can be further improved, such as using a larger sample size, collecting data from admission until discharge, differentiating types of hypertension, diabetes mellitus, and COVID-19 variants, and including serological biomarkers and vaccination status. These would help increase specificity and reliability whilst broadening the reach of the current findings.

Keywords: Biomarkers, Comorbidities, COVID-19, Diabetes mellitus, Hypertension

A Study of Eating Habits Associated with Elevated LDL Cholesterol Levels in Fourth-Grade Elementary School Children

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Introduction: An elevated low-density lipoprotein (LDL) cholesterol level is an important risk factor for cardiovascular disease. In adults, dyslipidemia is associated with excessive cholesterol from dietary foods. It is known that childhood obesity tracks into adulthood; therefore, it is important for children to develop healthy eating habits to manage their own health. In Japan, healthy elementary school students rarely undergo blood tests, and height and weight are used to assess health status. This means standard weight or thin children may be considered “healthy,” even if they have a high-fat diet. A blood test is needed to evaluate the LDL cholesterol level because it cannot be estimated by physical status. This study examined the influence of eating habits on LDL cholesterol levels among fourth-grade children.

Methods: We obtained the data from blood tests and lifestyle survey responses from 2014 to 2016 for fourth-grade children in A city, Japan. There were no significant differences by sex or grade, and 576 boys and girls were included in the analysis as a whole sample for the 3-year study period. Multiple regression analyses were performed with LDL cholesterol level as the objective variable and eating habits as explanatory variables. Sex was an adjustment variable.

Results: The mean LDL cholesterol level was 96.55 ± 23.44 mg/dl ($n=554$). The results of a single regression analysis showed significant factors were Monday's physical condition, body image, dieting experience, low motivation, frequency of breakfast, thinking about healthy food, and frequency of fried food. A multiple regression analysis excluded explanatory variables with p -values >0.05 (body image, dieting experience, Monday's physical condition, and thinking about healthy food). Another multiple regression analysis (adjusted $R^2=0.04$) showed significant factors were sex ($\beta=-0.07$, $p=0.08$), low motivation ($\beta=0.12$, $p=0.01$), breakfast frequency ($\beta=-0.13$, $p<0.01$), and fried food frequency ($\beta=0.09$, $p=0.03$).

Discussion: Elevated LDL cholesterol was associated with being a girl, skipping breakfast, less intake of fried foods, and low motivation. Skipping breakfast was related to obesity. When children gained weight, their parents reduced fried foods, which may decrease LDL cholesterol levels. The fit of the regression equation was not good, which suggested the results were insufficient to show an association between eating habits and LDL cholesterol levels. Further research is needed to reveal factors that influence serum lipids in fourth-grade children, which may contribute to the effectiveness of eating education as a lifelong health promotion strategy.

A study protocol to determine the influence of socio-demographic characteristics on Knowledge, Attitude, and Behaviour of Artisanal Miners on Occupational Health and Safety, and Mining regulation in Kolwezi, Democratic Republic of Congo

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Abstract

Introduction: Artisanal mining has been classified as a high-risk occupation worldwide. This has been largely attributed to the nature of the work, the lack of knowledge on occupational health and safety, and non-compliance with safety regulations. This study is designed to assess the knowledge, attitudes, and behaviour of artisanal miners on occupational health and safety and the Democratic Republic of Congo mining regulation in Kolwezi city. **Method:** This paper proposal describes the influence of socio-demographic characteristics on the level of knowledge, attitude and, behaviour of artisanal miners and compliance with safety regulations. A cross-sectional study will be conducted among workers using simple random sampling from five different artisanal mines in Kolwezi, in the Democratic Republic of Congo. Data analysis will be performed using both Statistical Package for Social Sciences (SPSS) version 25 and the Center for Disease Control and Prevention (CDC) program EP INFO 7.2. The results were reported as odds ratios and adjusted odds ratios with 95% confidence intervals. **Results:** The study will provide the causes of the lack of knowledge of Kolwezi's artisanal miners on Occupational Health and Safety and, non-compliance with safety measures and mining regulation. This study will assist the Ministry of Labour to reinforce the policies and framework in Occupational Health and Safety in artisanal mining by empowering and equipping occupational inspectors. **Conclusion:** Through the Ministries of Education and Public Health, artisanal miners can be trained on safety measures and the use of PPE.

Keywords: Occupational Health Safety, mining regulations, Artisanal Mining Card, Knowledge, Attitude, and Behaviour

Introduction

In the Democratic Republic of Congo, when public mining enterprises such as MIBA and GECAMINES bankrupted, a large part of the mining activities has been taken over by actors in the informal sector, who exploit concessions abandoned or formerly belonging to the public

enterprises (1). As of 2002, much artisanal mining has been happening due to increased demand for minerals and high rates of unemployment. This vertiginous progression of artisanal mining activities is not without unfortunate consequences. Several young people engaged in artisanal mining are exposed to all kinds of occupational hazards and daily, human lives are lost because of failure to comply with safety regulations. In 2006, at the artisanal exploitation site of Ruashi Mining, 13 accidents causing 35 deaths and 16 injuries has been reported, indicating an annual victim rate of 0.4 to 0.5% (2). In June 2019, 40 artisanal miners died in Kamoto Copper Company (KCC) in Kolwezi, and in October 2019, 21 artisanal miners died when a gold mine in Maniema Province collapsed (3-4). Although occupational health and safety in the mining industries have much improved over the past years, there are still more measures that need to be implemented to guarantee a safe working environment (5). Therefore, this paper aims to provide statistical information about the knowledge, attitudes, and behaviour toward OHS and mining regulation among artisanal miners in Kolwezi.

The working environment in artisanal mining is dangerous because of non-respect of safety standards, no wearing of personal protection equipment to protect miners from exposure to radiation, injuries, and other accidents that may occur (6). The International Labour Organization (ILO), convention No.176, Article 14 states that under national laws and regulations, workers should perform their specific duties following their training guidelines which include compliance with the prescribed safety and health measures in consideration of how possible carelessness can put not only their lives but also that of others in danger (7). Therefore, occupational health and safety are of great importance in terms of protecting employees from professional risks which have negative effects both economically and socially.

The DRC has developed regulations adapted to the local situation to ensure occupational safety based on Title 7 of the Labour Code, Article 207 of the Mining Code, and Article 492 of Mining Regulations (8, 9, 10). Congolese Labour Code requires the promotion and establishment of an occupational health and safety system. It is in this perspective that the Ministry of Labour undertook various actions to set up a promotional framework in matters of health and safety, in particular by the establishment of a better regulatory framework that aims to improve health and safety at work (8). In addition to these fundamental tools governing the country's mining sector, there are several official texts: orders, instructions, circulars, and deeds of engagement from the operators involved in formalizing and improving artisanal mining in the DRC.

In the DRC, although the safety concerns associated with artisanal mining activities are known, and the Congolese Labor code and Mining code are applied, hardly a week passes without an article in the press reporting new accidents. It appears there is no understanding of occupational health among artisanal miners. Therefore, this study will assess the knowledge, attitude, and behavior of artisanal miners on Occupational Health safety in Kolwezi City. The study aims to determine if artisanal miners in Kolwezi are well informed about Occupational Health and Safety and the DRC mining regulation and if non-compliance on safety measures is correlated to age, gender, educational level, work experience, and marital status.

Results

Data from the questionnaire will be entered and captured for storage, cleaned and coded then processed by IBM SPSS Statistics Version 25 to generate descriptive statistics such as Mean, Median, SD, Percentages, and Frequency tables. Frequency distribution will be used to compare the relationship between the different variables. The strength of association will be calculated using odds ratios (OR) with the CDC program Epi Info 7 and the probability of statistical significance set at a p-value of <0.05 with a confidence interval (CI) of 95%.

Regression analysis will be performed to determine if socio-demographic characteristics influence knowledge, attitudes and, behaviour of artisanal miners towards occupational health and safety guidelines and the DRC mining regulations.

Discussion

Several studies have been carried out locally and internationally in the past to solve occupational and safety problems. Kumwimba (12) found that working conditions in artisanal mining are very bad and often very dangerous. Diggers, even children, work barefoot, without personal protective equipment, and unventilated wells; Elenge (13) listed the causes of the most frequent accidents, such as lack of safety equipment and non-compliance with international standard safety measures in mining operations were mentioned and; Ayoo (14) enumerated the causes of non-compliance with safety measures in Kenya, such as the cost of equipment, knowledge, awareness on safety requirements and administrative issue.

In D.R. Congo, researchers agreed on Poor compliance with safety and security mining policies and regulation, lack of training, and unawareness of security measures as the cause of artisanal mining accidents. However, the causes of this poor compliance have not been mentioned in the research already published in the artisanal mining sector in D.R. Congo, especially in Kolwezi.

This study is the first (according to our knowledge) study carried out in five artisanal mines in Kolwezi aiming to look at the influence of socio-demographic characteristics on knowledge, attitudes, and behaviour of artisanal miners towards OHS and the D.R.C mining regulations. The results of this study will hopefully be able to identify the gaps in the knowledge of OHS and mining regulation observed in Kolwezi due to lack of awareness of the regulation. Gaining the level of knowledge of the artisanal miners on safety issues and the factors that affect compliance with occupational health safety regulations among the artisanal miners in Kolwezi, should be useful in improving the management of artisanal miners in terms of awareness on security measures that should be applied in the mines.

The study results will also inform the different stakeholders in the artisanal mining sector on the importance of complying with occupational health and safety measures. Lastly, the findings from this study may be used as a reference for further research on artisanal mining in the DRC particularly on the influence of socio-demographic characteristics on compliance with regulations.

The study focused only on the artisanal workers in one city, therefore, it cannot be generalized to all artisanal mining in the DRC. Being a quantitative study means that subjects will be unable to explain their responses further as the close-ended questions do not allow for descriptive answers which might sometimes be very useful.

Methodology

Study design and population: This study will adopt a descriptive quantitative approach, using a cross-sectional research design to determine the association between the knowledge, attitudes, and behaviour of artisanal miners and socio-demographic characteristics.

Population and sampling: The study population will consist of five artisanal mining organizations in Kolwezi by using simple random sampling. The updated population size of artisanal miners is unknown. However, the last estimation of artisanal miners made by Kolwezi

civil society in 2019, is 140,000 (11). To calculate sample size, the researcher used Epi Info version 7.2.3.0, considering a confidence interval of 95% (type value 1.96) and a margin of error of 5% (type value of 0.05) with 80% power, the sample size will be 383.

Data collection and analyse: The data will be collected from five main artisanal mining sites in Kolwezi namely; Kasulo, Mutoshi, Kamilombe, Uck Drain, and Tilwezembe et Intermediaires, within a period of five weeks. A closed-ended questionnaire validated by public health experts will be administrated to respondents at different artisanal mining sites. The questionnaire covers the following aspects; (1) socio-demographic characteristics, (2) knowledge of occupational health safety, (3) knowledge of the DRC safety regulation, (4) attitudes towards DRC mining regulations, and (5) behaviour by artisanal miners towards DRC mining regulations will be designed in English then translated into French and vernacular language. The questionnaires will be distributed to the artisanal miners who met the inclusion criteria during working hours. Participants who will be unable to read and write effectively will be assisted by the researcher and assistants trained for the task.

Conclusion

The study will determine the factors that affect compliance with Occupational health safety among the artisanal miners in Kolwezi. Methods of dissemination of results will include publishing research project results in journals, presenting at conferences and seminars and through workshops, and in-service training for artisanal miners.

Acknowledgements

The authors also wish to thank Mr. J. M. Tshizainga Sanama, the provincial ministry of Mines, Lualaba, and research assistants for working tirelessly on this project.

Funding

This research received no external funding)

Conflict of interest

Authors declare no conflict of interest.

Ethics Clearance

This study was approved by the University of Johannesburg, the Ethics Committee (REC-616-2020), and Higher Degrees Committee (MPH HDC-01-46-2020), and the DRC authorization (CAB.MIN/MINES/LBA/227/CNK/2020).

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Antibiotic Use Among Households Living In Selected Cities And Provinces In The Philippines

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ABSTRACT

Antibiotic resistance is a global concern contributing to the development of manageable ailments responsible for the increase in the country's morbidity and mortality rate. Irrational and excessive use of antibiotics primarily contributes to the progression of antibiotic resistance, occurring due to the lack of knowledge and awareness of antibiotic use. A cross-sectional analytic design was used to determine the correlation of the use of antibiotics between households in selected cities and provinces across Luzon, Philippines in terms of knowledge, attitude, and behavior as well as the correlation of these variables. Through snowball sampling, 388 participants answered a survey that gathered the responses needed for this study. The data were treated using descriptive statistics providing an overview of the data set and inferential statistics. Results showed no significant difference between the knowledge, attitude, and behavior of the respondents residing in the selected cities and provinces, which implies no significant antibiotic misuse was observed. Correlations between the variables, albeit no significant differences, showed a significant relationship between them.

KEYWORDS: Attitude, Antibiotic Resistance, Antibiotic Use, Behavior, Knowledge

Determinants of Overnutrition: A Cross-Sectional Study of Small-scale Garment Workers in Cipadu, Tangerang

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ABSTRACT

Small-scale garment workers are susceptible to overnutrition. Preliminary studies show that out of 30 workers in small-scale garment industries in Cipadu, Tangerang, 40% experience overnutrition. To analyze the determinants of overnutrition in workers so preventive measures can be implemented. A cross-sectional design was conducted for this study. The population of this study comprises all small-scale garment workers in Cipadu, Tangerang. Simple random sampling was used to determine the sample size, amounting to 125 workers. Nutritional status was determined by body fat percentage measured with bioelectrical impedance instruments. Data were analyzed using multiple logistic regression to identify the main determinant. Results showed that 55.2% of workers experience overnutrition. The majority of workers that experience overnutrition is characterized by <35 years of age, low levels of nutritional knowledge, excess nutrient intake, adequate carbohydrate consumption, heavy levels of stress, <6 hours of sleep, and light physical activity. Statistical analysis shows that age, physical activity, energy intake, and fat consumption are significantly associated with overnutrition. Energy intake is the main determinant of overnutrition in small-scale garment workers. Workers that are 35 years and older and perform light physical activity are advised to regulate their diet, especially towards foods containing high energy and fat levels.

KEYWORDS: Overnutrition; Small-scale Garment Workers; Energy Intake

1 INTRODUCTION

Overnutrition is a nutritional status that can be categorized into overweight and obese. This term also identifies a weight range that has been proven to increase the chances of specific diseases and other health problems. Nutritional problems have become more widespread and have become a risk factor in causing degenerative diseases. In 2008, the United States, a developed country, recorded that out of the individuals with a body mass index (BMI) greater than 30, 2.2% were men and 35.5% were women. Similar results were also found in Australia. In 2008, it was found that out of the individuals with a BMI greater than 30, 25.66% were men and 24.0% were women (1). Indonesia, a developing country, is not left out of facing overnutrition. According to Indonesian Basic Health Research, nutritional problems in adults were dominated by obesity and overnutrition. This was shown by a prevalence of 15.4% in obesity and 13.5% in overnutrition. Therefore, it can be concluded that 28.9% of adults experience overnutrition (2).

Nutritional problems in Indonesia are mainly experienced by the working-age population, or individuals older than 15 and dominated by those who have a job or are still seeking. A preliminary study was conducted on 30 workers spread throughout 4 *rukun warga* or RW (the second smallest division of a city) in an informal small-scale garment center in Cipadu, Larangan, Tangerang. The results showed that 40% of workers in this area experience overnutrition (measured by body fat percentage).

Overnutrition has negative implications for individual workers and their life quality. In a study by Firman, the impacts of overnutrition in workers vary widely, e.g., adverse linear posture influenced by excess weight, 6 – 10% less muscle strength compared to normal workers, difficulty in fulfilling metabolic needs, an increased risk of heat disorder, a decrease in speed of anti-gravitational movements, and increased absence which in turn decreases work productivity. Other than that, obese workers spend more on medical care than normal workers because of an increased threat of coronary heart disease (CHD), stroke, type 2 diabetes, high blood pressure, dyslipidemia, metabolic syndrome, cancer, osteoarthritis, sleep apnea, reproductive problems, and gallstones (3).

Generally, nutritional problems are caused by many factors. A study by Khusun H *et al.* shows that being overweight or obese is not related to only one factor, but many interrelated factors, including age, marital status, food consumption, and physical activity. A worrying fact is that in a survey conducted on office employees, it was found that fat intake was much higher than the average Indonesian, with a high frequency in consuming fried food and sweetened drinks (tea, coffee) that are high in energy. Meanwhile, the intensity of physical activity is relatively low (4). Nutritional problems in workers are due to several factors, including educational background, socio-economic conditions, culture, dietary habits, and degree of well-being (5). This study was intended to assess the factors associated with overnutrition status of small-scale garment workers.

2 METHODOLOGY

A cross-sectional design was conducted for this study. The population of this study comprises all workers across 55 small-scale garment workers in Cipadu, Tangerang. Each garment center employs 3 – 7 workers. The small-scale garment industry centers in Cipadu are an informal work sector where marginal economic activities are done using simple technology. In informal sectors, occupational health and safety are not yet well implemented

because of the lack of legal bases in the informal sector, limited capacity building for workers, the lack of occupational health awareness, and the lack of cross-sector collaboration (6). This serves as the justification of this study within the identified area, with a sample size of 125 workers chosen through simple random sampling.

The data collection process was conducted by three undergraduate students at the Department of Public Health, Faculty of Health Sciences, State Islamic University Syarif Hidayatullah Jakarta that underwent prior training. The dependent variable, nutritional status, was measured using bioelectrical impedance instruments. Information regarding determinant variables was collected through various techniques. Age, nutritional knowledge, and sleep duration were asked through questionnaires. Nutritional intake data that consists of energy intake, carbohydrate consumption, fat, and protein was collected through a 2x24 hour food recall, differentiated between weekends and workdays. Physical activity was measured using the physical activity questionnaire by Baecke JA et al., consisting of work index, sports index, and leisure index. Stress levels were identified through a number of questions regarding individual stress perception using the Perceived Stress Scale (PSS-10) (7). All instruments used have been tested for validity and reliability. Data from this study was analyzed step-by-step, starting from characterizing the variables in the study up to performing multiple logistic regression to identify the main determinant of overnutrition in workers.

3 RESULTS

This study found that out of 125 small-scale garment workers involved, 69 workers (55.20%) experienced overnutrition. Table 1 below shows that workers with overnutrition were mostly characterized by ≥ 35 years of age (80.0%), total sleep duration of < 6 hours (74.3%), and light physical activity (65.6%). Psychological characteristics showed that workers with overnutrition also had low levels of nutritional knowledge (55.4%) and high stress levels (58.1%). Nutritional characteristics showed that overnutrition was experienced by workers with excessive energy intake (89.7%), adequate carbohydrate consumption (66.0%), excessive fat consumption (68.0%), and excessive protein consumption (73.9%).

Multiple logistic regression results showed that significant factors ($\alpha=5\%$) associated with overnutrition in small-scale garment workers include age, physical activity, energy intake, and fat consumption. Workers aged ≥ 35 years were 9.84 times more likely to experience overnutrition compared to workers aged < 35 years. Aside from that, workers categorized as having light physical activity were 3.43 times more likely to experience overnutrition compared to workers that were categorized as having vigorous physical activity (95% CI: 1.08-10.86).

Unbalanced nutrition is also a determinant of overnutrition in workers. This study found that excessive energy intake is the main determinant behind overnutrition in small-scale garment workers. Workers with excessive energy intake are 18.31 times more likely to experience overnutrition compared to workers with adequate energy intake (95% CI: 4.60-72.88). Additionally, workers with a high fat intake are 4.79 more likely to experience overnutrition compared to workers with adequate fat intake (95% CI: 1.10-20.94).

Tabel 1. Characteristics and Determinants of Overnutrition in Small-scale Garment workers in Cipadu, Tangerang

Variable	Category	Overnutrition Status		Adjusted Odds Ratio (95% CI)	Pvalue
		Yes n (%)	No n (%)		
Age	≥ 35 years	36 (80,0)	9 (20,0)	9.48 (2.90-30.98)	$< 0.001^{**}$

	<35 years	33 (41,3)	47(58,8)		
Sleep Duration	< 6 hours	28 (74,3)	9 (25,7)	2.05 (0.62-6.78)	0.237
	≥ 6 hours	43 (47,8)	47 (52,2)		
Physical Activity	Light	59 (65,6)	31 (34,4)	3.43 (1.08-10.86)	0.036*
	Vigorous	10 (28,6)	25 (71,4)		
Nutritional Knowledge	Low	41 (55,4)	33 (44,6)	1.17 (0.424-3.23)	0.761
	Sufficient	28 (54,9)	23 (45,1)		
Stress Level	Heavy	54 (58,1)	39 (41,9)	1.34 (0.44-4.09)	0.607
	Moderate	15 (46,9)	17 (53,1)		
Energy Intake	Excessive	35 (89,7)	4 (10,3)	18.31 (4.60-72.88)	<0.001**
	Adequate	34 (39,5)	52 (60,5)		
Carbohydrate Consumption	Excessive	36 (48,0)	39 (52,0)	1.14 (0.26-4.94)	0.857
	Adequate	33 (66,0)	17 (34,0)		
Fat Consumption	Excessive	51 (68,0)	24 (32,0)	4.79 (1.10-20.94)	0.037*
	Adequate	18 (36,0)	32 (64,0)		
Protein Consumption	Excessive	17 (73,9)	6 (26,1)	2.33 (0.54-10.16)	0.259
	Adequate	52 (51,0)	50 (49,0)		

* p < 0.05, ** p < 0.01

4 DISCUSSION

The indicator of overnutrition in this study is individual body fat percentage. Body fat percentage is a nutritional indicator using anthropometric measurements that describes the ratio of fat mass and fat-free mass in an individual's body. Over half of the workers in this study experience overnutrition. The results of this study are a bit higher than the results shown in a study conducted by Aryatika et al., who found that 42.4% of garment workers experienced overnutrition (8). The difference in characteristics of the chosen sample could be the reason behind the difference between the two studies. However, it is still important to note that overnutrition is an important problem in the garment industry and needs further attention. Overnutrition in workers may impact workers' physical endurance, which may adversely influence linear posture, muscle strength, increased risk of heat disorder, increased work absence, and other degenerative diseases (3) (1).

Energy intake is the main determinant behind overnutrition in small-scale garment workers in Cipadu. Workers with excessive energy intake are 18.31 times more likely to experience overnutrition compared to workers with adequate energy intake (CI 95%: 4.60-72.88). According to the data found in the 2x24 hour food recall, it was found that the main energy sources consumed by workers are staple foods such as rice and side dishes that were eaten 3 times a day. Other than staple foods, workers' energy intake may also be derived from snacks, which are usually consumed during work. Results showed that most of the snacks consumed by workers are high in calories. The type of snack that is most frequently consumed by workers is fried foods, which are high in calories. Based on this finding, it is concluded that workers with a high calorie intake during work hours are 90% more likely to experience overnutrition compared to workers with a high calorie intake outside of work hours.

Small-scale garment workers in Cipadu have been found to excessively consume foods high in fat because of their good taste, yet low in satiety. Data from the 2x24 hour food recall showed that the majority of respondents consume at least 2 pieces of fried food during lunch. Other lunch menus such as chicken, fish, eggs, tofu, tempeh, and fish-flavored crackers are also fried. This, of course, increases workers' fat intake through frying oil. Other than that, 60.6% of workers consume adequate levels of fat outside of working hours. Fat is consumed through milk, chocolate-filled bread, wafers, and flavored biscuits.

Excessive fat intake may cause workers to experience overnutrition. In this study, it was found that over half of the small-scale garment workers have a fat intake $\geq 25\%$ of their total energy intake, while 68.0% of workers experience overnutrition. Similar results were found in a study by Ashteria where 71.8% of workers with excessive fat intake are more likely to experience overnutrition in comparison to workers that do not consume fat excessively (9). Our study found that workers with an excessive fat intake are 4.79 times more likely to experience overnutrition compared to workers with an adequate fat intake (CI 95%: 1.10-20.94). This could be caused by the fact that fat cells have unlimited storage capacity. Fat excess is not accompanied by increases in fat oxidation as a compensation mechanism to maintain energy balance. Therefore, around 96% of fat will be stored as adipose tissue (10). Consecutive increases in adipose tissue will result in excessive body fat percentage (11).

Age is an internal factor that determines nutritional needs and may be related to nutritional status (Apriadi, 1986). This study found that 80% of workers ≥ 35 years of age experience overnutrition. Similar conditions were also found in studies by Hutajulu (2012) and Ashteria (2013) that showed overnutrition in 63% and 73% of workers over 35 years, respectively (12)(9)

Physical activity is another determinant of overnutrition. This study found that workers that are categorized as having light physical activity have an increased potential of overnutrition compared to workers that are categorized as having rigorous physical activity. According to Choi *et al* (2010), light physical activity at the workplace (sedentary work) plays a role in the rising prevalence of obesity in American workers. Sedentary work, low physical activity, or a combination of both may increase the risk of total obesity and central obesity in men, especially those with over 40 hours of weekly worktime (13). If an individual performs physical activity that is able to balance energy intake and expenditure, energy accumulation in the form of fat would not occur. Conversely, if high energy intakes are not balanced with high energy expenditure, fat accumulation will occur and may develop into obesity over time. Routine physical activity may stimulate major decreases in fat tissue, sometimes without weight loss (14).

5 CONCLUSION

The majority of small-scale garment workers in Cipadu, Tangerang experience overnutrition. There are four factors that are significantly associated with overnutrition in workers, which are age, physical activity, energy intake, and fat consumption. Energy intake is the main determinant behind overnutrition in workers. Workers that are aged 35 years and older and perform light physical activity are advised to regulate their diet, especially towards foods that contain high energy and fat.

ACKNOWLEDGEMENTS: We would like to appreciate the coordinators of the small-scale garment industry center in Cipadu, Tangerang, and the Board of the Faculty of Health Sciences, State Islamic University Syarif Hidayatullah Jakarta who have facilitated this study.

FUNDING: This research received no external funding

CONFLICT OF INTEREST: Authors declare no conflict of interest

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Epidemiological Characteristics, Seroprevalence, and Antimicrobial Susceptibility Pattern of *Salmonella* spp. Isolated from the Enteric Fever Patients in the Philippines

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ABSTRACT

Enteric fever has been a global and public health concern for decades. It remains troubling especially in developing countries of Asia. In the Philippines, this infection has yet to be controlled and remains to be underreported. Moreover, alarming cases of antimicrobial resistance by *Salmonella enterica* serovars against multiple lines of drugs have been reported. Thus, the occurrence of multidrug and extensively-drug resistant strains have reduced treatment options. The study aimed to provide an updated Filipino-centric base knowledge and to examine the antimicrobial susceptibility testing (AST) pattern of *Salmonella* spp. from the diagnosed patients. Retrospective and cross-sectional study was performed. Data sets were collected from the Department of Health's Epidemiological Bureau and selected hospitals to determine the (1) prevalence, incidence rate, and demographic analysis and (2) AST pattern, respectively. Prevalence and incidence rates were declining with 30.02% in 2016 to 28.03% in 2021 and 21.65% in 2016 to 4.24% in 2021, respectively. Lowest rates were found during the pandemic in the years 2020 and 2021. There was a significant difference among age groups (p -value = 0.000) while no significant difference was found between males and females (p -value = 0.756). Majority of enteric fever cases were observed among age group 5 to 9 while age group 55 to 59 reported the lowest. Most of the isolates were still sensitive to the drugs tested. However, third generation cephalosporins were ineffective to all clinical isolates while Ampicillin/Sulbactam and Piperacillin remained effective to 50% and 40% of clinical isolates, respectively. Overall, there was a decrease in the antibiotic resistance rates (p -value = 0.000). Majority of the cases were observed among the children and teenagers (<1 to 19) regardless of sex. *S. typhi* accounted for most cases and exhibited higher antibiotic resistance in contrast with *S. paratyphi*. Nevertheless, decreased antibiotic resistance to multiple lines of drugs is promising.

Keywords: Enteric fever, *Salmonella* spp., *Salmonella typhi*, *Salmonella paratyphi*, Epidemiological characteristics, Seroprevalence, Antimicrobial susceptibility pattern, Antibiotic Resistance, Public health

Knowledge, Attitudes, and Practices Concerning Self-Medication with Antibiotics Among the Undergraduates of Medical Technology, Pharmacy, and Biochemistry from A University in Manila, Philippines

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ABSTRACT

Self-medication is a public health risk resulting in increased drug resistance as well as the development of adverse effects among drugs, wherein students in the health sciences field are more prone to self-medicating than the general population. The study aimed to assess the knowledge, attitudes, and practices concerning self-medication with antibiotics among the undergraduates of Medical Technology, Pharmacy, and Biochemistry from a University in Manila, Philippines. The study utilized a quantitative, cross-sectional descriptive research design. It garnered 536 respondents selected through stratified sampling, and data gathering was conducted through an online questionnaire. Frequency and percentage, weighted mean, Likert scale, Kruskal-Wallis H test, and Pairwise comparison was used to analyze the data acquired. The mean score for knowledge was 6.10 out of a maximum score of 7, indicating that most respondents have a superior level of knowledge. The majority also had favorable attitudes and good practices regarding self-medication with antibiotics. Moreover, a significant difference was found in the level of knowledge ($p=0.007$), attitudes ($p=0.001$), and practices ($p<0.001$) regarding self-medication with antibiotics among the target population. Further analysis revealed that Pharmacy and Medical Technology undergraduates resulted with higher levels of knowledge and proper attitudes than Biochemistry undergraduates. Pharmacy students were the most familiar among the three programs regarding antibiotics practices. At the same time, no significant difference was observed among the Biochemistry and Medical Technology undergraduates. Despite superior knowledge, favorable attitudes, and good practices, the respondents also exhibited common misconceptions and malpractices regarding antibiotic intake, implying that self-medicating is prevalent among these allied health students and should be addressed urgently.

KEYWORDS: Self-medication, Pharmacy, Medical Technology, Biochemistry, undergraduates, knowledge, attitudes, practices, antibiotics

1 INTRODUCTION

The World Health Organization (2020) announced that COVID-19 has become an international public health emergency last January 2020. The pandemic has created fear, panic, and anxiety, eventually resulting in many people self-medicating to relieve the stress (Chopra et al., 2021). Self-medication is defined as using pharmaceutical drugs to treat diseases or symptoms that are self-diagnosed without the need of any prescription or doctor's advice (World Health Organization, 2020). Karimy et al. (2017) stated that self-medication has different forms, such as taking the medication without a physician's prescription, based on previous experiences, and taking medication at home without any doctor's advice.

Antibiotics are the specific remedy appropriate for bacterial infections among animals. Specifically, urinary tract infection (UTI) and strep throat are some examples of bacterial infections, while viral infections include common colds, flu, and bronchitis (Center for Disease Control, 2021). Unlike bacteria, viruses are more specific in targeting the cells because a host is essential for their survival. This results in most pathogenic viruses, thereby deeming viral infections more challenging to treat (Ansorge, 2011).

A study from China by Wang et al. (2018) conducted among local university students reported that most had antibiotics in their homes, either leftover from previous prescriptions or bought over-the-counter. Another study conducted by Patil, S.B. et al. (2014) showed that 88.18% of undergraduate medical students of a university in India practiced self-medication for common colds. Only 37.1% of the students completed the antibiotic doses and procedures. Moreover, over-prescription of antibiotics also contributes in the same manner wherein 28% of the annual antibiotic prescriptions in the U.S. were deemed unnecessary (CDC, 2020).

Antimicrobial Resistance Surveillance Program (ARSP) and released a report annually regarding this matter. The country also has its own Antimicrobial Resistance Surveillance Reference Laboratory (ARSRL) which is managed by Department of Health and is located at the Research Institute for Tropical Medicine (RITM). Based on their most recent report in 2020, 61,527 isolates were analyzed, and a 38.68% resistance decrease was observed compared to the previous year's report. However, it should be noted that the COVID-19 pandemic had significantly decreased the number of isolates submitted (2020 ASRP Data, 2021). The study aimed to assess the level of knowledge, attitudes, and practices concerning self-medication with antibiotics among the undergraduates of Medical Technology, Pharmacy, and Biochemistry from a University in Manila, Philippines. Furthermore, this study can be beneficial to the Filipino youth, health policymakers, professionals, and future researchers to raise awareness of antibiotic self-medication's possible risks and dangers, formulate and review drug licensing policies, and the basis for thoroughly exploring this area and developing appropriate strategies to identify and educate their patients on the dangers of practicing self-medication and to gather valuable information needed for future research related to the study.

2 METHODOLOGY

The target population of the study was from a University in Manila, Philippines. The researchers predetermined a sample size from the target population by means of stratified sampling, which was used as the margin for data pool gathering. An online questionnaire was created using Google Forms wherein the questions were adapted from two different studies per the permission of the respective original authors. The researchers modified the original questionnaires to one that was appropriate for the study by revising the question type to True or False and incorporating the Likert scale. A publication material announcing the study's

call for respondents was posted on social media to kick start the data collection and the questionnaire was disseminated by means of social media platforms – Gmail, Facebook, and Facebook Messenger – wherein the researchers garnered a total of 536 responses. Data was automatically stored in a linked Google Sheet that the researchers had open access to once they submitted their responses. The researchers removed all identity-specific data that was recorded prior to handing the collected data over to the statistician for data analysis. Microsoft Excel and SPSS were used to generate the frequency, percentage, standard deviation, weighted means, Likert scale, Kruskal-Wallis H test, and the Pairwise Comparison Post Hoc test with Bonferroni Correlation for data analysis. Furthermore, the researchers provided verbal interpretations to correlate the numerical values of the weighted means that served as a basis for the discussion of results.

3 RESULTS AND DISCUSSION

Table 1 Demographic Profile of the Respondents

Variables		Frequency
Department	Biochemistry	35
	Medical Technology	280
	Pharmacy	221
Year Level	First Year	144
	Second Year	116
	Third Year	104
	Fourth Year	172
Age	18-19	190
	20-21	218
	22-23	128
Gender	Male	131
	Female	405
Family's Monthly Income	50,000 below	96
	51,000-70,000	106
	71,000-90,000	83
	90,000 above	251
Total		536

Table 1 depicts the demographic profile of the respondents. A total of 536 respondents were included in the study, wherein the Department of Medical Technology and Fourth Year level students dominated the group with 52% and 32% respectively. Among the age groups stated, most of the respondents were 19 years old (26%) and female (76%). Furthermore, most of the respondents have a family's monthly income of 90,000 above (47%).

Table 2 Statements and Corresponding Answers in the Knowledge Part of the Questionnaire

Statement	Answer
Antibiotics are effective for the treatment of bacterial infections	TRUE
Antibiotics are effective for the treatment of viral infections	FALSE
Antibiotics are effective for the treatment of both bacterial and viral infections	FALSE
Antibiotic resistance is the loss of activity of an antibiotic	TRUE

Missing an antibiotic dose contributes to antibiotic resistance	TRUE
Antibiotic resistance can be caused by the overuse of antibiotics	TRUE
Consumption of antibiotics without physician's prescription can contribute to antibiotic resistance	TRUE
Total Score	7

Table 2 contains the statements and their corresponding answer key that was utilized as the basis for analyzing the knowledge part of the questionnaire. Each statement answered correctly is equivalent to one point. A total score of seven points will be obtained if the respondents answered all the statements correctly.

Table 2.1 Statements and Corresponding Answers in the Knowledge Part of the Questionnaire

Knowledge Scores	Frequency	Percentage
2	1	0
3	16	3
4	30	6
5	97	18
6	130	24
7	262	49
Total	536	100

Table 2.1 demonstrates the frequency and percentage distribution of the knowledge scores of the respondents. Scores were obtained based on Table 2. Out of the 536 total respondents, 262 obtained a perfect score of 7, while 1 obtained a score of 2. In the percentage column, 49% of the respondents have superior knowledge about antibiotics, whereas 0% do not know. This representation means that most respondents know about self-medication with antibiotics since the range of scores they acquired is between 5 and 7 out of a possible maximum score of 7. Most of the respondents' sufficient level of knowledge may be related to the series of didactic lectures they received on antibiotics (Lv et al., 2014). Since the respondents have clinical subjects such as Pharmacology and other drug-related courses, their level of knowledge becomes more profound and comprehensive. Thus, medical classes or lessons play an essential role in the students' knowledge concerning self-medication with antibiotics. In accordance, Aljaouni et al. (2015) identified study textbooks and learning experiences as the medical students' primary source of information towards self-medication decisions. Furthermore, Marzan et al. (2021) revealed that the low knowledge level regarding antibiotics in their data or results could be due to most of their respondents being non-medical students. Hence, students studying clinical and drug-related courses have deep and extensive knowledge about antibiotics.

Table 2.1.1 Descriptive Statistics of the Knowledge Scores Concerning Self-Medication with Antibiotics of the Respondents

Variable	Minimum	Maximum	Mean	Standard Deviation
Knowledge Score	2	7	6.10	1.09

Table 2.1.1 presents the descriptive statistics of the knowledge scores of the respondents. Scores were obtained based on Table 2.1. Out of the seven questions on the knowledge part of the questionnaire, the minimum score a respondent obtained was 2. In contrast, the maximum score a respondent received was a perfect score of 7. Furthermore, the

mean knowledge scores were 6.10, with a range of 5 to 7 out of a possible maximum score of 7, representing approximately 87.14% of the respondents who achieved an ideal score of 7 points.

On the other hand, the raw scores had a standard deviation of 1.09, denoting that the data is more concentrated or tightly clustered around the mean. Essentially, this representation means that the variation of the respondents' knowledge scores is slight. Therefore, the respondents have a superior level of knowledge. This level of knowledge may be attributable to the allied health courses taken by the respondents, making them knowledgeable about antibiotics. In a study by Marzan et al. (2021), medical students obtained higher overall knowledge scores regarding antibiotics than students not part of the medical field. Moreover, medical students used fewer antibiotics for self-treatment. Several studies also deliberated that individuals who harbor thorough understanding of legitimate concepts of antibiotic self-medication would culminate to more responsible actions (Sontakke et al., 2011) (Mehta, R.K., and Sharma, S., 2015). These studies support the adequate level of knowledge of the respondents. Hence, students taking allied health courses are more knowledgeable about antibiotics than non-medical students because they are exposed more to in-depth discussions regarding antibiotics.

Table 2.2 Attitudes Concerning Self-Medication with Antibiotics of the Respondents

Questions	Weighted Mean	Verbal Interpretation
I agree that it is necessary to get further information regarding judicious antibiotic use	3.90	Agree
I agree that the effectiveness of treatment would be reduced if the full course of antibiotic treatment was not completed	3.72	Agree
I agree that limiting the inappropriate use of antibiotics play an important role in preventing the emergence of antibiotic resistance	3.89	Agree
I agree that patients could ask the physician to prescribe an antibiotic during the visit	2.31	Disagree
I agree that one can self-medicate with antibiotics rather than to see a doctor when he/she got minor illness	3.71	Agree
I agree that one can cease treatment one or two days after recovery	3.47	Agree
I agree that expensive antibiotics are more effective and have a more negligible side effect	3.29	Neither Agree nor Disagree
Total Score	3.47	Agree

Table 2.2 shows that the respondents showed a favorable attitude as they agreed (with a weighted mean of 3.90) that it is necessary to get further information regarding judicious antibiotic use. This result is consistent with a study by Lv et al. (2014), wherein 95% (697/731) of their student respondents agreed with the statement. Dagan published an article in 2014. He stated that antibiotics are not to be used generally as their effect on antibiotic resistance differs per organism. In line with this, he enhanced that there are significant points needed to be considered for judicious use of antibiotics to be achieved; some of these include a) solely for bacterial infections, b) diagnosis and disease severity assessment made to personalize and maximize antibiotic treatment, and c) the application of pharmacokinetics and pharmacodynamics for effective dosage.

The respondents showed a favorable attitude as they agreed (with a weighted mean of 3.75) that the effectiveness of treatment would be reduced if the full course of antibiotic treatment was not completed. The study by Lv et al. (2014) also included this statement in

their questionnaire, wherein 60% (440/731) of their target population agreed with the statement. Correspondingly, the US FDA (2019) advised people to strictly abide by the physician's prescription to receive maximum treatment efficacy; hence, they recommend not skipping dosage, not saving antibiotics for future use, and not taking other people's prescriptions.

Based on the results, the respondents were still able to show a favorable attitude as they agreed (with a weighted mean of 3.89) that limiting inappropriate use of antibiotics plays a vital role in preventing the emergence of antibiotic resistance, which is in accordance with the respondents gathered from Lv et al. (2014) study wherein 79% (578/731) of the respondents likewise agreed to this statement. Comparatively, with WHO (2020) and per the study's RRL, the consistent misuse and abuse of antibiotics is a significant contributor that hastens the development of antibiotic resistance among various bacteria.

With a weighted mean of 2.31, the respondents correctly disagreed with the statement that patients could ask the physician to prescribe an antibiotic during the visit. This result is supported by a study by Lv et al. (2014). Their results revealed that 16.3% (119/731) of the respondents incorrectly agreed with the statement. The respondents showed a favorable attitude as they correctly disagreed with that statement, which the respondents from Lv's study could not do. Patients are not encouraged to request the physician directly or indirectly for a prescription since it may not be necessary depending on their conditions. According to Stivers (2021), physicians usually experience pressure even in the subtlest forms from patients, especially parents, who expect a prescription after every consultation or diagnosis. In response, WHO (2020) advises individuals to refrain from demanding antibiotics when the professionals suggest it is unnecessary. This is also a factor for over-prescription that contributes to the development of antibiotic resistance (Stivers, 2021; WHO, 2020).

With a weighted mean of 3.71, the respondents incorrectly agreed that one can self-medicate with antibiotics rather than seeing a doctor when they got minor illnesses. Similarly, with a weighted mean of 3.29, the respondents also incorrectly agreed that one could cease treatment one or two days after recovery. In comparison, 65.06% of the respondents from Sirijoti et al. (2014) study and 77.6% of the respondents from Kim et al. (2011) study was also reported to execute said malpractice. In response to the attitude demonstrated by not only our respondents but also respondents from similar studies, this study repeatedly highlights the importance of seeking a physician and receiving proper prescriptions, even for minor illnesses, to provide patients with the best effective treatment and not to abuse the use of antibiotics with excessive doses resulting from unprofessional treatment plans. Nepal and Bhatta (2018) mentioned in a study that abruptly ceasing treatment after the symptoms subside is the most inappropriate practice that could feed the growing antibiotic resistance. Correspondingly, the US FDA (2019) advised people to strictly abide by the physician's prescription and not skip any dosage, while the American Lung Association (2021) stressed the importance of continuing the prescribed medication despite already feeling relieved in the process as ceasing treatment may pose a risk for the recurrence of the infection along with increased antibiotic resistance.

Meanwhile, the respondents neither agree nor disagree (with a weighted mean of 3.29) that expensive antibiotics are more effective and have more minor side effects. Although several studies have stated that generic medications produce increased rates of drug-related side effects, an article by Harvard Health Publishing (2021) compared branded and generic drugs. There is no hard proof that generic medications are less effective than the original or branded ones since these kinds of drugs are heavily regulated by the FDA, giving the patient assurance about the quality. However, although existing medications are considered effective yet inexpensive, it is still to note that antibiotics proven to be effective are naturally expected to be more expensive and more cost-efficient (Simoens, 2011).

Table 2.3 Level of Practices Concerning Self-Medication with Antibiotics of the Respondents

Questions	Weighted Mean	Verbal Interpretation
I take antibiotics through a physician's prescription	3.85	Agree
I take antibiotics as suggested by my friends or relatives	3.47	Agree
I take antibiotics as suggested by pharmacists	2.56	Disagree
I take antibiotics according to my previous prescription	3.13	Neither Agree nor Disagree
I take antibiotics via self-medication	3.71	Agree
I often switch antibiotics during the course of self-medication	3.72	Agree
I often change the dosage during the course of self-medication	3.78	Agree
I often read the instructions in the package insert carefully before taking antibiotics	3.40	Neither Agree nor Disagree
I take multiple antibiotics at the same time during the course of a single infectious disease	3.67	Agree
I stop taking antibiotics when I feel better	3.37	Neither Agree nor Disagree
I choose a more expensive or new antibiotics when I am sick	3.26	Neither Agree nor Disagree
Total Rating	3.45	Agree

In Table 2.3, the respondents agreed (with a weighted mean of 3.85) that they practice taking antibiotics from physician's prescriptions; however, they also agreed (with a weighted mean of 3.47) in taking antibiotics from their friends or relatives. Antibiotics should solely be taken with a valid prescription and proper counseling with a physician. Meanwhile, the respondents disagreed (with a weighted mean of 2.56) that they do not practice taking antibiotics suggested by pharmacists. Per Section 33 of Article IV of the Republic Act No. 10918, physicians provide the prescriptions required for duly registered and licensed pharmacists to be eligible to dispense the drugs. In line with the pandemic and per the FDA Circular No. 2020-007, electronic prescriptions are deemed equivalent to written prescriptions. A licensed physician validly issues them. They are likewise required for duly registered and licensed pharmacists to be eligible to dispense the drugs.

It should be noted that the respondents also agreed that: a) they take antibiotics via self-medication (with a weighted mean of 3.71), b) they often switch antibiotics during the course of self-medication (with a weighted mean of 3.72), c) they often change the dosage during the course of self-medication (with a weighted mean of 3.78), and d) they take multiple antibiotics at the same time during the course of a single infectious disease (with a weighted mean of 3.67). According to the Centers for Disease Control and Prevention (2022), patients should take antibiotics precisely as the physician directs. During their treatment, patients must never change the antibiotics they are taking, the specific dosage of the antibiotics prescribed, or handle numerous antibiotics at the same time unless their physician says otherwise.

The respondents neither agree nor disagree that they may or may not practice, the following statements: a) taking antibiotics according to their previous prescription (with a weighted mean of 3.13), b) reading the instructions in the package insert carefully before taking antibiotics (with a weighted mean of 3.40), c) stopping antibiotics when they feel better (with a weighted mean of 3.37), and d) choosing a more expensive or new antibiotics when they are sick (with a weighted mean of 3.26). One should only take antibiotics prescribed in real-time and complete the course even if symptoms are relieved prior to the

end of the prescribed course for treatment. Labels and instructions on medications and other products should always be read thoroughly before consumption or application to ensure that they are being used for appropriate situations and to know beforehand the troubleshooting measures in case of accidents (Queensland Health, 2017). To receive their maximum benefits, one should hone and turn it into a habit to always read the labels and package inserts, even on familiar drugs or products. There could have been changes or additional information in the instructions. Despite agreeing to the statement that they can cease treatment one or two days after recovery in the assessment of the attitudes concerning self-medication, the respondents did not distinctly agree to be undertaking this practice.

Table 3 Kruskal-Wallis H Test in the Knowledge, Attitudes, and Practices concerning Self-Medication with Antibiotics in terms of the Respondents' Department

Variable	N	df	Test Statistic	p-value	Decision	Remarks
Knowledge	536	2	9.989	0.007	Reject Ho	Significant
Attitude	536	2	14.126	0.001	Reject Ho	Significant
Practices	536	2	17.603	<0.001	Reject Ho	Significant

Table 3 shows that there was a significant difference in the level of knowledge ($p=0.007$), attitudes ($p=0.001$), and practices ($p<0.001$) regarding self-medication with antibiotics between the three departments. Previous research utilizing the KAP framework has also found significant associations between respondents' knowledge, attitudes, and practices for self-medication across different demographics, including undergraduates in Western China (Lv et al., 2014), Public University Students in Bangladesh (Marzan et al., 2021), and medical students. (Patel et al., 2013) (El Ezz and Ez-Elarab, 2011). However, Shankar et al. (2016) contrasts these findings since the authors found no significant difference in knowledge and perception among premedical and primary science undergraduate medical students. Moreover, as all p-values are less than 0.05, this indicates a statistically significant difference in the said factors when respondents are grouped according to their department. Hence, post hoc tests with Bonferroni correction were utilized to compare the groups pairwise and know which groups differ.

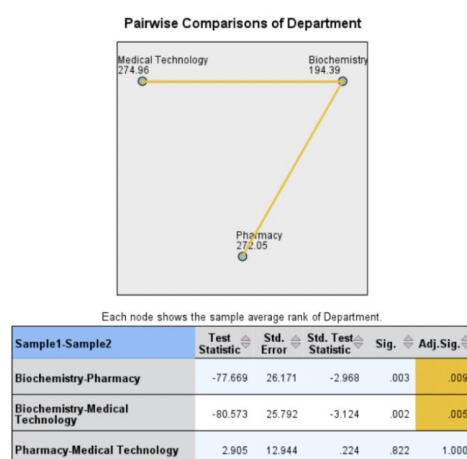


Figure 1.1: P Pairwise Comparison in the Knowledge concerning Self-Medication with Antibiotics in terms of the Respondents' Department

Figure 1.1 displays revealed a statistically significant difference in the knowledge scores between Biochemistry and Pharmacy students ($p=.009$) and Biochemistry and Medical Technology students ($p=.005$). This was evident on the diagram as it shows a yellow line

joining the mentioned pair groups, indicating a significant difference. Meanwhile, there is no significant difference in the knowledge scores between students from the Medical Technology and Pharmacy department ($p=1.000$). From this result, it can be said that Pharmacy and Medical Technology students performed better and had higher scores on knowledge of antibiotics than Biochemistry students. This most likely reflects the differences in educational courses and curriculums of these three departments. The high scores of the Medical Technology students may be due to having Pharmacology as one of the courses included in their curriculum. Meanwhile, Pharmacy students have more drug courses and deeper integration with pharmaceuticals. This was similar to the study by Hashemzaei et al. (2021), wherein the ratio of those who had good knowledge of antibiotics and its issue related to self-medication was significantly higher in pharmacy students than the medical students.

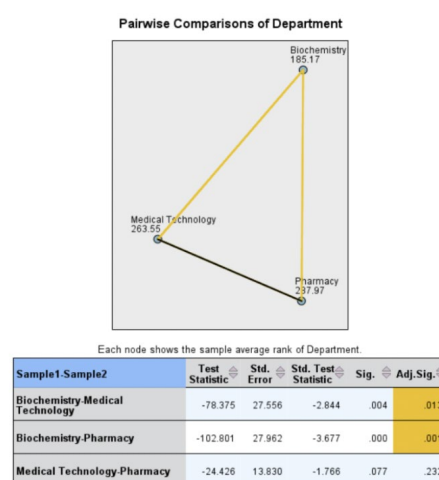


Figure 2.2: Pairwise Comparison in the Attitudes concerning Self-Medication with Antibiotics in terms of the Respondents' Department

Figure 1.2 shows a statistically significant difference in attitudes between Biochemistry and Medical Technology students ($p=.013$) and Biochemistry and Pharmacy students ($p=.001$). On the other hand, there is no significant difference between Medical Technology and Pharmacy students ($p=.232$), implied by the connecting black line between the two groups. Hence, it can be said that Biochemistry students have lower attitudes and beliefs concerning self-medication with antibiotics compared to the Medical Technology and Pharmacy students. These observations indicate that knowledge played an essential role in the students' attitudes. This finding corresponds with the study by Nepal et al. (2019) that indicated that the respondents who have less knowledge are most likely to have less appropriate attitudes towards the appropriate use of antibiotics.

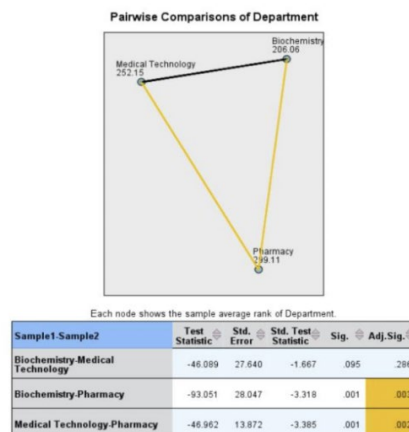


Figure 3.3: Pairwise Comparison in the Practices Concerning Self-Medication with Antibiotics in terms of the Respondents' Department

Furthermore, Figure 1.3 shows a significant difference in the practices between Biochemistry and Pharmacy ($p=.003$) and Medical Technology and Pharmacy students ($p=.002$). In contrast, there is no significant difference between the Biochemistry and Medical Technology students ($p=.286$). This indicates that Pharmacy students are the most familiar among the three departments with antibiotics practices. This result coincides with the study done by Nair et al. (2020), where self-antibiotic practice among the participating pharmacy students was good since most students were aware of antibiotic resistance. The authors mentioned that most students in the study were willing to see a doctor when they were sick and did not opt for self-treatment. Additionally, findings obtained by Albusalih et al. (2017) suggest that pharmacy students have a better knowledge of drugs and their toxicology, which may increase their reluctance to practice self-medication.

4 CONCLUSION

According to the findings of the study, the respondents generally demonstrate a superior level of knowledge concerning self-medication with antibiotics. The participants also generally show favorable attitudes regarding antibiotic use. Furthermore, the results indicate that most respondents exhibit good practices when taking antibiotics. Overall, the data reveals a significant difference between the knowledge, attitudes, and practices among the undergraduates of Medical Technology, Pharmacy, and Biochemistry. Hence, the study's findings highlight the need for further efforts to encourage responsible self-medication, particularly among health allied students, to raise new generations of individuals capable of combating unregulated self-medication.

The researchers recommend that future researchers conduct a similar study that would utilize a different target population (e.g., non-health allied students) or a different age group (e.g., working population). A study involving respondents from health allied and non-health allied fields can also be carried out to correlate the findings between the two respondent categories. Finally, future researchers may consider comparing different settings, such as conducting a study with the general population in a designated urban and rural area.

ACKNOWLEDGEMENTS: The researchers of this study would like to express their sincere gratitude to acquaintances who aid in disseminating the survey across social media platforms; the respondents who have voluntarily participated in the data collection; Ma. Janna J. Dela Cruz for sharing her expertise in research methods and being the statistician for this

study; Anne Valkyrie S. Flores for proofreading the entirety of the study; William BaThein and Salequl Islam for generously granting permission to adapt the data collection tool that they have created; and last but not the least; Almighty God, for granting the researchers the wisdom, perseverance, and patience to conduct and accomplish this study.

FUNDING: This research received no external funding.

CONFLICT OF INTEREST: Authors declare no conflict of interest.

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Knowledge, Attitudes, and Practices on COVID-19 Variants of Medical Technology Students in a Selected University in Manila, Philippines

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ABSTRACT

Initially discovered in Wuhan City, Hubei Province of China, SARS-CoV-2 caused a global pandemic on March 11, 2020. With this predicament, several variants have mutated and continue to affect people worldwide. Prior studies have shown that students' self-determination of the importance of knowledge, attitude, and practices increases their self-assurance in taking precautionary measures in the face of impending threats such as the COVID-19 infection. Hence, understanding the variants of SARS-CoV-2 is crucial in managing COVID-19.

This study was conducted to assess the level of knowledge, attitudes, and practices of medical technology students in a selected university regarding the COVID-19 VOCs in the Philippines. Using a snowball sampling technique, a survey questionnaire was sent to 208, 181, 206, and 272 of the first-, second-, third-, and fourth-year students of the Department of Medical Technology at the University of Santo Tomas, respectively.

This study's independent and dependent variables were descriptively assessed via their measures of central tendency, while the inferential analysis was done using the Chi-Squared Test via SPSS. The strength of association among the variables were determined via a Cramer's V Test. The participants showed overall fair knowledge of COVID-19 VOCs. It caused their positive attitude towards the subject, which subsequently manifested as best preventive practices against COVID-19.

KEYWORDS: *COVID-19, COVID-19 variants of concern, medical technology students*

INTRODUCTION

The COVID-19 pandemic has caused a myriad of health, social, and economic issues around the globe. Despite the recommendation of the Centers for Control and Disease Prevention to wear face masks and adhere to social-distancing protocols, SARS-CoV-2 continuously spread, eventually mutating into different variants, four of which are being classified as variants of concern, namely, the Alpha variant, the Beta variant, the Gamma variant, and the Delta variant. These variants were discovered in different countries; in London and Kent, South Africa, Brazil, and India, respectively (Jeong, 2021). They are highly transmissible in comparison to the original virus. Furthermore, vaccine efficacy is lower when it comes to these emerging strains (Hewings-Martin & Cohut, 2021).

Amidst compliance with public health standards in the Philippines, reports about COVID-19 cases arise. The said variants mainly contribute to the growing number of cases. As of November 14, 2021, the total active cases rose to 28,102, while the overall recoveries were 2,743,297. Moreover, the total number of COVID-related deaths increased to 45,581. To summarize, there are 2,816,980 total cases nationwide (DOH, 2021). Despite the threat of strains, most Filipinos at risk seek jobs outside the comforts of their homes to earn a living. It endangers their family members, including students, who can be indirectly exposed to the virus despite being confined in their homes.

Previous findings have shown that self-determination of the importance of knowledge, attitude, and practices increases students' self-assurance in practicing precautionary measures for imminent threats such as the COVID-19 infection. (Goyal et al., 2021).

Therefore, it is in this light that the study aimed to evaluate how the future members of the healthcare team, specifically the Medical Technology students, perceive the COVID-19 variants of concern by assessing the level of their knowledge, their attitudes, and the practices they perform in their daily lives during the pandemic in the Philippines.

RESULTS

Table 1 Demographic background of the respondents

Variable	Parameter	n	%
Age	18	52	6.0
	19	199	23.0
	20	193	22.3
	21	220	25.4
	22	175	20.2
	23	28	3.2
Sex	Male	295	34.0
	Female	572	66.0
Year Level	1st year	208	24.0
	2nd year	181	20.9
	3rd year	206	23.8
	4th year	272	31.4

Table 1 presents the demographic background of the respondents. The respondents are predominantly female (66%), and the average age of the respondents is 20.40. As per the sampling design, the respondents were divided per year level – there are 208 first year students, 181 second year students, 206 third year students, and 272 fourth year students. – completing the computed sample size of 867; hence, we have a response rate of 100% for this study.

Table 2. Source of Information on COVID-19 variants of Concern

Sources of Information	n	%
News channels	698	80.5
Newspaper articles	370	42.7
Social Media	752	86.7
Google or other search engines	774	89.3
Peers	370	42.7
Relatives	376	43.4
Healthcare providers	518	59.7
Others	4	<0.0

Table 2 displays the results of the sources of information on COVID-19 variants of concern. Data shows that almost 9 out of 10 respondents are heavily relying on Google or other search engines for information about COVID-19, followed by social media and news channels, with 86.7% and 80.5% of the respondents, respectively. Relatively less people are using newspaper articles, peers,

and relatives as their main source of information. Some respondents stated that their source of information also comes from their educational institution, as well as online scientific journals.

Table 3 Chi-Square Test of Association between Demographic Profile and Sources of Information

Demographic profile		News channels	Newspaper articles	Social Media	Google or other search engines	Peers	Relatives	Healthcare providers	Others
Age	Cramer's V	.086	.077	.110	.054	.029	.117	.107	.101
	χ^2	6.47	5.173	10.429	2.515	.745	11.796	9.834	8.812
	p-value	.263	.395	.064	.774	.980	.038*	.080	.117
Sex	Phi	-.015	-.001	.028	.011	.099	-.035	-.048	-.023
	χ^2	.131	.000	.507	.039	8.074	.902	1.827	.022
	p-value	.717	1.000	.476	.843	.004*	.342	.176	.883
Year level	Cramer's V	.036	.044	.142	.073	.055	.111	.023	.041
	χ^2	1.125	1.658	17.564	4.628	2.663	10.676	.469	1.3444
	p-value	.771	.646	.001*	.201	.447	.014*	.926	.695

*significant at 5%

Table 3 delineates the chi-square test of association results between the demographic profile and sources of information of the study's respondents. Results show that there is a statistically significant association between age and relatives as a source of information ($p=.038$), between sex and peers as a source of information ($p=.004$), between year level and social media ($p=.001$), and between year level and relatives ($p=.014$).

The strength of association is derived by using Phi Cramer's V and Cramer's for 2x2 and greater than 2x2 contingency tables, respectively. The statistically associated variables (1) age and relatives, (2) sex and peer, (3) year level and social media, and (4) year level and relatives have a Cramer's v value near 0.1, signifying low positive association between the two variables, per pairing.

Table 4 Descriptive Statistics on the Level of Comprehension on COVID-19 variants of concern

Level of Comprehension	Mean	SD	Interpretation
General background on COVID-19 variants	68.3506%	21.13799%	Fair knowledge
Mode of Transmission	76.2843%	21.99454%	Fair knowledge
Transmissibility and Virulence	65.4268%	23.88714%	Fair knowledge
Signs and Symptoms	79.0850%	23.59743%	Fair knowledge
Vaccine Efficacy	93.6563%	13.22044%	Good knowledge
Preventive Measures	88.7351%	19.03772%	Good knowledge
Overall	74.8419%	13.36558%	Fair knowledge

Table 4 delineates the participants' level of comprehension on COVID-19 variants of concern. Based on the results, the participants are highly knowledgeable about vaccine efficacy and preventive measures, with a mean percentage of 93.66% and 88.74%, respectively. Additionally, the respondents have a fair knowledge of the general background of COVID-19, mode of transmission, transmissibility and virulence, and signs and symptoms. Overall, the respondents are 74.84% knowledgeable and have a fair knowledge of the COVID-19 variants of concern.

Table 5 Attitude on COVID-19 variants of concern

Attitude	Mean	SD	Interpretation
Are you willing to share information that you know regarding the COVID-19 variants of concern in the Philippines with your family, classmates, or friends?	.98	.130	Positive attitude
Are you willing to be updated on the development of COVID-19 variants of concern in the Philippines?	.99	.076	Positive attitude

Table 5 presents the respondents' attitudes with respect to the COVID-19 variants of concern. Based on the results, 98% of the respondents expressed their willingness to share information regarding the COVID-19 variants of concerns and 99% of respondents are also willing to continue to be updated with the development of the COVID-19 variants of concern. These values entail that the respondents of the study express a positive attitude towards the willingness to share information and be updated with regards to the COVID-19 variants of concern.

Table 6 Frequency Distribution of the Practices of the Respondents in Response to COVID-19

Practices	n	%
I always wear face masks	865	99.8
I frequently sanitize my hands with alcohol/hand sanitizer when in public areas	864	99.5
I regularly wash my hands	857	98.8
Whenever I go outside, I practice social distancing	838	96.7
I avoid going out of my home	708	81.7
I avoid public transportation (jeep, taxi, bus, plane, train)	862	99.4
I avoid consuming outdoor food	590	68.1
I avoid unnecessary vacations that involves going outdoors	379	43.7
I take vitamin supplements	683	78.8
I use disinfectant and solutions to sanitize my belongings/newly bought items	805	92.8

Table 6 demonstrates the frequency distribution of the practical application of the knowledge of the respondents in response to COVID-19 pandemic. Data shows that people are generally practicing best practices in response to COVID-19. People have developed a habit of wearing face masks and sanitizing hands in public areas. To also limit people interactions, most of the respondents have avoided riding public transportations such as jeeps and taxis and are practicing social distancing whenever they go out of their houses. Most of the respondents are diligently taking their vitamin supplements to provide them with additional immunity. Results also confirm that 8 out of 10 respondents do avoid going out of their residences, but only 4 out of 10 respondents consequently avoid unnecessary outdoor vacations.

Table 7 Chi-Square Test of Association between Demographic profile and KAP regarding COVID-19 variants of concerns

Demographic profile		Knowledge	Attitude_1	Attitude_2	Practices
Age	Cramer's V	.095	.064	.087	.118
	χ^2	15.799	3.525	6.495	24.142
	p-value	.106	.620	.261	.007*

Sex	Cramer's V/Phi	.058	.073	.042	.081
	χ^2	2.942	3.486	.572	5.720
	p-value	.230	.062	.450	.057
Year level	Cramer's V	.095	.065	.051	.100
	χ^2	15.745	3.675	2.229	17.198
	p-value	.015*	.299	.526	.009*

*significant at 5% level

Table 7 shows the chi-square test results of correlation and the strength of association between the demographic profiles and the level of knowledge, attitude, and practices of the respondents regarding COVID-19 variants of concern. It shows that there is a statistically significant association at a 5% level of significance between age and practices ($p=.007$) with positive low association ($v=.118$), year level and knowledge ($p=.015$) with positive little association ($v=.095$), and year level and practices ($p=.009$) with positive low association ($v=.100$).

On the other hand, there is no significant association between age and knowledge, age and attitude, sex and KAP, and year level and attitude ($p>=.05$).

DISCUSSION

The medical technology students involved in the study utilized *Google* and other search engines as their major source of information regarding the COVID-19 and its variants. This is because it makes information more accessible, especially for individuals avoiding going outside their homes due to the pandemic (Wang et al, 2020). Social media ranks second as the most utilized platform of the respondents to search for information about the virus. A similar study by Jaber et al. in 2021 reported that doctors and other medical staff were the most trusted source by the general population in middle eastern parts of the world. The said study also reported that social media was the second most used informational medium for the said topic.

A study viewed this positively as reports stated that individuals who used at least one type of social media platform were 4.7 times more likely to possess good infection preventive measures against COVID-19 than those who did not utilize social media (Berihun, 2021). Still, the spread of misinformation in social media platforms regarding the virus has increased since the pandemic and it remains to be a threat to global public health as per the World Health Organization., With this, the organization is actively making efforts to dispel such misinformation regarding COVID-19. On the other hand, newspapers were the least utilized source of information by the respondents.

This result is also aligned with the study conducted by Jaber et al. in 2021. However, studies conducted among European respondents such as the Netherlands, Germany, Italy, and Australian citizens reported the use of traditional media as their primary sources of information regarding the COVID-19 pandemic. This can be attributed to the fact that in the said countries, official reports by the government regarding the virus are broadcasted on traditional media.

There has been an association between the demographic profile and sources of information of the respondents, and one of these relationships is between year level and social media. In a study conducted by Ho et al. (2020), higher education or bachelor's degree level individuals were observed in the high-frequency group of information from internet media, including social media. 953 respondents had a high-frequency group in internet media as their information source. As of writing, there is no related literature that determined the correlation strength of demographic profile and information source using Phi Cramer's V and Cramer's contingency tables.

Knowledge regarding COVID-19 VOCs is vital in the medical profession. The study's findings showed that the participants have good knowledge of vaccine efficacy and preventive measures against COVID-19. According to Goyal et al. in 2021, a survey of 230 dentistry students regarding COVID-19 variants awareness showed that the respondents are well-informed about vaccine efficacy. They firmly believe that vaccines such as Covishield, Covaxin, Pfizer-BioNTech, and Moderna effectively minimize the severity of the infection and decrease death rates by 70-80%. It reduced the citizen's fear and promoted vaccine acceptance. Similarly, they are also highly aware of COVID-19 basic safety protocols set by WHO, which are vital in controlling the spread of infection.

The participants possess a fair understanding of the general background, mode of transmission, transmissibility, virulence, and signs and symptoms of COVID-19 VOCs. Similarly, the survey conducted by Goyal et al. in 2021 showed that the current study's participants and the dentistry students from the survey have similar levels of comprehension regarding the signs and symptoms of COVID-19 variants. However, the latter are more knowledgeable of the COVID-19 VOCs' transmissibility and virulence as 88.6% know that SARS-CoV 2 is contagious, and 90.43% are aware of its high virulence.

According to Lee et al. (2021), one's attitude is the intermediary element in translating knowledge into practices. This can be correlated to the study conducted by Reuben et al. in 2020 wherein 99.5% of the participants are aware and knowledgeable with regards to COVID-19. Among the said participants, 93.7% also expressed their willingness to read and disseminate right information with regards to COVID-19. These findings are in line with the present study wherein the participants possessed fair knowledge and expressed a positive attitude towards their willingness to share information (98%) and their willingness to be updated with the development of the COVID-19 variants of concern (99%).

Respondents who scored higher on the assessment of knowledge demonstrated better practices (Li et al., 2020). Wearing of face masks significantly reduces the transmission of COVID-19 and its variants by blocking the exhalation of the virus. Laboratory experiments stated the masks reduced the risk of testing positive for the virus by 70% (Brooks & Butler, 2021). It happens to be the most practiced preventive measure of medical technology students to combat the spread of COVID-19 and the further development of its variants. This is not the case in the study by Salameh et al (2021) among Palestinian university students. Instead, avoiding places where many people gather is the most common practice by them to prevent COVID-19 infection. This is followed by covering of mouth when coughing and avoiding close contact with individuals who are infected. Contrastingly, wearing of face masks was only practiced by 381 (79%) of their respondents. This difference may be explained by the varying regulations imposed by government agencies across different countries.

Practicing social distancing has also been implemented and almost all of the respondents (96.7%) agreed that they are also utilizing this standard procedure. In a study conducted by Glogowsky et al. (2021), individual mobility was impacted by social distancing policies. The researchers found out that the said practice significantly slowed the spread of the virus. Based on their estimates, within three weeks, they prevented approximately 84% of COVID-19 cases and approximately 66% of related fatalities. Going out despite the pandemic has also been inevitable due to the need of finding jobs and resources needed at home, but it was reported in the study that only 43.7% agreed to avoid unnecessary vacations that involve going outdoors. It is understandable that the number of trips decreased dramatically because of the pandemic.

On the other hand, in a study conducted by Abdullah et al. (2020), most of their respondents (65%) took 0–2 trips per week for the primary purpose of travel or going outdoors. Additionally, there has been a significant shift away from public transportation and toward private transportation and non-motorized modes. When it came to choosing a mode during the pandemic, people prioritized pandemic-related concerns over general concerns. Gender, car ownership, employment status, travel distance, primary reason for travel, and pandemic-related underlying factors were discovered to be significant predictors of mode choice during COVID-19.

Despite the mandate to limit unnecessary travel in public places, it still scored the lowest among the practices to combat COVID-19 variants of concerns presuming that some students continue to travel or go on vacations. This can be attributed to the varying restrictions or lockdown classifications imposed by different local government units per region. This includes the Enhanced Community Quarantine (ECQ), Modified Enhanced Community Quarantine (MECQ,) and General Community Quarantine (GCQ) (DOH, 2020).

Consequently, in a study conducted by Li et al. (2020) among workers in China, there was a significant association between age and practices, education level and knowledge, and education level and practices. Older respondents showed decreased practice towards COVID-19, while respondents in higher education levels showed increased knowledge and practices towards the COVID-19. The higher score of the respondents in higher levels of education may be because they can process information more quickly, and they are able to distinguish reliable sources of information from sources spreading misinformation.

Similarly, a study by Abd et al. (2021) in Malaysia demonstrated a positive association between year level and knowledge. Medical students in years 4 and 5 have shown increased knowledge as compared to students in years 1 and 3 due to longer clerkship experience. This is in line with the study by Al-Hanawi et al. (2020) among the public in Saudi Arabia and Berihun et al. (2021) among students in Ethiopia. Moreover, in a study conducted by Lau et al. (2020) in the Philippines, individuals with higher levels of education scored higher in knowledge and practices. This study has similar findings to Zhong et al. (2020) among Chinese residents. The positive correlation between educational attainment and knowledge is due to the countless news reports regarding COVID-19. This motivated the respondents with higher education to research more about the virus from reliable sources of information. This is also consistent with the study of Faisal et al. (2021) among university students in Pakistan. However, to the best of the researchers' knowledge, there is no relevant literature with the same statistical tool that tested the strength of association between the mentioned variables.

In contrast to our findings, a study by Angelo et al. (2021) among university students in Ethiopia has found a significant association between sex and knowledge and sex and attitude, while studies by Li et al. (2020), Al-Hanawi et al. (2020), and Berihun et al. (2021) have shown a significant association between age and knowledge. However, it is difficult to compare across studies due to the difference in demographics and statistical treatment. The lack of significant association between age and knowledge, age and attitude, sex and KAP, and year level and attitude may be due to the small age gap (18-23 years old), similar college program (Department of Medical Technology), and similar educational attainment of the respondents of this study.

METHODOLOGY

Research Design

A quantitative correlational design was used in the study. The researchers created a questionnaire composed of five (5) main parts with a total of forty (40) questions answerable within ten (10) minutes. The first part presented the consent form and statement on Data Privacy. In this section, three (3) agreement statements answerable with yes or no were provided. The second section, comprising four (4) questions, focused on the demographic data of the participant. The third section, composed of thirty (30) questions, focused on the evaluation of the participant's knowledge and the determination of the participant's sources of information. Next, the fourth section, composed of two (2) questions answerable with yes or no, assessed the participant's level of awareness. For the last section of the survey questionnaire, a 10-item checklist was utilized to determine the different practices used by the participants to prevent being infected by COVID-19. The respondents' level of knowledge, attitudes, and practices regarding COVID-19 variants of concern was determined using a standard level of scoring. After this, the said variables were correlated to their demographic profile in terms of age, sex, and year level together with the sources of information they utilized in gathering information about the topic. The data collected was subjected to data analysis using the appropriate statistical test to establish the relationship between the stated variables.

Research Locale

The University of Santo Tomas, Faculty of Pharmacy, Department of Medical Technology in Manila, Philippines, was the research locale of the study. A formal letter of consent was sent to the Dean of the Faculty of Pharmacy via email to ask for permission to conduct the study at the chosen study site. Due to the restrictions brought by the COVID-19 pandemic, the researchers communicated remotely. As there are no face-to-face classes during the duration of the study, communication with the respondents as well as the dissemination of the survey questionnaires was also done online.

Sampling Procedure

An online sample size calculator called Raosoft was used in the determination of the number of respondents. Raosoft is an online survey software program used for data collection and analysis (Raosoft, n.d.). Based on the 5% margin of error, with a confidence level of 95%, a response distribution of 50%, and 0.820 effect size, the sample size was calculated per year level, limiting the respondents from first year with 208 students, second year with 181 students, third year with 206 students, and fourth year with 272 students, which totals to 867 respondents.

The researchers made use of a survey questionnaire for the collection of raw data. The survey was adapted from the studies of Dr. Zaib Maroof et al. and Dr. Reena Doomra et al. entitled "Knowledge, Attitudes, and Practices towards COVID-19 among Pakistan University Students" and "A survey on awareness towards the new COVID-19 variants", respectively. A formal letter of request was sent to the corresponding authors via email to ask for permission to adapt the survey questionnaires that they utilized in their respective studies. Dr. Reena Doomra did not recognize the email sent but the questions were already included in her paper published online. The questions were modified to meet the objectives of the study.

Following the instrument validation, a registration and application for initial review which included information that discussed the study category, protocols, objectives, research design, target

population, and ethical considerations of the study was accomplished. It was then reviewed by the thesis adviser and co-adviser. After being approved, the form was submitted to the Faculty of Pharmacy Research Ethics Committee (FOPREC). After securing the certificate of approval to conduct the study, each author of the study proceeded to disseminate a recruitment publication material via Facebook to select willing participants that are fit for the target population of the study. Details of how the participants' data will be utilized and protected were stated on the informed consent form which can be reviewed by the participant prior to engaging with the study.

Data Collection

The target population of this study were first- to fourth-year Medical Technology students from the University of Santo Tomas, Faculty of Pharmacy, Department of Medical Technology enrolled for the academic year 2021-2022. The snowball sampling technique was utilized in this study. The researchers began the sampling with a small group of participants that met the inclusion criteria and then expanded the sample size by asking the initial participants to recruit individuals with similar characteristics. The new set of participants was also asked to recruit other individuals they knew until enough participants were reached. Even though snowball sampling is usually utilized when the respondents are difficult to find or are hidden, the researchers still utilized it to select the target students. This is because the respondents have the tendency to ignore emails or messages from unknown individuals. The entire data gathering process lasted from April 24, 2022, until May 08, 2022. Upon reaching the target sample size, the data collected from the survey questionnaires were gathered, tabulated, and statistically analyzed.

Data Analysis

The data collated from the accomplished survey questionnaires were subjected to analysis via descriptive and inferential statistical treatments. To acquire general information of the dataset gathered, the independent and dependent variables were descriptively assessed via its measures of central tendency. Specifically, the independent variables of the study are as follows, the demographic profile of the participants, which included the age, sex, and year level and their different sources of information with regards to the COVID-19 variants of concern. On the other hand, the dependent variables encompassed the level of knowledge, attitudes, and practices of the participants concerning the subject matter. A mean score of 80% and above indicated good knowledge and practices; a score of 61-79% was regarded as fair knowledge and practices, while a score of 60% and below was considered poor knowledge and practice towards COVID-19 variants of concern.

For the determination and correlation of the relationships between the pertinent data, the independent and dependent variables were subjected to inferential statistical testing. For this, a Chi-squared test was used. Chi-Squared Test via the Statistical Package for the Social Sciences (SPSS), a statistical test widely used in hypothesis testing, allowed the establishment of a statistically significant relationship between the collected data and the actual expected data (Hayes, 2021). This method of statistical testing enabled the researchers to support the hypothesis of their study as the Chi-Squared Test determined if there was a significant level of knowledge, attitudes, and practices regarding the COVID-19 variants of concern among the Medical Technology students. To determine the strength of association among the variables, a Cramer's V test was applied. This is an effect size measurement that determines and correlates the strength of association among two nominal variables (van den Berg, n.d). Lastly, to ensure accuracy and precision were observed, a qualified statistician performed the said statistical analysis.

CONCLUSION

The objective of the research was to assess the level of knowledge, behavioral attitudes, and current practices of medical technology students in the University of Santo Tomas with regards to COVID-19 variants of concern. The findings of this study presented that medical technology students presented a good attitude towards COVID-19 VOCs, this could be attributed to the student's being knowledgeable enough to have a fair background on COVID-19 VOCs, suggesting that having moderate knowledge on a certain topic, in which case is COVID-19 variants of concern, has a positive effect on the attitudes of a person. Moreover, the participants of the study are generally following the best practices in response to COVID-19, which can be connected to participants having a good attitude with regards to COVID-19 variants of concern.

The following conclusions answered the objectives of the study. Relationships between factors were statistically proven and derived from the results and insights obtained in the conduct of the study.

1. Majority of the participants from the University of Santo Tomas rely on Google or other search engines for information with regards to COVID-19 variants of concern followed by social media and news channels. On the other hand, sources of information obtained from newspaper articles, peers, and relatives were not as heavily relied upon by the respondents.
2. The participants of the study have an overall fair to moderate knowledge of COVID-19 variants of concern. They are seen to be highly knowledgeable on topics that tackle vaccine efficacy and preventive measures. Furthermore, the participants have a fair amount of knowledge concerning the general background of COVID-19, its mode of transmission, its transmissibility and virulence, and its signs and symptoms.
3. Participants have a positive attitude towards their willingness to be informed and updated about COVID-19 variants of concern. Most of them are willing to share information on COVID-19 variants of concern and are willing to stay updated on the topic.
4. Most of the participants have developed the habit of applying these practices in their daily lives. These practices include wearing face masks, hand sanitation, avoiding public transport vehicles, and taking vitamin supplements for boosted immunity. On the contrary, avoiding unnecessary outdoor vacations is the least followed practice.
5. Correlation between the participant's level of knowledge, attitudes, and practices with their demographic profile can be seen in areas such as age and practices, year level and knowledge, and year level and practices. However, there is no significant correlation between age and knowledge, age and attitude, sex and KAP, and year level and attitude.

ACKNOWLEDGEMENTS

The researchers would like to acknowledge the following individuals and institutions who extended their guidance and generosity in order to complete this study. To our Lord, we are truly grateful for the gifts of grace and wisdom you have bestowed upon us to accomplish our undergraduate thesis. All glory and honor are lifted upon you. To our loving family, thank you for physically, emotionally, and financially supporting us throughout our studies. To Ms. Kristina Villanueva, thank you for efficiently guiding us in the statistical analysis of our raw data. To Ms. Joanna J. Reyes, thank you for taking the time and effort to ensure that the content, structure, and grammar of this study is comprehensible. To Assoc. Prof. Gregorio Martin I, Ph.D., and Prof. Florence Navidad, Ph.D., we are grateful for your complete guidance and support from the conceptualization stage until defense. All of these are possible with your knowledge and expertise.

Lastly, to the University of Santo Tomas, Faculty of Pharmacy, we are grateful for permitting us to conduct our research on your premises. Your generosity truly inspired us to accomplish this study.

FUNDING

This study received no external funding.

CONFLICT OF INTEREST

The researchers declare that there is no conflict of interest in any form may it be personal, financial, propriety, or professional with the sponsor/grant-giving organization, the study, the co-investigators/personnel, or the site. They also certify that they had followed all ethical principles and considerations in this document. In fact, they had submitted and was approved by the UST Faculty of Pharmacy Research Ethics Committee a copy of the proposal prior to engaging any human respondent.

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Knowledge, Attitudes, Motivations, and Inhibitory Influences regarding Blood Donation of Selected Filipinos Ages 18-65 years old in Metro Manila during the COVID-19 Pandemic

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ABSTRACT

A decrease in blood transfusion and blood donation occurred worldwide due to the COVID 19 pandemic. Specifically, the Philippines had a significant drop in blood donations in 2020, compared to 2019. Hence, the study was conducted since there is a limited number of related publications in Metro Manila regarding Filipino's knowledge, attitudes, motivations, and inhibitory influences towards blood donation during the COVID-19 pandemic. The study aimed to determine the knowledge, attitudes, motivations, and inhibitory influences of 18-65 years old eligible Filipinos residing in Metro Manila towards blood donation during the COVID-19 pandemic. The study utilized the quantitative cross-sectional descriptive research design that includes a survey to collect the necessary data for interpretation. Also, purposive sampling technique was performed to collect information from 385 participants that were deemed fit for the inclusion criteria. Out of 385 participants, majority had moderate knowledge (49.4%), and a more positive attitude (88.8%) towards blood donation. The participants agreed that donating blood to a family member/friend that is in dire need of blood was the main motivation. Meanwhile, exposing themselves and others to COVID-19 was the most agreeable inhibitory influence. The attitude and motivation were significantly associated with blood donation status, age, and educational attainment. Moreover, knowledge was only significantly associated with sex while the inhibitory influence was only significantly associated with blood donation status. Therefore, the study concluded that sex, blood donation status, age, and educational attainment have a significant relationship to the knowledge, attitudes, motivations, and inhibitory influences of Filipinos towards blood donation.

KEYWORDS: Attitude, Blood Donation, COVID-19, Knowledge, Motivation

1 INTRODUCTION

Blood provides numerous functions which are beneficial for the human body. These include transport of oxygen, regulation of temperature, and resistance against infection (IQWiG, 2006). Therefore, alterations in the blood volume will pose severe threats to an individual's health. Ever since blood circulation was discovered, experts from all over the world had since tried to carry out this procedure successfully, and it was not until almost 200 years later that the first successful blood transfusion between humans had occurred (American Red Cross, 2021). With the recent advancements in modern medicine and technology, blood donation has become essential in treating and preventing blood-related diseases and disorders. In fact, according to the Centers for Disease Control and Prevention, most patients that participate in blood transfusions rarely encounter adverse reactions or side effects. Thus, blood transfusion has been an integral part of saving lives with minimal risk.

Nonetheless, there are still factors that discourage people from donating blood. One of them is poor healthcare. According to the World Health Organization, 40% of globally donated blood comes from high-income countries, which is only home to 16% of the global population. In addition, the rate of blood donation is directly proportional to a country's income. This means that lower-income countries would have a more scarce amount of blood compared to higher-income countries. In the Philippines, the amount of blood units collected has slowly improved, but the target amount of blood units for 2014 and 2016 were still not met (Department of Health, 2017). In recent times, there was a 17% decrease in blood transfusion worldwide during the COVID 19 pandemic and an 11% decrease in blood donation due to lockdowns (Delabranche et al., 2021). As a result, some blood banks made adjustments to comply with the decreasing supply of blood. In Wang *et al.* (2021) study, blood bank centers of Zhejiang province in China postponed elective surgeries and enforced restrictive transfusion strategies. Moreover, mobile blood drives in donors' homes were the response of King Abdullah Hospital in Saudi Arabia to the blood shortage (Yahia, 2020). However in the Philippine setting, the Department of Health follows a different approach to address the decreasing blood supply during pandemic, they posted an article that encourages people to donate more blood since there was a decrease of 22.8% in the total blood collection during the COVID-19 pandemic (Department of Health, 2021). Moreover, Dr. Christie Nalupta, the head of the Philippine Red Cross National Blood Services, stated that the Philippines had a significant drop in blood donations in 2020, with 365,000 units compared to 516,000 units in 2019, a 29% reduction in donation (Lacsamana, 2021).

Correspondingly, the COVID-19 pandemic greatly affects the blood collection in the country. Blood drives, encouragement and promotions are some ways to improve the overall supply of blood in the country especially in Metro Manila which is the most densely populated area in the Philippines with a density of 21,765 persons per square kilometer, which is significantly higher compared to the national average of 363 persons per square kilometer in the country (PSA, 2021). However, Metro Manila ranks 13th out of the 17 regions in terms of the number of health facilities in the country. For these reasons, there is an extreme need for blood supply in Metro Manila since there is an inadequate amount of health facilities catering to a large population. Additionally, the study was conducted since there is a limited number of related publications in Metro Manila regarding the knowledge, attitudes, motivations, and inhibitory influences of Filipinos towards blood donation during the COVID-19 pandemic.

Therefore, the study aims to determine the knowledge, attitudes, motivations, and inhibitory influences of 18-65 years old eligible Filipinos who are residing in Metro Manila towards blood donation during COVID-19 pandemic. The outcomes of the study would also help further research in assessing the appropriate actions that should be taken based on the factors affecting potential

donors by providing accurate reliable data regarding the knowledge, attitudes, motivations, and inhibitory influences of Filipinos that are residing in Metro Manila.

2 RESULTS

Table 1 Summary of Knowledge Scores of People in Metro Manila during the COVID-19 Pandemic

Remarks	Knowledge Score Range	Frequency (n(%))
Low Knowledge	0-4	77 (20.0)
Moderate Knowledge	5-7	190 (49.4)
High Knowledge	8-10	118 (30.6)

Table 1 is the summary of the score of 385 participants wherein, 77 (20.0%) have low knowledge, 190 (49.4%) have moderate knowledge, and 118 (30.6%) have high knowledge towards blood donation during COVID-19 pandemic. The mean knowledge of the total participant is 6.319 ± 2.010 SD. Majority of the Filipino people of Metro Manila (49.4%) have moderate knowledge regarding blood donation.

Table 2 Summary of Attitudes Scores of People in Metro Manila during the COVID-19 Pandemic

Remarks	Attitudes Score Range	Frequency (n(%))
Less Positive Attitude	10-29	43 (11.2)
More Positive Attitude	30-50	342 (88.8)

Table 2 is the summary of scores of 385 participants wherein 43 (11.2%) have less positive attitude, and 342 (88.8%) have more positive attitude towards blood donation during COVID-19 pandemic. The mean attitudes of the total participants is 37.423 ± 8.787 SD. Most Filipinos in Metro Manila (88.8%) have a more positive attitude towards blood donation.

Table 3 Summary of Motivation Scores based on a weighted sum analysis of People in Metro Manila during the COVID-19 Pandemic

Motivational Factors	Scores
I am willing to donate blood during this pandemic	1,407
I am open to donate blood out of my sense of duty	1,429
I would be more willing to donate blood if there was no pandemic present	1,470
I would be more willing to donate blood if my family member/friend is in dire need of blood	1,698

I would be more willing to donate blood if donors were paid to do so	1,043
I would be more willing to donate blood if donors were given insurance from any nosocomial diseases that they may contract, especially on COVID-19	1,429
I would be more willing to donate blood if I knew that the country is in dire need of donors	1,544
I would donate blood if I would be given “ayuda” or financial assistance for the COVID-19 pandemic	1,021
I am generally amenable to receiving blood from someone who has a history of COVID-19	1,155
I believe that I am physically fit and mentally able to donate blood	1,471

Table 3 shows the summarized motivation scores of selected respondents in Metro Manila. The mean motivation score of the total participants is 35.499 ± 7.100 SD. Based on the gathered results of the study, the participants were most agreeable with the motivational factor of donating blood to a family member/friend that is in dire need of blood (1,698). Meanwhile, the participants were the least agreeable to the motivational factor of giving “ayuda” or financial assistance for the COVID-19 pandemic (1,021).

Table 4 Summary of Perceived Inhibitory Influences Scores based on a weighted sum analysis of People in Metro Manila during the COVID-19 Pandemic

Perceived Inhibitory Influences	Scores
I am not physically/mentally fit to donate blood	950
I am afraid of needles	850
I am afraid of medical personnels (eg. nurses, doctors)	615
I am afraid of blood or any operations that involve seeing /touching blood	813
I am afraid to expose myself and others to COVID-19 in the process of donating blood	1,209
I am afraid to donate blood considering the risks brought by the pandemic	1,129

I am afraid of making contact with potentially unvaccinated individuals in the process of donating blood	1,207
The lockdowns and the enforcement of social distancing makes me hesitate in donating blood	1,108
I am not able to donate blood as someone else is preventing/prohibiting me from doing so	749
I am currently physically/mentally impaired or disabled, and is thus preventing me from potentially donating blood especially during this pandemic	677

Table 4 shows the summarized scores of perceived inhibitory influences among selected respondents in Metro Manila. The mean inhibitory influence score of the total participants is 24.174 ± 6.877 SD. Based on the gathered results of the study, the participants were most agreeable to the inhibitory influence of exposing themselves and others to COVID-19 in the process of donating blood (1,209) as well as making contact with potentially unvaccinated individuals in the process of donating blood (1,207). On the other hand, the participants were the least agreeable to the inhibitory influence of being afraid of medical personnels (615). The participants' most notable grounds of being inhibited to donate blood being their potential exposure to COVID-19 unvaccinated individuals as well as the COVID-19 virus itself would indicate the general fear caused by COVID-19, leading to people taking precautionary measures to avoid being infected by the virus.

Table 5 Test statistics of knowledge, attitude, inhibitory influence, and motivation scores with Sex using Mann-Whitney U Test

Variable	W	p-value
Knowledge	21487	0.0002
Attitude	17511	0.9797
Inhibitory Influence	19225	0.1119
Motivation	16374	0.2727

Table 5 shows the test statistics of knowledge, attitude, inhibitory influence, and motivation scores with Sex using Mann-Whitney U Test. This is performed to compare if there is a significant difference in the distribution of scores for knowledge, attitude, inhibitory influence and motivation for sex. And, it appears that only the knowledge scores were significant at 5% alpha. For attitude, inhibitory influence and motivation, there is insufficient evidence to conclude that the scores are significantly different between females and males.

With a similar shape of distribution in both groups; it can be concluded that at 5% level of significance, the median knowledge scores of females (7) and males (6) are statistically significantly different.

The mean knowledge score was 6.62 for the females compared to 5.84 for males. Meanwhile, the obtained attitude values were consistent with the findings of Shahshani et al. (2006), in which it revealed that females compared to males, had a slightly more positive attitude towards blood donation. However, Table 5 revealed that there is no significant relationship between the scores of

males and females in terms of attitude, motivation and inhibitory influences. This insignificance may suggest that there are no factors (due to culture, etc.) within biological sex that may cause a differing approach towards blood donation during the COVID-19 pandemic.

Table 6 Test statistics of knowledge, attitude, inhibitory influence, and motivation scores with blood donation status using Mann-Whitney U Test

Variable	W	p-value
Knowledge	10325	0.0758
Attitude	9647.5	0.0113
Inhibitory Influence	15531	< 0.0001
Motivation	9351.5	0.0041

Table 6 shows the test statistics of knowledge, attitude, inhibitory influence, and motivation scores with Blood Donation Status using the Mann-Whitney U Test. This is performed to compare if there is a significant difference in the distribution of scores for knowledge, attitude, inhibitory influence, and motivation for blood donation status. Moreover, only the knowledge scores were not significant at 5% alpha; thus, there is insufficient evidence to conclude that the scores for knowledge are significantly different for blood donation status.

Out of the four factors, only the knowledge scores were not significant at 5% alpha; thus, there is insufficient evidence to conclude that the scores for knowledge are significantly different for blood donation status.

For attitude scores with a similar shape of distribution in both groups; it can be concluded that at 5% level of significance, the median attitude scores for those who have donated blood (40) and those who have not donated blood (38) were statistically significantly different.

For inhibitory influence and motivation with a p-value less than 5% alpha, since the shapes of distribution for these scores were not similar in both groups, it can only be concluded that there is a significant difference between their scores for those who have donated blood compared to those who have not.

These findings are supported by a study conducted by Alfouzan (2014) as well as Aedh (2021) which revealed that people who had previously donated blood showed a higher attitude score than those that have not donated blood.

Table 7 Test Statistics of Knowledge, Attitude, Inhibitory Influence, and Motivation Scores with Age Groups using the Kruskal Wallis Test

Variable	Kruskal-Wallis Chi-Squared	df	p-value
Knowledge	4.3298	3	0.2280
Attitude	25.5920	3	<0.0001
Inhibitory Influence	0.8858	3	0.8288
Motivation	25.4210	3	<0.0001

Table 7 shows that a test statistic, specifically, Kruskal-Wallis test was used to compare the equality of distribution of knowledge, attitude, inhibitory influence, and motivation scores of the participants according to their age group. As for knowledge and inhibitory influence, there is insufficient evidence to conclude that the scores are significantly different among the age groups.

For attitude and motivation, since the p-value was less than 5% alpha but the shapes of the distribution are not similar in both groups, it can only be concluded that there is a significant difference among the groups for attitude and motivation. The mean attitude score for the age groups ranges from 26.8 to 38.9, while the mean motivation score for the age groups ranges from 31.4 to

36.6. Thus we conclude that the sample of people in Metro Manila during the COVID-19 pandemic grouped by age are non-identical populations.

Table 8 Test Statistics of Knowledge, Attitude, Inhibitory Influence, and Motivation Scores with Religion using Kruskal Wallis Test

Variable	Kruskal-Wallis Chi-Squared	df	p-value
Knowledge	3.6500	4	0.4554
Attitude	3.3828	4	0.4959
Inhibitory Influence	2.4921	4	0.6461
Motivation	7.3504	4	0.1185

Kruskal-Wallis test was used to compare the equality of distribution of knowledge, attitude, inhibitory influence, and motivation scores of the participants when grouped according to their educational attainment. None were significant at 5% alpha. There is insufficient evidence to conclude that the religious groups' knowledge, attitude, inhibitory influence, and motivation scores are significantly different.

In the study, religion is not a significant factor that affects the participants' knowledge, attitude, inhibitory influences, and motivation toward blood donation, in contrast to the Malaysian study, which found that religion was significantly associated with the attitude of the participants (Meiku et al., 2016). Another study in Saudi Arabia found that religion is a primary motivator for the local community to donate blood, with 71% of donors believing that blood donation is a religious obligation (Alfouzan, 2014). The disparity between studies may be due to the religion and culture of the said countries.

3 DISCUSSION

The study has determined the sociodemographic profile of selected Filipino blood donors in Metro Manila. Most are between the ages of 18-29; there were also more female respondents (61.6%); the majority of the respondents had achieved tertiary education (64.6); most of the respondents are Roman Catholics (77.9%), and most of the respondents had not donated blood before (80%).

The data analysis led to the assessment of the perceived knowledge of the selected Filipino blood donors. The questions with the most incorrect answers were whether one could donate blood soon after getting a flu shot (52.5%), whether someone with tattoos and piercings can donate blood months after getting them (54%), and whether blood donated from someone who has had COVID-19 can transfer the virus (52.5). The two items mentioned above are among the most common myths regarding blood donation, and according to the data, these items are still not disproved for half of the selected blood donors. Regarding sex, females are generally more knowledgeable regarding blood donation than males. And as for history, regardless of whether the respondents had previous blood donation experience, their knowledge level is moderate. However, those who donated blood had a slightly higher knowledge score. True, if someone has had experience in blood donation, they understand the process and its system sufficiently. Regardless of age and educational attainment, on the other hand, the respondents have average knowledge scores. Regarding religious affiliations, those with none scored the lowest knowledge score, while the rest was moderate. No religious affiliations may be a factor in insufficient knowledge regarding blood donation; however, there were not enough respondents under this group that may prove this true.

The knowledge score is in concordance with the previous study by Fauzi et al. (2019) and Melku et al. (2016). In the current study, good blood donation knowledge was a crucial component in blood donation, as more knowledgeable subjects tended to donate blood more than those with less knowledge, according to Alfouzan (2014) and Beyene (2020).

Next, the data analysis has led to assessing the attitudes of selected Filipino blood donors. According to the data gathered, most of the selected Filipino blood donors (88.8%) have a more positive attitude towards blood donation, which corresponds to other studies. Female respondents have a slightly more positive attitude than males—those who donated before also, because they may have fewer fears or concerns regarding the process. All age groups have a more positive attitude toward blood donation except for ages 54-65, the oldest age group. Regarding educational attainment, all levels had a positive attitude towards blood donation. However, there was a significant difference, and a noticeable decrease in positive attitude as the educational attainment improved. And all religious affiliates generally have a more positive attitude toward blood donation. The findings are similar to the study of Fauzi et al. (2019), Alfouzan (2014), and Meiku et al. (2016). Hence, in spite of the COVID-19 pandemic, blood donation remains to be a vital medical procedure that could support those who are in need of blood, given the positive disposition towards donating blood during the pandemic.

In succession, data analysis was done to assess the motivations affecting the blood donor's drive to donate blood during the pandemic. Association with a family member or friend who is in urgent need of blood is the driving force for the decision of some Filipino blood donors to donate, with a leading motivation score of 1,698. Although the male respondents had higher motivation scores than the female respondents, the difference between these two groups is insignificant. Regarding blood donation status, respondents who had donated blood before are more motivated to do the practice. Meanwhile, the youngest age group of 18-29 had the highest motivation, while the oldest age group of 54-65 had the lowest. There was a noticeable decrease in motivation to donate blood as the age of the respondents increased. Additionally, respondents who achieved secondary education had the highest motivation score, while those who received post-graduate education had the lowest. And regarding religion, the Roman Catholic respondents had the highest motivation score. However, scores were not significantly different among the religious groups.

The most notable factor of donating blood due to having a family member in need of blood, suggests a strong sense of altruism and the selfless motive in donating blood, which is further supported by the idea of receiving financial assistance or incentives being the least agreeable motivational factors, as these constitute a transactional approach in being motivated to donate blood.

Subsequently, the perceived inhibitory influences of selected Filipino blood donors were determined in the data analysis as well. The fear of COVID-19 exposure to oneself and others and the dread of interaction with unvaccinated people during the donation process are the two main perceived factors preventing selected Filipino blood donors from donating during COVID-19. Females had a higher inhibitory influence score than males. However, the difference between these two groups' scores is insignificant. In terms of blood donation status, however, those without experience donating blood had a significantly higher inhibitory influence score. Therefore, those who have not donated blood are more susceptible to inhibitory influences, a factor significant to a person's hindered intention to donate during the COVID-19 pandemic. As for the age, the youngest age group, 18-29, had the highest inhibitory influence score, while the oldest age group, 54-65, had the lowest. And although there was a noticeable decrease in inhibition as the education level of the respondents increased, educational attainment is not a substantial factor in influencing the inhibition of blood donors. And lastly, respondents not affiliated with religious groups had the highest inhibition, but overall the scores were not significantly different among the other groups. Moreover, the relationship between the respondents' sociodemographic factors and their perceived knowledge, attitudes, motivations, and inhibitory influences towards blood donation were evaluated. The significant differences between the groups were ascertained using the Mann-Whitney U test and the Kruskal-Wallis test. In terms of sex, it was found that only the knowledge scores between males and females were significantly different, and that the difference between males and females in terms of their attitudes, motives, and inhibitory influences was not statistically

significant. While there was insufficient data to determine whether there was a significant difference in knowledge scores, there were significant differences in attitude, inhibiting influences, and motivations between those who had donated blood and those who had not. The Kruskal Wallis test revealed that there were substantial differences in knowledge and inhibitory influences between the age groups, while there was inadequate data on attitude and motivation to evaluate their significance in differences. While there was no significant correlation between participants' educational attainment and their knowledge about and inhibitory influences toward blood donation, it was found that attitudes and motivations significantly varied across educational levels. Finally, it was shown that religion had no discernible influence on the participants' knowledge, attitude, motivation, or inhibitory influences with regard to blood donation.

4 METHODS

This study utilized the quantitative cross-sectional descriptive research design. In this method, the variables such as the sociodemographic, knowledge, attitudes, motivations, and inhibitory influences were observed without any influences during a particular time frame.

The study identified the target participants based on the data of the Philippine Statistics Authority. Afterward, the proponents adapted and modified the survey questionnaire from the previous studies of Alfouzan (2014), Shahshahani *et al.* (2006), Al Drees (2007), and Zaller *et al.* (2005) to assess the knowledge, attitudes, motivations, and inhibitory influences of the respondents regarding blood donation during the COVID-19 pandemic. The reliability of the questionnaire was determined by conducting pilot testing. Subsequently, individuals who have the potential to be a respondent were screened based on the inclusion and exclusion criteria. Those individuals who are not qualified were excluded from the study, while those qualified proceeded. Then, the significance and purpose of the study were explained to the qualified respondents thoroughly. Also, a consent form was provided and required signing before proceeding. The survey questionnaire was given only to those who signed the consent form. All qualified respondents answered the questionnaire completely through Google Forms for approximately 10 minutes, given an adequate internet connection. Then, all responses were compiled and analyzed. The proponents did interpret and make a conclusion based on the data collected.

Descriptive statistics (frequency, percentage, mean, and standard deviation) were used in participant response analysis. The knowledge scores were computed by assigning a score of “1” for every correct answer and a score of “0” for those who chose incorrect and do not know answers. Therefore, the total knowledge scores ranged from 0 and 10. After this, the knowledge scores were then further classified into “low knowledge”, “moderate knowledge”, and “high knowledge”. Knowledge scores that ranged from 0-4 were classified as “low knowledge”, while those scores that ranged from 5-7 were classified as “moderate knowledge”, while knowledge scores that ranged from 8-10 were classified as “high knowledge”. The responses were also assessed for attitudes wherein the strongly agree option was given a score of “5,” agree “4,” neutral “3,” disagree “2,” and strongly disagree “1”. Hence, the total attitude score ranged from 10 and 50. The attitude scores were then further classified into “less positive attitude” for scores that ranged from 10-29, while a “more positive attitude” was associated with scores that ranged from 30-50.

In terms of identifying the socio demographic profile of selected Filipino blood donors and its relationship with the perceived Knowledge, Attitudes, Motivations, and Inhibitory Influences, frequency tables and percentages were utilized to summarize the data. Meanwhile, the knowledge, attitudes, motivations, and inhibitory influences of selected Filipino blood donors were identified by determining the mean and standard deviation. A weighted sum analysis was also performed to determine the motivations that affects the donor's drive to donate blood as well as inhibitory influences of the participants regarding blood donation. Aside from this, the Mann-Whitney test

was utilized to determine significant differences on the distribution of two groups. With this in mind, the null hypothesis was that the distribution of the scores for the knowledge, attitudes, motivations, and inhibitory influences of people towards blood donation are the same for two groups (sex, blood donation status). This hypothesis was tested by using the formula: $U = N_1 N_2 + \frac{N_1(N_1+1)}{2} - R_1$

to compute the test statistic wherein, N_1 is the number of scores in the first condition and N_2 is the number of scores in the second condition. The null hypothesis would be rejected if the value of the test statistic is greater than or equal to subcritical value from the Mann Whitney U Table or if the p-value of the test statistic is less than the level of significance. Likewise, the Kruskal Wallis test was also utilized to compare the equality of distribution between three or more groups. Thus, the formulated null hypothesis is that there is no significant difference between the distribution of knowledge, attitudes, motivations, and inhibitory influences scores of the participants when grouped according to their sociodemographic profile (age, educational attainment, religion). This hypothesis was tested by using the formula:

$$H = \frac{12}{n(n+1)} \sum \left(k \frac{R_j^2}{n_j} - 3(n+1) \right)$$

to compute the test statistic wherein, k is the number of comparison groups, n is the total sample size, n_j is the sample size in the j th group and R_j is the sum of the ranks in the j th group. The null hypothesis would be rejected if the p-value of the test statistic is less than the level of significance. Statistically significant differences were considered at $P < 0.05$.

5 CONCLUSION

In general, the selected Filipino blood donors in Metro Manila are knowledgeable regarding blood donation. However, some common misconceptions about donor qualifications exist and are still not disproven, such as those who have had a flu shot or those with tattoos or piercings. Moreover, lacking or inappropriate information regarding the transmission of SARS-Cov-2 in most of the respondents was evident in the knowledge assessment. Most of the selected Filipino blood donors in Metro Manila had a more positive attitude regarding blood donation during the pandemic. The motivator that affects the drive of selected Filipino blood donors the most to donate blood during the pandemic is association when a family member or a friend is in dire need of blood. The two most significant perceived inhibitory influences of selected Filipino blood donors to donate during the COVID-19 are the fear of COVID-19 exposure to themselves and other people and the fear of contact with unvaccinated individuals during the donation process. Sex has a significant relationship with only the knowledge of Filipino blood donors. Meanwhile, blood donation status has a significant relationship with only the attitudes, motivation, and inhibitory influences. And finally, age and educational attainment both have a significant relationship with only attitudes and motivation. On the other hand, religion is not a significant factor in any of the selected Filipino blood donors' knowledge, attitudes, motivation, and inhibitory influences. Based on the findings, the study decided to reject the null hypothesis. Thus, the sex, blood donation status, age, and educational attainment have a significant relationship to the knowledge, attitudes, motivations, and inhibitory influences of people towards blood donation.

FUNDING: This research was funded by its members and no external funding was received.

CONFLICT OF INTEREST: Authors declare no conflict of interest.

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Molnupiravir as Treatment for COVID-19 and Its Effects on Alanine Aminotransferase Levels: A Systematic Review and Meta-analysis

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ABSTRACT

The novel SARS-CoV-2 virus, more commonly known as the COVID-19 virus, had caused a worldwide public health emergency; thus, the demand for finding a treatment becomes more critical as people are desperate to find a medication that could mitigate its clinical manifestations. Molnupiravir is known to inhibit viral replication and transcription through its mechanism of error catastrophe. This study aimed to validate the efficacy and safety of Molnupiravir by comparing the data from studies in terms of the occurrence of the increased alanine aminotransferase levels in COVID-19 patients. A search method using MESH terms alongside exclusion and inclusion criteria was utilized for browsing online databases, namely ClinicalTrials.gov, Cochrane Library, medRxiv, ScienceDirect, and PubMed. Data were analyzed for each of the objectives using Dersimonian and Laird, mean difference, risk ratio, and forest plot. After intake of Molnupiravir, a lower viral load equivalent of -1.5233 units was compared to -1.45 units of non-Molnupiravir treatment and an average mean difference of -0.0999 [95% CI: -0.33,0.13] was calculated showing no significant effect in terms of viral load. Lower mortality rates were also observed, with Molnupiravir treatment (5 out of 781 patients; 0.64%) compared to the non-Molnupiravir treatment (10 out of 774; 1.29%) resulting in a relative risk of 0.67 [95% CI: 0.0000, 7273534693.4025] showing no significant effect in terms of mortality rate. Lower occurrence of increased ALT levels was also observed, with Molnupiravir treatment (9 out of 172 patients; 5.23%) compared to non-Molnupiravir treatment (10 out of 137; 7.30%) resulting in a relative risk of 0.95 [95% CI: 0.3232, 2.7974] showing no significant difference between the Molnupiravir group and non-Molnupiravir group. In conclusion, intake of Molnupiravir has no effect on the viral load, mortality rates, and ALT levels of COVID-19 patients; therefore, the efficacy of Molnupiravir cannot be directly assessed as limited information, and clinical studies were available for the study.

KEYWORDS: *SARS-CoV-2, COVID-19, Molnupiravir, Mortality, Viral Load, Alanine aminotransferase, Hepatotoxicity*

1 INTRODUCTION

Coronaviruses such as SARS-COV-2, the viral agent causing COVID-19 infections, can cause mild to severe respiratory problems. Its dominant mode of transmission in humans is through respiratory droplets. Individuals exposed to the virus experience different clinical manifestations within the fourteen-day incubation period. Different clinical diagnostic methods are being used; however, this study will focus on COVID-19 diagnosis using real-time Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) as the gold standard [3] [4] [11] [14].

Molnupiravir (EIDD-2801) is an isopropyl ester prodrug of nucleoside analog β -d-N4-hydroxycytidine (NHC or EIDD-1931) which targets the RNA-dependent RNA-Polymerase (RdRp) enzyme utilized by the SARS-CoV-2, thereby inhibiting viral replication in human lung epithelial cell. This antiviral drug also inhibits viral transcription of the RNA genome, thereby blocking viral transmission and reducing the presence of viral RNA in patients [10] [12] [13]. It is said to be a mutagenizing agent as it causes an “error catastrophe” during viral replication. An increased rate of mutation beyond the tolerable threshold of the virus is observed and is considered lethal and may eventually lead to viral extinction. Clinical trials have shown that Molnupiravir significantly decreased the risk of hospitalization, mortality, and viral load, which is seen as an increased negative RT-PCR [7]. Adverse events were also observed in patients administered with the drug. Such adverse events that were commonly observed include headache, nausea, and diarrhea [5] [8]. However, in certain clinical trials, an increase in the alanine aminotransferase levels has been reported to be one of the drug’s adverse events. In a clinical phase 2a trial conducted by Fischer et al. (2022), increased alanine aminotransferase is one of the reported adverse events made by more than four participants; however, the study found no significant difference in terms of the treatment arm and the dosage of the drug [2].

Molnupiravir has shown great potential for reducing the risk of hospitalization and mortality rates. Although adverse events were reported, including an increase in alanine aminotransferase levels, this only occurs in a small number of patients. Existing clinical trials and studies are limited and have contrasting results; thus, a more in-depth analysis of its significant viral activity in patients diagnosed with COVID-19 infections. [2] [6] [8] [13].

This study aims to assess the efficacy of Molnupiravir as an antiviral agent in terms of viral load and mortality and to evaluate its effects on the alanine aminotransferase levels of COVID-19 patients through systematic review and meta-analysis of carefully selected studies and clinical trials in treating COVID-19 cases. The study utilized clinical trials and studies only using Molnupiravir with a dosage of 800 mg administered twice a day through the oral route in a span of five days to provide a valid assessment on the efficacy of Molnupiravir as treatment for COVID-19 patients. The assessment of its efficacy is seen as a decreased viral load and the number of patients who tested a negative RT-PCR after administration of Molnupiravir and reviewing the occurrence of increased ALT levels in Molnupiravir-treated patients.

2 METHODS

2.1 Introduction

This study is a systematic review and meta-analysis of the clinical efficacy of Molnupiravir as treatment for COVID-19 and its effects on alanine aminotransferase levels in different studies and findings in the treatment of COVID-19 cases with high mortality and viral load, as well as the occurrence of elevated alanine aminotransferase levels in COVID-19 patients. This study utilized a quantitative research design to critically assess and evaluate relevant peer-reviewed studies and clinical trials. Data from selected peer-reviewed journal articles were extracted for synthesis of new data through meta-analysis.

Research instrument used in this study were search engines to look for articles in databases namely ClinicalTrials.gov, Cochrane Library, medRxiv, PubMed, and Science Direct for randomized controlled trials (RCTs) that evaluates efficacy and safety of Molnupiravir treatment in COVID-19 patients. These instruments were used in the collection of data in order to test the validity and reliability of the study being conducted. Moreover, the purpose of this is to gather credible data from published journals such that variables may be isolated and correlated to form an educated conclusion. Interviews and observational methods were not used as they are proven not useful to this particular study.

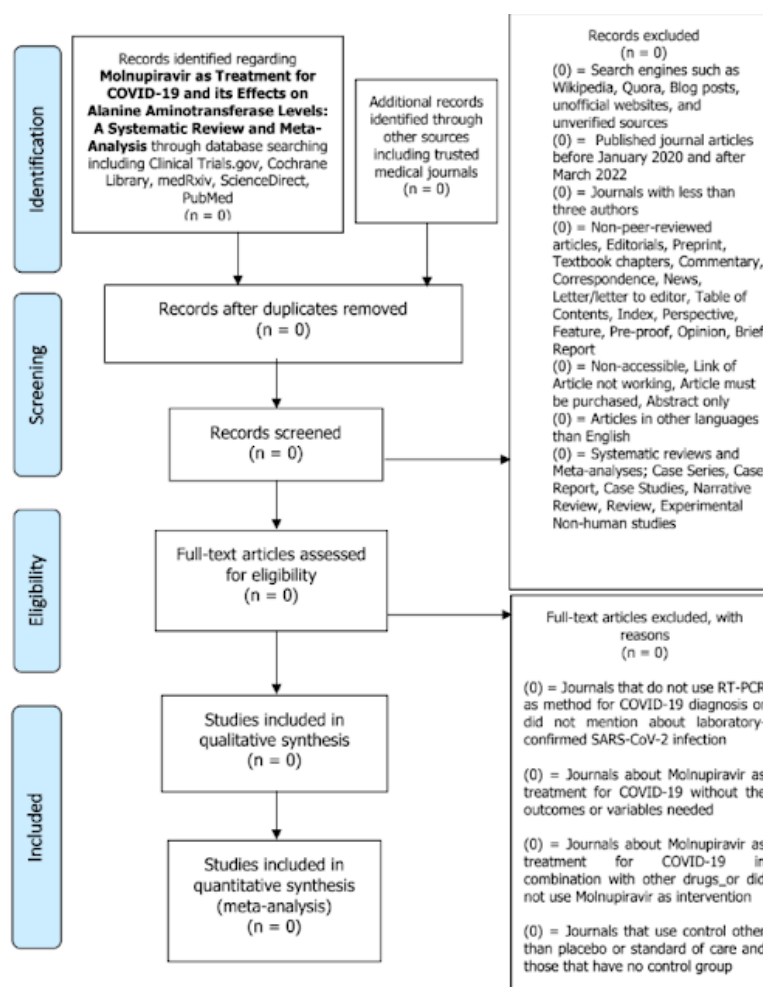


Figure 1. Prisma Flowchart

2.2 Selection Criteria

The results were manually screened based on the inclusion and exclusion criteria, and only the studies and clinical trials which met the inclusion criteria were collected. The studies and clinical trials were categorized according to their relevance in addressing the research problems. The data that were retrieved were extracted based on the values required for statistical analysis.

The research design of the journal articles that were used in this study were either clinical trials, retrospective, or prospective studies. The target population or subjects were patients infected and confirmed with RT-PCR or had a laboratory-confirmed SARS-CoV-2 infection.

Table 1. Inclusion and Exclusion Criteria for the Article Selection Regarding Molnupiravir as Treatment for COVID-19 and its effects on Occurrence of increased ALT Levels

Inclusion Criteria		Exclusion Criteria
Bibliographical Database	Trusted medical journal search engines such as, but not limited to: ClinicalTrials.gov, Cochrane Library, medRxiv, PubMed, ScienceDirect,	Search engines such as Wikipedia, Quora, blog posts, unofficial websites, and unverified sources
Date of Publication	January 2020 to March 2022	Before January 2020 and after March 2022
Authors	Minimum of three authors	Less than three authors
Publication type	Originally published and peer-reviewed articles	Non-peer-reviewed articles, Editorials, Preprint, Textbook chapters, Editorial, Commentary, Correspondence, News, Letter/letter to editor, Table of Contents, Index, Perspective, Feature, Pre-Proof, Opinion, Brief Report, Summary, Keynote
Publication status	Complete and accessible scientific journal articles published and peer-reviewed	Incomplete (abstract only) and inaccessible journal articles
Language	English	Non-English
Design of the study	Clinical trials, prospective studies, and retrospective studies	Systematic review and meta-analyses; Case Studies, Case Report, Case Series, Narrative review, Review, Experimental Non-human studies
Study subject	Patients with COVID-19 infection diagnosed through RT-PCR or has laboratory-confirmed SARS-CoV-2 infection	Articles that do not use RT-PCR to diagnose COVID-19 infection or did not mention about laboratory-confirmed SARS-CoV-2 infection
Outcomes	Mean change in SARS-CoV-2 or COVID-19 viral RNA load over time Mortality Alanine Aminotransferase Levels	No outcome needed in the study
Intervention	Molnupiravir	Articles that used Molnupiravir in combination with other drugs or interventions other than Molnupiravir
Control Group	Placebo Standard of Care	Articles that used control other than placebo and standard of care and those that have no control group

Studies were collected based on the inclusion and exclusion criteria established in the review. Among the inclusion criteria are the qualities of the articles being written in the English language, written by at least three authors with a publication date from January 2020 until March 2022, which contains clinical data on the administration of Molnupiravir as the mode of treatment for SARS-

CoV-2 and its adverse effects. The study population of articles were patients with COVID-19 infection diagnosed through RT-PCR or have laboratory-confirmed SARS-CoV-2 infection. The included outcomes that were assessed in the study included: viral load, mortality, and alanine aminotransferase levels. Intervention used must only consist of Molnupiravir. A control group must be present, whether it may be placebo or standard of care.

The exclusion criteria included: articles found through search engines such as Wikipedia, Quora, blog posts, unofficial websites, and unverified sources; a publication date before January 2020 and after March 2022; published by less than three authors, those that have the following publication types: non-peer-reviewed articles, editorials, preprint, textbook chapters, editorial, commentary, correspondence, news, letter/letter to editor, table of contents, index, perspective, feature, pre-proof, opinion, brief report, summary, keynote; incomplete (abstract only) and inaccessible journals; studies not written in English; systematic reviews, meta-analyses, case studies, case report, case series, narrative review, review, and experimental studies. Eligibility exclusion criteria consist of journal articles that did not use RT-PCR to confirm COVID-19 or did not mention laboratory-confirmed SARS-CoV-2 infection, journal articles that did not contain the outcomes needed, and used Molnupiravir in combination with other drugs or used antiviral agents other than Molnupiravir; and used other controls than placebo or standard of care as the control group.

2.3 Data Extraction

This study aimed to utilize secondary data gathered from studies which met the inclusion criteria that were acquired across credible sites wherein data were extracted for the tracking, organization, and collation of studies using the Google Sheets platform which were included in the process of review by using a data extraction form. The review authors considered the following variables or parameters to be evaluated: mean change in SARS-CoV-2 or COVID-19 viral RNA load over time, mortality, and alanine aminotransferase levels, upon administration with Molnupiravir. Furthermore, the collection of necessary details regarding the studies were done, by which are the following: the publication date, authors, study design, registration number, outcomes, sample size, and age of participants. S.T.P., and B.M.I.G. independently reviewed the journals while the third review author was M.A.M.B, responsible for possible clarifications and discrepancies with regards to the extraction of data.

2.4 Quality Assessment

The studies that were included for systematic review and meta-analysis were subjected through assessment of risk of bias that was independently performed by two reviewers (A.K.M.O. and H.C.A.) using the Cochrane RoB 2.0 tool for randomized controlled trials (RCTs) (Ma et al., 2020). The risk of bias in RCTs was assessed following the five-domain framework of RoB 2.0: randomization of allocation sequence and concealment of allocation sequence (selection bias), masking of participants and personnel (performance bias), masking of outcome assessment (detection bias), incomplete outcome data (attrition bias), and selective reporting (reporting bias) (Higgins et. al, 2011; Wormald & Evans, 2018). A third reviewer was assigned to cross-check the results and resolve any discrepancies (J.M.B.), if necessary.

2.5 Statistical Analysis

The gathering of data was from original and verified articles that tackle the consistency of results in the efficacy of treatment based on proven clinical trial data and to assess if hepatotoxicity is indeed a concern. Furthermore, this study excluded systematic reviews and meta-analyses and was limited to research that was conducted from January 2020 up to March 2022.

DerSimonian and Laird. In the investigation of whether the data provided by clinical trials have any significant consistencies and conclusive evidence regarding the efficacy of Molnupiravir as a treatment of COVID-19, the researchers made use of DerSimonian and Laird, and random-effects models were used which are statistical models which assume that various studies are estimating distinct but related intervention effects. The DerSimonian and Laird method presumptively assumed that the effects being assessed in various research follow a certain distribution. The use of this method was to address heterogeneity that was not easily explained by other causes. Random-effects models provided identical results, without heterogeneity among the selected studies.

Mean Difference. The mean difference calculates the absolute difference between the mean values of two clinical trial groups. This analytical procedure also calculated how much the experimental intervention affects the result on average when compared to the control group. The results provided data on how much difference is seen between the two clinical trial groups, also known as the experimental group and control groups. The value of 0 represents no difference between the experimental group and the control group. If the entire 95% of confidence interval is above 0, this represents that there is a significant increase, statistically, between the values of the experimental and control group. And lastly, if the entire 95% of confidence interval is below 0, it means that the values had a significant decrease, statistically, between the experimental and control groups.

Risk Ratio. Moreover, risk ratio (RR) also known as relative risk, measures the risk of a health occurrence in one group to the risk in another group. This procedure was used to initiate useful comparisons between two groups, one of which is regarded as the group of primary interest and the other as the control group. For the results, if the risk ratio is equivalent to 1, it means that both groups have identical risks. If the risk ratio is greater than 1, it means that there is an increased risk for the group of primary interest. Lastly, if the risk ratio is less than 1, it means that there is a decreased risk for the group of primary interest, indicating that the group of primary interest protects against disease occurrence.

Forest Plot. The forest plot was utilized to demonstrate the overall relationship of the selected studies. The forest plot method illustrates the consistency, heterogeneity, and precision of the studies' collective data. A table was used for the graphical presentation of the selected articles included in the meta-analysis. The left side of the table showed the chronological list of the selected studies. On the right side of the table, it showed the data extracted from each of the studies incorporated with the confidence intervals which are represented by the horizontal graphical lines. Moreover, the vertical line seen in the table represented that it has no effect, and it was used to assess the statistically significant relationship within the selected studies. Overlap with the vertical line demonstrated that the confidence intervals for a study show no or at least less heterogeneity. If the results are positioned to the left of the vertical line, it is in favor of the experimental group. If the results are positioned to the right of the vertical line, it is in favor of the control group. And lastly, if the results touched the vertical line, it means that the results are not statistically significant.

3 RESULTS

3.1 Data Mining Results

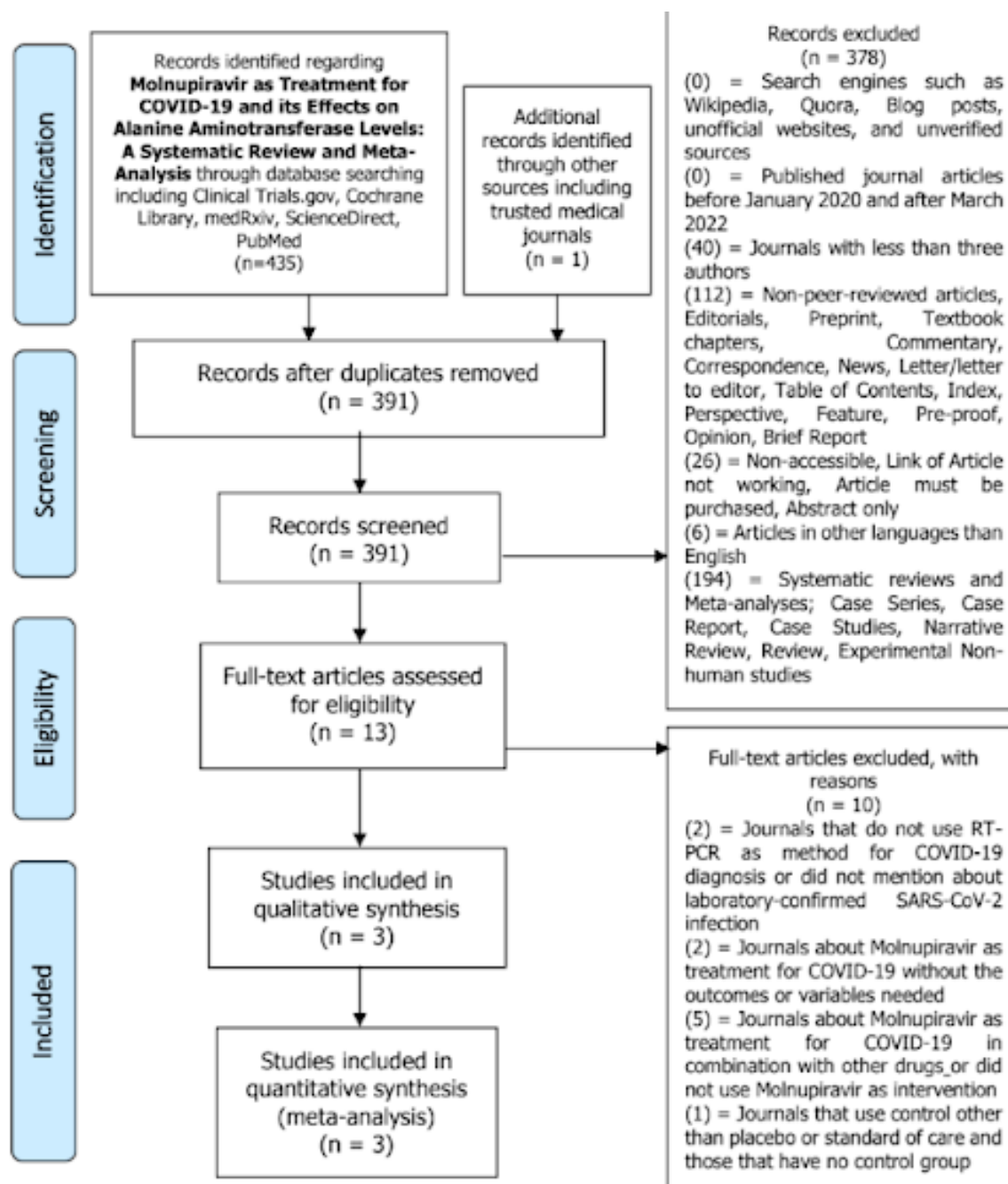


Figure 2. PRISMA Flowchart of Included Studies

A total of 436 studies were identified, 435 studies from the said databases, and 1 additional study from other medical sources. After the removal of duplicates, a total of 391 studies remained that were subjected to screening based on the initial inclusion and exclusion criteria. Out of the 378 studies excluded, 40 studies have less than 3 authors, 112 studies were found to be non-peer-reviewed and/or have a different publication type, 26 studies were found to be incomplete and/or non-accessible, 6 studies were found to be in other languages than English, and 194 studies have a study design of systematic review and meta-analysis, experimental non-human studies, case report,

case series, and case studies. From that, 13 full-text studies remained, which were subjected to further screening for eligibility. Out of these, 10 studies were excluded due to the following reasons: (2) journals that do not use RT-PCR as a method for severe COVID-19 diagnosis or did not mention laboratory-confirmed SARS-CoV-2 infection, (2) journals about Molnupiravir as a treatment for COVID-19 without the outcomes or variables needed, (5) journals about Molnupiravir as a treatment for COVID-19 in combination with other drugs or did not use Molnupiravir as intervention, and (1) study that uses control other than placebo and standard of care or those that has no control group. After further screening, 3 studies were included for qualitative and quantitative synthesis.

3.2 Quality Assessment of Viral Load

Risk of Bias Domains						
Study	D1	D2	D3	D4	D5	Overall
Arribas et al, 2022						
Jayk Bernal et al, 2022						
Fischer et al, 2022						

Domains:
D1: Bias arising from the randomization process
D2: Bias due to deviations from intended interventions
D3: Bias due to missing outcome data
D4: Bias in measurement of the outcome
D5: Bias in selection of the reported result.

Judgement
 High
 Some Concerns
 Low

Figure 3. Risk of Bias Domain through assessing Molnupiravir's efficacy in terms of viral load

A.K.M.O. and H.C.A., are the first two reviewers and independently assessed risk bias. To cross-check the study's results and resolve any discrepancies, the third reviewer, J.D.B., performed an independent review of the included studies based on the complete guide for using the Cochrane Rob 2.0 tool. Three studies shared almost the same results, which include the study of Jayk Bernal et al. (2022), Fischer et al. (2022), and Arribas et al. (2022). These three studies shared almost the same results. In terms of viral load, Jayk Bernal et al. (2022) and Fischer et al. (2022) have an overall judgment of a high risk of bias, and Arribas et al. (2022) have a low risk of bias. With these results, the number of deviations from the intended intervention that occurred due to the trial context is unknown. However, no outcome measurement method was used, and no outcome measurement or ascertainment differed between intervention groups. Furthermore, there was insufficient data to evaluate the outcome, which could have been influenced by knowledge of the intervention received.

3.3 Quality Assessment of Mortality Rate

The following studies had undergone the quality assessment tool, which is the RoB 2 or also known as the Revised Cochrane risk-of-bias tool used for the randomized trial as seen in Figure 4.

Risk of Bias Domains						
Study	D1	D2	D3	D4	D5	Overall
Arribas et al, 2022						
Jayk Bernal et al, 2022						

Domains:
D1: Bias arising from the randomization process
D2: Bias due to deviations from intended interventions
D3: Bias due to missing outcome data
D4: Bias in measurement of the outcome
D5: Bias in selection of the reported result.

Judgement
 High
 Some Concerns
 Low

Figure 4. Risk of Bias Domain through assessing Molnupiravir's efficacy in terms of mortality rate

All the included studies were done in a randomized manner. The final verdict for the risk of bias for Arribas et al. (2022) consists of a high risk result because domain 4 was considered to be high risk based on the reviewers verdict in terms of mortality rate of patients in Molnupiravir as for Bernal et al (2022) the reviewers results overall consisted some concern in domain 2 and domain 4 in the study therefore it had a verdict of some concerns but it was still included in the study of Molnupiravir. Assessment of risk bias were independently performed by A.K.M.O. and H.C.A. To cross-check the results of the study and to resolve any discrepancies present, the third reviewer, namely J.D.B. performed an independent review of the included studies based on the full guide for using the Cochrane Rob 2.0 tool.

3.4 Quality Assessment of Increased ALT Levels

Risk of Bias Domains						
Study	D1	D2	D3	D4	D5	Overall
Arribas et al, 2022						
Fischer et al, 2022						

Domains:
D1: Bias arising from the randomization process
D2: Bias due to deviations from intended interventions
D3: Bias due to missing outcome data
D4: Bias in measurement of the outcome
D5: Bias in selection of the reported result.

Judgement
 High
 Some Concerns
 Low

Figure 5. Risk of Bias Domain in evaluating the effect of Molnupiravir on the increased alanine aminotransferase levels

The included studies for systematic review and meta-analysis seen in Figure 5 were subjected through assessment of risk of bias using the Cochrane RoB 2.0 tool for randomized controlled trials (RCTs) (Ma et al., 2020). Molnupiravir's effect on increased alanine aminotransferase levels was evaluated in two studies. These studies were found to be high risk. Assessment of risk bias were independently performed by A.K.M.O. and H.C.A. To cross-check the results of the study and to resolve any discrepancies present, the third reviewer, namely J.D.B. performed an independent review of the included studies based on the full guide for using the Cochrane Rob 2.0 tool.

3.5 Results

Upon the implementation of the data mining process described in Figure 2, the following data were collected for investigating the effect of Molnupiravir as treatment for COVID-19 and its effect on aminotransferase levels in COVID-19 patients.

Table 2. Summary of Data collected from the studies qualified for investigating the effect of Molnupiravir as treatment for COVID-19 and its effect on aminotransferase levels in COVID-19 patients.

Study	Design	Locus	Official Title	Molnupiravir administered	Outcomes
Arribas et al. (2021)	RCT	United States, Brazil, Canada, Chile, Colombia, France, Israel, Italy, Republic of Korea, Mexico, Philippines, Poland, Russian Federation, South Africa, Spain, Ukraine, United Kingdom	<i>Randomized Trial of Molnupiravir or Placebo in Hospitalized with Covid-19</i>	200, 400, 800 mg	Mortality, Viral Load, Alanine aminotransferase levels
Jayk Bernal et al. (2022)	RCT	United States, Argentina, Brazil, Canada, Chile, Colombia, Egypt, France, Germany, Guatemala, Israel, Italy, Japan, Mexico, Philippines, Poland, Russian Federation, South Africa, Spain, Taiwan, Ukraine, United Kingdom	<i>Molnupiravir for Oral Treatment of Covid-19 in Nonhospitalized Patients</i>	800 mg	Mortality, Viral Load
Fischer et al. (2022)	RCT	United States	<i>A phase 2a clinical trial of Molnupiravir in patients with COVID-19 shows accelerated SARS-CoV-2 RNA clearance and elimination of infectious virus</i>	200, 400, 800 mg	Mortality, Viral Load, Alanine aminotransferase levels

All the included studies reported similar doses of Molnupiravir, which is 800 mg. A meta-analysis via forest plot was performed to interpret the data presented in Table 2.

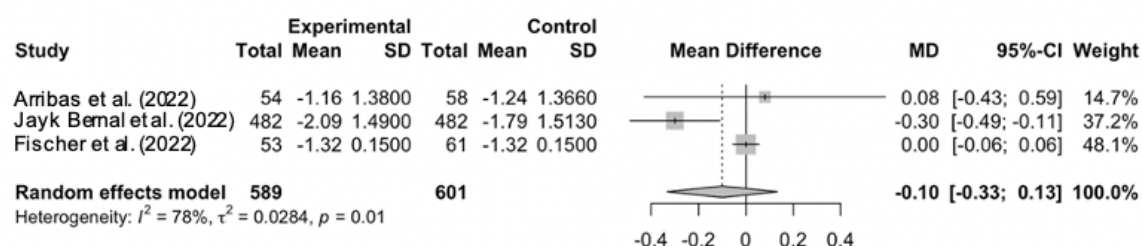


Figure 6. Forest Plot of the Meta-Analysis of the Effects of Molnupiravir in Viral Load

Figure 6 above shows the forest plot of the meta-analysis of the effects of Molnupiravir in viral load of COVID-19 patients. In the study by Arribas et al. (2022), the mean change of viral load from baseline in 54 patients treated with Molnupiravir was reported to be -1.16 compared to -1.24 mean change of viral load in 58 patients under control group. As for the study of Jayk Bernal et al. (2022), the mean change in viral load from baseline in Molnupiravir and control groups were reported to be -2.09 and -1.79, respectively. Meanwhile, Fischer et al. (2022) observed a -1.32 mean change in both Molnupiravir and non-Molnupiravir treatment groups. The researchers obtained a mean difference of 0.08, -0.30, and 0.00 for the studies of Arribas et al. (2022), Jayk Bernal et al. (2022), and Fischer et al. (2022), respectively. The overall mean difference of the studies is -0.0999 (95% CI: [-0.33, 0.13]). Since the confidence interval contains the value of 0, the difference between the Molnupiravir and placebo groups are not significant. This means that there is not enough evidence to conclude that Molnupiravir indeed can reduce viral load. Moreover, the studies included for analysis obtained a 78% heterogeneity. This means that the effect of Molnupiravir in viral load is inconsistent in between the studies.

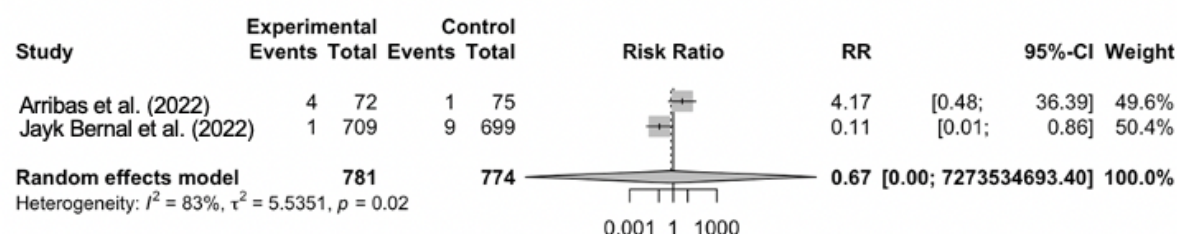


Figure 7. Forest Plot of The Meta-Analysis of the Effects of Molnupiravir in Mortality

Figure 7 shows the DerSimonian and Laird random effects meta-analysis on determining whether Molnupiravir is effective on improving the mortality rate compared to non-Molnupiravir treatment. In the study conducted by Arribas et al. (2022), four deaths out of the 72 patients were reported upon being treated with Molnupiravir; however, only one death was reported in the non-Molnupiravir treatment group. A relative risk of 4.17 was obtained in the study conducted by Arribas et al. (2022), which means that the likelihood of a patient to die using Molnupiravir is four times higher compared to the non-Molnupiravir treatment. On the other hand, in the study conducted by Jayk Bernal et al. (2022), one out of the 709 COVID-19 patients died upon administration of Molnupiravir, this is in comparison with the nine reported deaths out of the 699 COVID-19 patients which belongs to the control group. A relative risk of 0.11 was obtained for the study of Jayk Bernal et al. (2022), which means that there is a smaller chance that people die upon treatment with Molnupiravir. Therefore, an increased risk of mortality was observed in the study conducted by Arribas et al. (2022) which is in contrast with the results of the study of Jayk Bernal et al. (2022) which shows a reduced risk of mortality rate in patients treated with Molnupiravir. Overall, the relative risk of both studies resulted in a relative risk with a value of 0.67, thus, the

mortality rates decreased by about 33.00% upon intake of Molnupiravir. With the confidence interval containing our null value (which is 1), no significant difference was observed between the Molnupiravir and non-Molnupiravir treatment, thus, both treatments have a relatively equal behavior in terms of mortality rate. Moreover, the studies included for the analysis obtained a heterogeneity of 83% which indicates that the effect of Molnupiravir in mortality rates is inconsistent in between the studies.

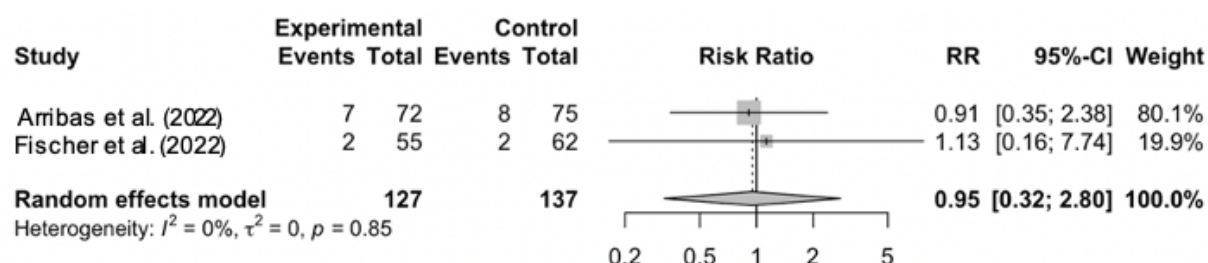


Figure 8. Forest Plot of The Meta-Analysis of the Effects of Molnupiravir in the Occurrence of increased ALT levels

Figure 8 presents the Dersimonian and Laird random effects meta-analysis regarding Molnupiravir treatment and its effect on the occurrence of increased ALT levels. For the study conducted by Arribas et al (2022), seven patients out of 72 had an increase in the ALT levels when administered with Molnupiravir, while in 75 patients that received placebo or non-Molnupiravir treatment, eight patients had an increase in ALT levels. On the other hand, for the study of Fischer et al. (2022), in patients who were administered with Molnupiravir, two out of 55 patients had an increase in ALT levels, while in patients who received placebo or non-Molnupiravir treatment, two out of 62 patients had an increase in ALT levels. In terms of the relative risk, for the study of Arribas et al. (2022), it is 0.91. With this, there is a 9% decrease in the occurrence of increased ALT levels with Molnupiravir treatment than with the non-Molnupiravir treatment. In the study by Fischer et al. (2022), the relative risk is 1.13, and with this, there is a 13% increase in occurrence of increased ALT levels with administration of Molnupiravir treatment compared to the non-Molnupiravir treatment. In general, using Molnupiravir gives a 5% decrease in occurrence of increased ALT levels. Furthermore, a 0% heterogeneity was seen in both studies, which may suggest that Molnupiravir's effect on the occurrence of increased ALT levels is consistent between the studies. However, since the confidence interval contains our null value (which is 1), the findings are insignificant.

4 DISCUSSION

For the meta-analysis regarding the efficacy of Molnupiravir in terms of viral load, the researchers determined that the mean difference of the SARS-CoV-2 viral load before and after using the Molnupiravir treatment has an average of -1.5233 units while -1.45 units for the non-Molnupiravir treatment group. This resulted in an overall mean difference of -0.0999, and the researchers are 95% confident that the average mean difference will fall between the confidence interval which is -0.33, 0.13. The findings were found to be statistically insignificant since the confidence interval contains our null value 0. This means that the difference between the Molnupiravir group and placebo group is not significant, and there is not enough evidence to conclude that Molnupiravir indeed can reduce viral load. This indicates that more studies are needed to be analyzed to fully assess the effect of Molnupiravir treatment in the viral load of COVID-19 patients. Reduction in viral load upon using Molnupiravir was supported in the study by Caraco et al. (2021), wherein reduced viral RNA load titer obtained from nasopharyngeal swab samples were reported among COVID-19 patients treated

with Molnupiravir. However, viral load reduction was said to be expected as it targets the replication process of the SARS-CoV-2 virus that is dependent on its conserved viral protein (Bojkova et al., 2022, Vangeel et al., 2022).

Effect of Molnupiravir treatment was also assessed in this study regarding mortality through meta-analysis. Overall, the researchers have determined that the mortality rate in the Molnupiravir treatment group is equal to 0.64%, while the mortality of the respondents who used the non-Molnupiravir treatment is equal to 1.29%. This resulted in a relative risk of 0.67, which means that the mortality rate decreases by 33.00% when they receive the Molnupiravir treatment than those who receive the non-Molnupiravir treatment. However, since the confidence interval, which is 0.0000; 7273534693.4025, contains our null value 1, the findings are statistically insignificant. Therefore, the researchers suggest that more clinical trials and articles should be used to assess the effect of Molnupiravir on mortality rates as limited data from clinical trials were used in the study. In a phase 3 randomized, double-blind clinical trial by Merck Sharp & Dohme LLC, data have shown that the risk of hospitalization for any cause of mortality through day 29 has been reduced in patients administered with Molnupiravir. Similarly, in comparison with the study conducted by Jayk Bernal et al. (2022), the risk of hospitalization or mortality at day 29 was said to be 6.8% and 3% lower in comparison to the placebo group and all-randomized analysis, respectively. However, although similar results were also seen in the study conducted by Bai et al. (2022), Molnupiravir is said to have limited potential in inhibiting virus replication. The claims of the previous systematic reviews and meta-analyses support the claims of the researchers that the administration of Molnupiravir has a significant beneficial effect in terms of reducing hospitalization or mortality in COVID-19 patients.

Meta-analysis of occurrence of increased ALT levels was also assessed in this study to determine Molnupiravir's effect on the liver. The researchers have determined that the occurrence of the increased ALT of the respondents who use the Molnupiravir treatment is equal to 7.09% of the experimental group, while the occurrence of the increased ALT of the participants who use the non-Molnupiravir treatment is equal to 7.30%. This resulted into a relative risk of 0.95, which means that the occurrence of increased ALT levels decreases by 5.00% when they receive the Molnupiravir treatment than those who receive the non-Molnupiravir treatment. The number of patients that had an increase in ALT levels in either the Molnupiravir group or non-Molnupiravir group, were almost relatively equal, despite the different sample sizes, wherein there are nine of 127 patients in the Molnupiravir group, compared to the 10 out of 137 patients who received the non-Molnupiravir treatment. Although the number of patients who received non-Molnupiravir was slightly higher than the Molnupiravir group, those that had increased ALT levels in the non-Molnupiravir group was slightly higher as well in comparison to the Molnupiravir group. However, since the confidence interval, which is 0.3232; 2.7974, contains our null value 1, the findings are insignificant. There were only two studies analyzed, so the researchers suggest that more studies will be needed to determine the effect of Molnupiravir on occurrence of increased ALT levels. Moreover, comparison with other studies cannot be made since no other systematic reviews or meta-analysis were found regarding Molnupiravir's effect on occurrence of increased ALT levels. With this, it makes this study a novel one since this is the first systematic review and meta-analysis which measures the occurrence of increased ALT levels on COVID-19 treated with Molnupiravir.

4.1 Limitations

The results of the systematic review and meta-analysis of this study poses several limitations. The limitations of this study includes: (1) Limited journals were available from 2020 to 2022 since Molnupiravir was a recently recognized drug candidate for treatment of COVID-19; (2) Limited

sample size for data analysis since out of the three articles included, two studies were only at Phase-2 and only one study at Phase-3; (3) Each of the study had few similar variables with each other; (4) Only the 800 mg dosing regimen was used to measure the outcomes since the studies have different regimens for administering Molnupiravir, except for 800 mg dosage; (5) There is an insufficient number of completed clinical trial that can be used; (6) The benefit of Molnupiravir to moderate to severe COVID-19 cases was not included in the analysis due to the limited data available; (7) Participants in the included studies may have underlying comorbidities or were subjected to other medications, hence, these may have contributed confounding factors to the findings obtained; and (8) The clinical studies included in the study were determined to be of high risk of bias.

5 CONCLUSION

Molnupiravir to treat COVID-19. Three Molnupiravir studies and randomized clinical trials were used to review collected viral load data systematically; two studies were also used to assess the mortality rate and the increased ALT levels. The researchers found that there was no sufficient evidence or data to assess these objectives efficiently. Thus, it is statistically insignificant. The viral load was lower in Molnupiravir than in the control group. The findings have been statistically insignificant since there is no difference between the effect of Molnupiravir compared to the placebo. The Molnupiravir treatment group had lower mortality rates compared to the control group. As a result, the findings indicate that Molnupiravir has the potential to reduce mortality rates in COVID-19 patients, yet despite the promising results, it is still insignificant since there is no difference in the treatment itself. Increased ALT levels were only slightly lower in the Molnupiravir group compared to the non-Molnupiravir group studies. Thus, Molnupiravir may decrease the incidence of elevated ALT levels. However, only two studies were analyzed, and the results were insignificant overall, implying that more research studies are needed. Thus, the study is inefficient in concluding that Molnupiravir can decrease the viral load and mortality rate. Moreover, the increased occurrence of alanine aminotransferase levels is slightly evident, but findings are statistically insignificant upon assessment due to limited data available.

There have been several therapeutic agents that have recently been evaluated for the treatment of COVID-19 and one of which is Molnupiravir. Hence, this study was conducted to provide a comprehensive overview of Molnupiravir as a drug of choice for COVID-19. In addition, this study evaluated and summarized relevant studies regarding the possible effect of Molnupiravir on alanine aminotransferase (ALT) levels in patients with COVID-19. If it is found out that Molnupiravir is an acceptable treatment for COVID-19 cases in terms of efficacy and safety, this will provide evidence-based knowledge to medical experts as well as medical practitioners who are the decision-makers in providing proper treatment to the diseases. In relation to this, physicians therefore will be able to assess possible effects and risks of treatment to their respective patients. Hence, after proper assessment of this study is done through careful evaluation of relevant information along with the right parameters, medical practitioners can widen their knowledge about Molnupiravir and expand their options in possible treatment for COVID-19, thus helping patients to possibly extend their lifespan through the efficacy of Molnupiravir as a drug of choice for treatment of COVID-19. Furthermore, this study may impart extensive knowledge to students and researchers about the efficacy of Molnupiravir in connection to the reduction in viral load and mortality rate, and safety in terms of occurrence of increased ALT levels. With this, students and future researchers can use this study as reference and source of information as well as evidence to support their future studies. Lastly, may this study be of great relevance to our society.

Ethical Considerations

There was no human subject participation involved in the study since it only includes the systematic assessment and synthesis of data from published studies. No ethical approval was required for the completion of study analysis.

Conflict of Interest

The authors of the study declared no competing interests in the conducted research.. If there is no conflict of interest, please state: “Authors declare no conflict of interest.”

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Predicting the Mortality of ICU Patients with Heart Failure: An Improved Stacking Ensemble Model

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ABSTRACT

Cardiovascular diseases have been identified as one of the top three causes of death worldwide, with onset and deaths mostly due to heart failure (HF). In ICU, where patients with HF are at increased risk of death and consume significant medical resources, early and accurate prediction of the time of death for patients at high risk of death would enable them to receive appropriate and timely medical care. The data for this study were obtained from the MIMIC-III database, where we collected vital signs and tests for 6,699 HF patient during the first 24 hours of their first ICU admission. In order to predict the mortality of HF patients in ICUs more precisely, an integrated stacking model is proposed and applied in this paper. In the first stage of dataset classification, the datasets were subjected to first-level classifiers using RF, SVC, KNN, LGBM, Bagging, and Adaboost. Then the fusion of these six classifier decisions was used to construct and optimize the stacked set of second-level classifiers. The results indicate that our model obtained an accuracy of 95.25% and AUROC of 82.55% in predicting the mortality rate of HF patients, which demonstrates the outstanding capability and efficiency of our method. In addition, the results of this study also revealed that platelets, glucose, and blood urea nitrogen were the clinical features that had the greatest impact on model prediction. The results not only improve the understanding of patients' conditions by healthcare professionals but allow for a more optimal use of healthcare resources.

KEYWORDS: heart failure, mortality, intensive care units, machine learning, stacking, electronic health records.

1 INTRODUCTION

Cardiovascular diseases (CVD) have ranked among the top three causes of death worldwide for many years, accounting for an estimated 18.9 million deaths per year, or approximately 31% of global mortality (Virani et al., 2020). The majority of CVD morbidity and mortality are derived from Heart Failure (HF), a common cardiovascular disease in which the heart fails to maintain the body's metabolism. Patients with HF experience a variety of overt symptoms such as shortness of breath, swollen ankles, and physical fatigue, and may also show signs of elevated jugular venous pressure, pulmonary fissures, and peripheral edema caused by cardiac or noncardiac structural abnormalities (L. Chen et al., 2021). As a major cause of cardiovascular morbidity and mortality, HF poses a significant threat to human health and social development (F. Li et al., 2021). In the face of the increasing number of people with HF, despite the rapid advances in medical technology and significant technological advances in diagnosis, assessment, and cardiovascular disease (Incidence, 2017), HF remains a major medical problem worldwide.

According to the World Federation of Societies of Intensive and Critical Care Medicine, an Intensive Care Unit (ICU) is an organized system for the provision of care to critically ill patients that provides intensive and specialized medical and nursing care, an enhanced capacity for monitoring, and multiple modalities of physiologic organ support to sustain life during a period of life-threatening organ system insufficiency (Marshall et al., 2017). As a result, the healthcare system is under a heavy burden, which may affect the criteria for ICU admission, the interventions used, and the duration, all of which may affect the patient's prognosis (Haase et al., 2020). Clinical decision-making in the ICU is time critical and highly dependent on the analysis of physiological data. If there is not enough real-time patient information to make accurate and rapid decisions in a dynamic and rapidly changing environment, it will be challenging for medical professionals to make clinical decisions (W. Chen et al., 2019). Patients admitted to the ICU require close and continuous monitoring to avoid the possibility of rapid deterioration of their health status, therefore, intensive monitoring through ICU equipment generates a large number of medical records and requires efficient and accurate systems to aid in data analysis (El-Rashidy et al., 2020). Using big data for clinical and basic research analysis and applications to improve human well-being and health, such as big data combined with artificial intelligence, can help doctors diagnose and treat diseases and improve the quality of care. Predictive models have been developed over the last few decades as important risk assessment tools and are utilized in a variety of healthcare settings (Kim et al., 2021).

Machine learning (ML) is a branch of artificial intelligence that focuses on training computers to learn from data collected and make improvements based on learned experience, and it is concerned with the problem of constructing computer programs that can automatically improve the accuracy of their output based on experience (Mitchell, 1997). Recently, ML has been increasingly introduced into clinical practice, with applications including preclinical data processing, bedside diagnostic assistance, patient stratification, treatment decision-making, and early warning as part of primary and secondary prevention (Adlung et al., 2021). In recent years, some researchers have applied ML techniques for mortality prediction in HF patients. For example, Negassa et al., developed an ensemble model for the prediction of 30-day mortality in patients with HF after discharge from hospital (Negassa et al., 2021). Luo et al., constructed a risk stratification tool by utilizing the extreme gradient boosting algorithm to correlate clinical features of HF patients with in-hospital mortality rates (Luo et al., 2022). Therefore, accurate prediction of hospital mortality has remained a challenge to date.

Given that each ML method may outperform or have shortcomings in different situations, developing a model that integrates multiple ML methods to obtain better performance has become a new research approach. Bagging involves training several base learners with different bootstrap samples, then consolidating them and voting on the result (Breiman, 1996). Stacking is a powerful ensemble technique that harnesses the predictions of multiple base learners as features to train new meta learners (Wolpert, 1992). Jia (Jia et al., 2021) proposed a stacked approach for ML to efficiently and rapidly construct 3D multi-type rock models using geological and geophysical datasets. In this paper, we deployed the stacking method to perform mortality prediction model construction for HF patients in ICU, which consists of Random Forest (RF), Support Vector Classifier (SVC), K-Nearest Neighbors (KNN), Light Gradient Boosting Machine (LGBM), Bootstrap aggregating (Bagging), and Adaptive Boosting (AdaBoost).

In this study, we used detailed clinical data from the MIMIC-III database, and focused on the collected data of ICU center patients suffering from heart diseases to predict the mortality of HF patients at 3 days, 30 days, 3 months and 1 year after admission to ICU using ML modeling techniques. This study focuses on proposing a stacking-based model to predict mortality in patients with HF. The base estimators can be adaptively selected and applied to the base layer of the stacking model. In addition, in the selection of key variables, it is expected that the constructed model can also successfully identify the important vital signs indicators of HF patients. We hope to improve the prediction of mortality in patients with heart disease by medical professionals, so that patients, their families and medical professionals are afforded with more informed judgments and make more appropriate prognostic preparations.

2 MATERIALS AND METHODS

2.1 Patient selection and variable selection

The MIMIC-III dataset was used in this study. MIMIC-III integrates comprehensive clinical data of patients admitted to the Beth Israel Deaconess Medical Center (BIDMC) in Boston, Massachusetts. The dataset collected de-identified data on 46,520 ICU admissions from 2001 to October 31, 2012 (Johnson et al., 2016). For this study, in order to prevent possible information leakage and ensure a similar experimental setting compared to the related work, we used only the first ICU admission data for each patient. To emphasize the early predictive value, we used data from the first 24 hours of patient admission as input to the predictive model and excluded patients younger than 16 years of age (Gangavarapu et al., 2020; Tang et al., 2021; Yu et al., 2020). A patient cohort was selected based on the following exclusion criteria: The first ICU stay without all subsequent ICU stays, single ICU stay more than 24 hours, patients' first 24 hour of ICU admission, and adult patients (age ≥ 16). Patients with discharge diagnosis as HF were screened out based on the International Classification of Diseases, 9th Revision codes (ICD-9) 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.xx (W. Q. Guo et al., 2021; Tang et al., 2020). After the first stage of data screening, a total of 7,278 eligible patients were qualified.

The data for the predictive variables selected in this paper were obtained from two tables: admission table and chartevents table in the MIMIC-III database. As a result of the study, we referred to the predictive variables that have been used by other researchers to predict HF mortality in patients (L. Chen et al., 2021; W. Q. Guo et al., 2021; F. Li et al., 2021) by measuring clinical symptoms 24 hours before admission to the ICU, including Heart Rate, Respiratory Rate, Diastolic Blood Pressure, Systolic Blood Pressure, Temperature,

Oxygen Saturation, Blood Urea Nitrogen, Creatinine, Mean Blood Pressure, Glucose, White Blood Cell, Red Blood Cell, Prothrombin Time, International Normalized Ratio, Platelets, GCS Eye, GCS Motor, GCS Verbal, and Patient's Age and Gender.

In addition, for the treatment of missing values, the data preprocessing method of Guo et al., (C. H. Guo et al., 2020) was adopted in this study to perform a three-stage missing value treatment. Firstly, patients with more than 30% missing values were removed, thus 579 patients were removed. Secondly, variables with more than 40% missing values of the predictor variables were removed. Finally, statistics with missing values greater than 20% for these indicators were removed, and the remaining missing values were interpolated using menus. Finally, a total of 6,699 patients were used in this study.

2.2 Proposed Framework

Mortality rate is a major outcome in acute care: ICU mortality is the highest among hospital units, and early identification of high-risk patients is key to improving outcomes (Harutyunyan et al., 2019). We use ICU admission records of HF patients in the MIMIC-III dataset to predict mortality in HF patients at different time points. We propose an ensemble learning model based on stacking. In the first layer of the stacking model we applied six ML methods, including RF, SVC, KNN, LGBM, Bagging and Adaboost to perform a first-level classifier on the dataset. Then the fusion of these six classifier decisions was used to construct and optimize the stacked set of classifiers. This was followed by subjecting the datasets to second-level classifier using LGBM, and formed the final prediction.

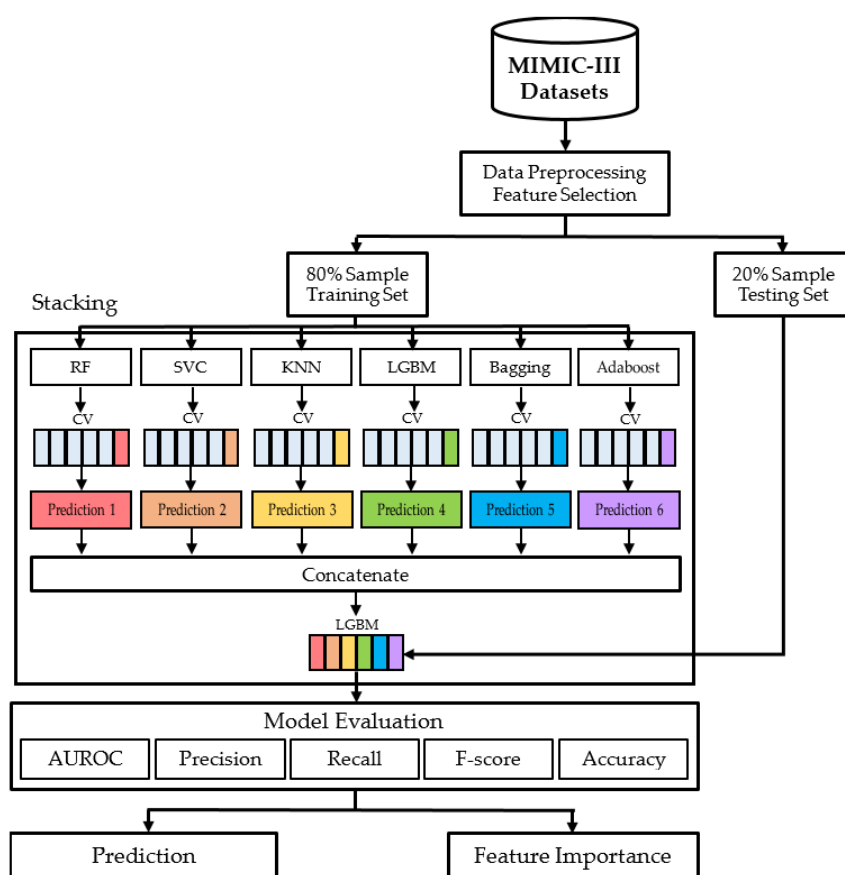


Figure 1. Stacking ensemble based on a cross-validation of all feature subsets.

2.3 Machine Learning

In this study, the most popular and diverse classifiers in related literature were applied in the mortality prediction model for patients with HF in the ICU. Six commonly used ML algorithms include: Random Forest (RF), Support Vector Classification (SVC), K-Nearest Neighbors (KNN), and Light Gradient Boosting Machine (LGBM), Bootstrap aggregating (Bagging), and Adaptive Boosting (AdaBoost).

- Random Forest (RF) is an ensemble supervised ML algorithm. It uses decision trees as the basic classifier. RF generates many classifiers and combines their results by majority voting. The random forest algorithm is well suited to handle datasets with missing values. (K. Li et al., 2021)
- Support Vector Classifier (SVC) performs classification and regression analysis on linear and non-linear data. SVC aims to identify classes by creating decision hyperplanes in a non-linear manner in a higher eigenspace (Nanayakkara et al., 2018).
- The K-Nearest Neighbors (KNN) algorithm is used to predict binary or sequential outputs. The data is divided into clusters and the number of nearest neighbors is specified by declaring the value of "K", a constant. KNN is an algorithm that stores all available instances and classifies new instances based on a similarity measure (K. Li et al., 2021).
- Light Gradient Boosting Machine (LGBM) is an ensemble approach that combines predictions from multiple decision trees to make well-generalized final predictions. LGBM divides the consecutive eigenvalues into K intervals and selects the demarcation points from the K values. This process greatly accelerates the prediction speed and reduces storage space required without degrading the prediction accuracy (Song et al., 2021).
- The Bootstrap aggregating (Bagging) algorithm is an ensemble learning algorithm in the field of machine learning. Bagging algorithm can be combined with other classification and regression algorithms to improve its accuracy, stability, and avoid overfitting by reducing the variance of the results (Ali et al., 2016).
- The self-adaptive nature of the Adaptive Boosting (AdaBoost) method is that the wrong samples of the previous classifier are used to train the next classifier, therefore, the AdaBoost method is sensitive to noisy data and anomalous data. It trains a basic classifier and assigns higher weights to the misclassified samples. After that, it is applied to the next process (Lee et al., 2021).

2.4 Stacking Ensemble Technique

Stacking is an ensemble method for connecting multiple different types of classification models through a meta-classifier (Verma & Pal, 2020). Generally, base learners are called first-level learners and combinatorators are called second-level learners or meta learners. The basic principle of stacking is as follows. First, the first-level learner is trained using the initial training dataset. Then, the output of the first-level learner is used as the input feature of the meta learner. Finally, a new dataset is formed using the corresponding original labels as new labels to train the meta learner (Cui et al., 2021). As heterogeneous ensembles have better generalization performance and prediction accuracy, this paper proposes a stacked ensemble classifier that can be divided into two stages. First, we use RF, SVC, KNN, LGBM, Bagging and Adaboost as the base classifiers in the first stage. The individual six classification models are trained using the complete training set; then, the probabilistic outputs obtained in the first

stage are fed into the meta-classifier in the second stage, and then the meta-classifier is fitted based on the output meta-features of each classification model using the chosen ensemble techniques. The meta classifier can be trained on the predicted category labels or probabilities from the ensemble technique.

2.5 Synthetic Minority Oversampling Technique (SMOTE)

In ML, the problem is imbalanced when the class distribution is highly skewed. Imbalanced classification problems usually occur in many applications and pose obstacles to traditional learning algorithms (Raghuwanshi & Shukla, 2021). SMOTE is a powerful solution to the classification imbalance problem and has delivered robust results in various domains. The SMOTE algorithm adds synthetic data to a small number of classes to form a balanced dataset (Raghuwanshi & Shukla, 2021). The core of the method is to perform random undersampling and oversampling for larger samples and smaller samples, respectively. In the MIMIC-III used in this study, only a few patients died during their ICU admission. Therefore, the SMOTE method, which uses synthetic minority sampling techniques to preprocess highly imbalanced data sets, was used in this study.

2.6 Evaluation criteria

The performance of the full classification is measured using different evaluation parameters, which consist of binary values (positive and negative). Two general evaluation measures, precision and recall, were used to evaluate the sentiment of tweets based on positive and negative polarity, including Accuracy and F-score for micro averaging purposes. Four functional accuracy measures were taken into account based on the outcomes of the confusion matrix named true positive (TP), true negative (TN), false positive (FP), and false negative (FN). The evaluation parameters used to measure the performance of our proposed system are listed below: we applied Precision, Recall, F-score, and Accuracy, which are widely used in the research field, to evaluate the results of our study, defined as follows:

$$Precision = PPV = \frac{TP}{TP + FP} \quad (1)$$

$$Recall = TPR = \frac{TP}{TP + FN} \quad (2)$$

$$F - score = \frac{2 * Precision * Recall}{Precision + Recall} \quad (3)$$

$$Accuracy = \frac{TP + TN}{TP + FP + TN + FN} \quad (4)$$

In addition, this study adopts the area under the receiver operating characteristic (AUROC) to measure the predictive performance of the model. The area under the receiver operating curve is primarily used to measure the classification threshold performance of classifiers. ROC is a curve consisting of points generated by the true positive rate (TPR) and false positive rate (FPR) of model. TPR signify the probabilities that models can correctly locate positive samples. Such probabilities are commonly referred to as recall rates and represent revenue. By contrast, FPR signify the probabilities that models incorrectly locate positive samples and represent losses. AUROC values range from 0 to 1, where the larger the value, the more superior the result (Song et al., 2021)

3 RESULTS

3.1 Baseline Characteristics

The study was from the MIMIC-III database and ultimately used the ICU admission records of 6,699 HF patients. Table 1 provides demographic information on HF patients. The mean age of the patients in this study was 70.3 years, 55% of whom were male, and the mean number of days hospitalized and the mean number of days in the ICU was 5.8 days.

Table 1. Features involved in the model.

	Overall	Alive at ICU	Dead at ICU
General			
Number	6,699 (100%)	5,754 (85.89%)	945 (14.11%)
Age (Q1-Q3)	70.31±13.04	69.88±13.03	72.92±12.74
Gender (male)	3,694 (55.14%)	3,185 (55.35%)	509 (53.86%)
Outcomes			
Hospital LOS (days) [Q1-Q3]	13.04 [5.99-16.00]	12.78 [6.06-15.77]	14.60 [5.27-19.09]
ICU LOS (days) [Q1-Q3]	5.79 [1.93-6.23]	5.40 [1.88-5.77]	8.17 [2.38-10.38]
Care Unit Type			
CCU	1,852 (27.65%)	1,633 (28.38%)	219 (23.17%)
CSRU	1,319 (19.69)	1,240 (21.55%)	79 (8.36%)
MICU	2,537 (37.87%)	2,049 (35.61%)	488 (51.64%)
SICU	635 (9.48%)	526 (9.14%)	109 (11.34%)
TSICU	356 (5.31%)	306 (5.32%)	50 (5.29%)

MICU Denotes Medical ICU; SICU Denotes Surgical ICU; CCU Denotes Coronary Care Unit; CSRU Denotes Cardiac Surgery Recovery Unit; TSICU Denotes Trauma Surgical ICU

3.2 Mortality prediction results of different models

In this study, a 10-fold cross-validated training and testing was used, with 80% of the data used for training the model and 20% for testing the model, followed by extensive statistical analysis to evaluate performance. Table 2 lists the six different ML methods used in the first phase of this study, and the addition of the Stacking technique in the second phase involved seven techniques to generate the AUROC of HF patient mortality prediction tasks over four different time periods. This study determined the highest AUROC for predicting 3 days mortality in patients with HF, i.e., death within 3 days could be accurately predicted within 24 hours of patient admission. Figure 2 indicates that the data collected from ICU admissions can be used to predict mortality within 3 days, which is a better prediction outcome; Figure 2 also clearly shows that all four models have high AUROC after adding stacking technique in the second stage, which means they can distinguish mortality from non-mortality cases well.

Table 2. The AUROCs of different classifiers.

	RF	SVC	KNN	LGBM	Bagging	Adaboost	Stacking
3 Days	0.7598	0.7249	0.7490	0.7868	0.7534	0.7230	0.8255
30 Days	0.7472	0.7179	0.7476	0.7724	0.7442	0.7168	0.8052
3 Months	0.7433	0.7002	0.7313	0.7596	0.7338	0.7005	0.7830
1 Year	0.6998	0.6671	0.6958	0.7269	0.7014	0.6706	0.7532

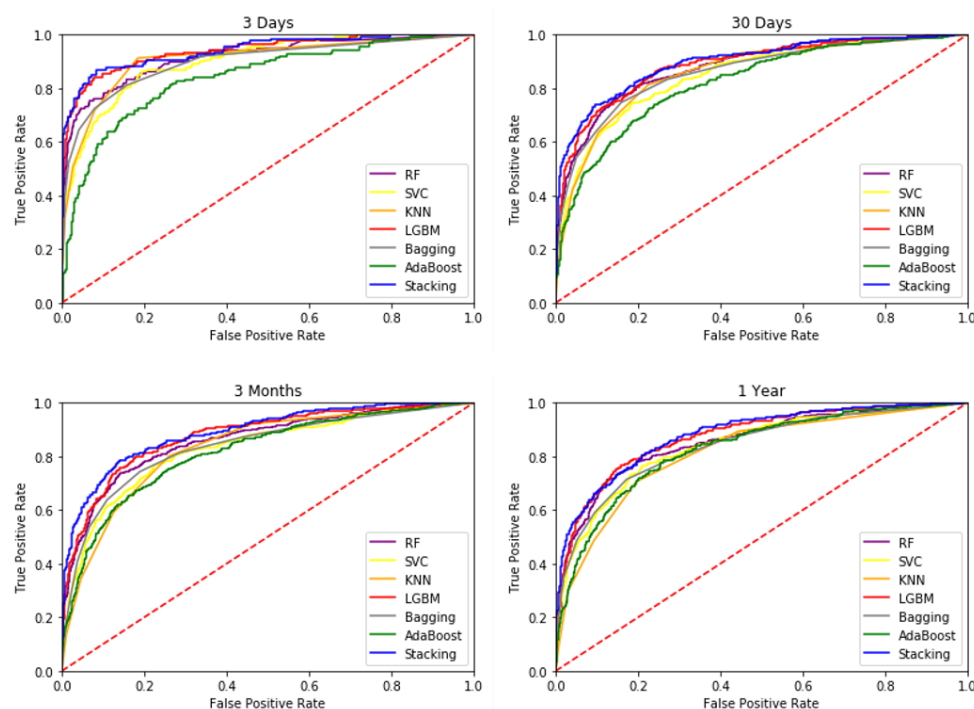


Figure 2 The ROC curves of all base models.

In addition to the above AUROC, this study also compares Precision, Recall, F-score, and Accuracy, as shown in Table 3, when evaluating the performance of different attribute sets used in the classification algorithm. The best precision and recall was shown in a run where the 3 days mortality was used to select the best subset of attributes. In addition, it can be observed from the addition of Stacking technique in the second stage results in a higher accuracy, with the highest value of 0.9525 for predicting mortality within 3 days. It also demonstrated that this study could achieve very good results in predicting mortality in HF patients using data from 24 hours before the patients were admitted to ICU.

Table 3. Diagnostic Precision, Sensitivity, F-Score, and Accuracy of different classifiers.

	Method	Precision	Recall	F-score	Accuracy
3 Days	RF	0.9167	0.3429	0.4989	0.9343
	SVC	0.8991	0.1920	0.3105	0.9208
	KNN	0.6635	0.5198	0.5824	0.9288
	LGBM	0.8763	0.5821	0.6989	0.9425
	Bagging	0.8176	0.3959	0.5322	0.9343
	AdaBoost	0.5937	0.3082	0.4044	0.9139
	Stacking	0.8030	0.6682	0.7286	0.9525
30 Days	RF	0.7857	0.5455	0.6435	0.8457
	SVC	0.7389	0.4962	0.5934	0.8262
	KNN	0.6399	0.6145	0.6264	0.8126
	LGBM	0.7704	0.6069	0.6789	0.8533
	Bagging	0.7526	0.5508	0.6355	0.8387
	AdaBoost	0.6827	0.5170	0.5871	0.8142
	Stacking	0.7831	0.6747	0.7247	0.8690
3 Months	RF	0.7878	0.5372	0.6385	0.8429
	SVC	0.7577	0.4505	0.5647	0.8206
	KNN	0.6507	0.5692	0.6072	0.8095
	LGBM	0.7712	0.5792	0.6613	0.8466
	Bagging	0.7476	0.5304	0.6200	0.8320

	AdaBoost	0.6844	0.4780	0.5625	0.8079
	Stacking	0.7720	0.6311	0.6939	0.8564
1 Year	RF	0.7600	0.4412	0.5577	0.8397
	SVC	0.7490	0.3722	0.4961	0.8267
	KNN	0.6252	0.4767	0.5408	0.8144
	LGBM	0.7405	0.5069	0.6017	0.8460
	Bagging	0.7114	0.4583	0.5569	0.8332
	AdaBoost	0.6558	0.4046	0.5001	0.8147
	Stacking	0.7428	0.5651	0.6414	0.8551

3.3 Interpretation of variable importance

Feature importance is the main contribution of each feature to improve the predictive power of the whole model. It provides an intuitive view of the importance of features to see which features have a greater impact on the final model, but it is not possible to determine how the features relate to the final prediction. We can observe that the clinical characteristics of Platelets, Glucose, Blood Urea Nitrogen, Age, Heart Rate, Systolic Blood Pressure, and Diastolic Blood Pressure are important factors influencing the prediction of HF, and previous studies of HF Similar results have been found in previous studies of HF (Barnett et al., 2019; Wallner et al., 2018). However, the effects of GCS eye, GCS motor, GCS verbal, Red Blood Cell, International Normalized Ratio and Gender were not as significant.

In our study, we collect some most important clinical features that contributed most to the model at four different prediction times. The contributions are ranked from most important to least important. We can find that, in addition to considering an HF patient's Platelets, Glucose, and Blood Urea Nitrogen, Systolic Blood Pressure and Diastolic Blood Pressure are also important variables in predicting 3 days, 30 days, and 3 months mortality of HF patients in the ICU. Heart Rate is an important variable to be considered when predicting 1 year mortality in patients with HF in ICU.

4 DISCUSSION

The feasibility of the ML technique for mortality prediction in HF patients has been previously demonstrated. Luo et al., constructed a risk stratification tool using the extreme gradient boosting algorithm to correlate patient clinical characteristics with in-hospital mortality, and this new ML model outperformed traditional risk prediction methods with an AUC of 0.831(Luo et al., 2022). Negassa et al., developed an ensemble model for 30-day post-discharge mortality and used discrimination, range of prediction, Brier index and explained variance as metrics to evaluate model performance, the discrimination achieved by the ensemble model was higher 0.83 (Negassa et al., 2021). The aim of this study is to predict the mortality of ICU patients by ML model from structural vital signs data collected during the ICU stay of HF patients. Through in-depth analysis of the experimental results, the following conclusions were drawn from this study. First, the data collected during the first 24 hours after the admission of HF patients to the ICU were used for modeling analysis, and the ML stacking method was effective and rapid in constructing predictive models. The results indicated that our proposed stacking method has good performance in predicting mortality in HF patients with Accuracy (95.25%) and AUROC (82.55%). Second, this study also found that Platelets, Glucose, and Blood Urea Nitrogen were the clinical characteristics that had the greatest impact on model prediction and were important indicators to be considered in the selection of important variables, which is in line with previous studies on HF (Barnett et al., 2019).

There are some limitations to this study. First, in this study, in order to consider the convenience and completeness of data collection, only ICU databases with the easiest access to complete dynamic patient information were considered. The MIMIC-III data used in this study were obtained from the Beth Israel Deaconess Single Medical Center in Boston, Massachusetts, USA. However, the broader application of our ML model requires further validation in different statistical populations. More comprehensive results and validation may be obtained for patients in other types of medical institutions such as large hospitals or small clinics, or in medical institutions of other scales. Second, the data used in this study were limited to the data collected during the first ICU stay, excluding the records and reports of patients readmitted to the hospital. The collection of data from multiple ICU hospitalizations may provide a comprehensive assessment of time series issues, or may provide more different levels of analysis to patients, healthcare professionals, and patients' families for future evaluation and prognosis.

5 CONCLUSIONS

In our study, we used detailed clinical data from the MIMIC-III database to predict mortality at 3 days, 30 days, 3 months, and 1 year after admission to the ICU for patients with HF, using ML modeling techniques, based on data collected from patients suffering from cardiovascular diseases and being treated in an ICU. We developed mortality prediction models for HF patients admitted to ICU that can be used in ICU monitoring techniques. Our model involves a small number of routinely collected variables that can be easily used in the clinical setting. Despite the recent development of various severity scores and ML models for early mortality prediction, such predictions remain challenging. Compared to existing solutions, this study provides a complement to current clinical decision-making methods by proposing a new stacked ensemble approach to predict mortality in patients with HF in the ICU. The base estimators can be adaptively selected and applied to the base layer of the stacking model. Our stacking model is significantly better than the traditional ML approach in mortality prediction, and can successfully screen out the important clinical features of HF patients. It can empower health care professionals to better predict mortality in HF patients, and provide patients, their families and medical professionals with more information to determine the status of patients and make more appropriate prognosis. For follow-up studies, this study suggests the following recommendations for future studies:

The MIMIC-III data is relatively rich and complete, and this study only modeled and predicted the mortality of patients; subsequent studies can be conducted to evaluate the readmission, length of stay, medication use, and complications of patients with reference to the framework of this study. This type of study can be made more objective and complete if it can be extended to conduct more comprehensive evaluation and analysis. The evolution of variables over time can be collected from patient EHR data in an attempt to obtain better predictive effects. In terms of research methods, future research can attempt different ML methods as well as deep learning methods that have recently been applied to solve time-series data more effectively. For example, long short-term memory or recurrent neural network(Ping et al., 2020) are common deep learning models.

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Predictors for COVID-19 Infection in a Tertiary Hospital in Manila

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Abstract

COVID-19 laboratory biomarkers must be established since infected individuals, especially those with comorbidities and the elderly, may develop multiple organ failure. This retrospective, non-experimental, quantitative, and comparative study aimed to identify the significant association of the five predictors: procalcitonin (PCT), high-sensitivity C-reactive protein (hs-CRP), ferritin, lactate dehydrogenase (LDH), and D-dimer, with the severity of COVID-19 infection among patients in a tertiary hospital. The secondary data was collected from a tertiary hospital and a total of 256 samples were included in the study through the non-probability sampling technique, purposive sampling. The data were processed with the use of IBM SPSS Statistics 25. Results obtained objectively compared the changes in the values of the predictors in severe versus non-severe COVID-19. All predictors showed elevated values except for PCT in age groups 19 to 38 years old for non-severe COVID-19 and PCT and D-dimer in age groups 39 to 49 years old for severe COVID-19. PCT, ferritin, and LDH values were higher for severe COVID-19 except age groups 39 to 49 years old for PCT and D-dimer, while hs-CRP values were only higher for age groups 19 to 49 years old and D-dimer for age groups 19 to 38 years old and 61 to 72 years old and above. Among these predictors, it may be concluded that PCT, ferritin, and LDH revealed a significant difference (p-value of <0.05) between severe and non-severe COVID-19 patients, while hs-CRP and D-dimer were insignificant. Consequently, ferritin, procalcitonin, and D-dimer were found to present a satisfactory level of prediction with 81.8% and an R value of .905. Moreover, the best fit model with the stated predictors indicates a directly proportional relationship with the expected probability of having severe COVID-19 infection. Therefore, the study rejected the null hypothesis, indicating that there was a significant difference between the laboratory test results (PCT, hs-CRP, ferritin, LDH, and D-dimer) of severe and non-severe COVID-19 infection.

Keywords: COVID-19; predictors; procalcitonin; lactate dehydrogenase; ferritin; high sensitivity C-reactive protein; D-dimer

Quality of life of Portuguese undergraduate Nursing students: Relation with sociodemographic characteristics

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ABSTRACT

Throughout life there are factors that interfere with an individual's Quality of Life (QoL). The admission to university constitutes one of these factors, since it demands substantial changes in one's lifestyle, implying a process of transition in young adults. Hence the importance of assessing the QoL of university students. This study aims to analyse the relationship between QoL and their sociodemographic characteristics. This is an observational, descriptive-correlational and cross-sectional study, with a sample of 289 undergraduate nursing students who received a questionnaire that included the WHOQOL-Brief scale to assess QoL. Data were processed using IBM Statistics (Version 25.0), using descriptive and inferential statistics. The significance level adopted was 5%. Of the total sample (n= 289), most were female (77.0%), in the 20-21 age group (40.5%), single (95.5%) and the largest group was classified in the middle class of Socio-Economic Level (SEL) (39.4%). The mean age was 21.29 ± 4.398 years, the minimum age 18 years and the maximum age 53 years. The mean Global QoL was 63.48 ± 10.64 points. The mean Global QoL differed among students of different gender (Student's t: $p < 0.003$), different age group (ANOVA: $p < 0.038$) and different SEL (ANOVA: $p < 0.034$), with male students, aged 22 and over and from the upper middle class obtaining the highest mean QoL scores. However, in the case of SEL this statistically significant difference was not confirmed in Tukey's test ($p \geq 0.06$). QoL is related to gender and age group. There is a need to promote the QoL of this student community, and the health team should have a close look at female students, younger students (Newly admitted) and with lower SEL.

Key words: Quality of life; Nursing students; Demographic factors; Public Health.

1 INTRODUCTION

The interest in the issue of Quality of Life (QoL) has increased significantly in recent decades. However, there is still no consensual definition that can fully represent it, since it involves individual and subjective aspects of each person [1].

For other authors, the concept of QoL has evolved. Initially having a materialistic basis, in which priority was given to the objective aspects of life, currently the subjective aspects are considered essential. The same authors also refer that it is currently consensual that this construct has a multidimensional nature and includes both objective and subjective components [2].

QoL can be said to be a multidimensional, complex concept, encompassing autonomy, individual and subjective perceptions, which involve the harmonization of biopsychosocial aspects. This term is conceptualised by the World Health Organization (WHO) as an individual perception of his or her position in life, in the context of the culture and value systems in which we live and in relation to the goals, expectations, standards and concerns of each one of us [3; 4].

Entering Higher Education is an important period in the lives of young adults, causing very significant transformations in the lives of these individuals, requiring an adaptive process that causes insecurity, anxiety and satisfaction of social and family needs. Therefore, we may consider ourselves to be in the presence of a critical period, of transition, causing vulnerabilities, with consequences at the level of the QoL of these young people. However, these consequences are also different according to the socio-demographic characteristics of each young person [3; 5-9].

Thus, the QoL of university students is influenced by biopsychosocial aspects, interconnected with the great demands of the training process, which may be aggravated by conflicting relationships with teachers and peers [10-12].

It should be noted that undergraduate students in the health sciences have higher levels of anxiety than those in other scientific areas. In turn, nursing students present exacerbated symptoms of stress, taking into account the more frequent exposure to ethical conflicts that trigger high-intensity stress [6, 7, 13].

The enhancement of students' well-being promotes educational and professional success, from a quinquenary prevention perspective. Promoting the QoL of these students influences the humanization process, which can be improved and have an impact on the quality of care, since feeling well is reflected in the way of caring for others [14].

Items such as functional capacity, pain, general health status, vitality, social, emotional and mental health aspects can be assessed by instruments that measure QoL. The most commonly used instruments are the so-called generic ones. Among the generic instruments, the Medical Outcomes Studies 36-item Short-Form (MOS SF-36), the EuroQol (EQ-5D) and the WHOQOL-100 are the most used. The WHOQOL-bref, a shortened version of the WHOQOL-100 was developed and recommended by the WHO, values individual perception and may assess QoL in various groups and situations, regardless of the level of education. The instrument presents satisfactory psychometric properties and requires little application time. Through this instrument, it is possible to describe the subjective perception of an individual in relation to his physical and psychological health, social relationships and the environment in which he lives [15-20].

This study arose within the scope of this phenomenon, with the general objective of analysing the relationship between QoL and the sociodemographic characteristics of undergraduate nursing students in Northern Portugal.

There are some international studies that analyse the relationship between this phenomenon and sociodemographic characteristics, but they are practically non-existent in Portugal, including in the geographical area of this student population.

2 METHODOLOGY

The methodological component is a key aspect in any research process, since it serves as a guide during the development of research, guiding the researcher to find answers to specific questions and, thus, acquire new knowledge to base practice on evidence.

This is an observational, descriptive-correlational and cross-sectional study of quantitative approach [21].

2.1 Participants

The population of a study is defined by the inclusion criteria [21]. The inclusion criteria were: i) Sstudent's attending the school context of this study (North region of Portugal), in the 2017/2018 academic year; ii) students of both genders; iii) Being aged 18 years or more. The population was composed of 375 undergraduate nursing students.

The sample is the fraction or subset of a population selected and on which the study is performed, and should be representative of the population, being defined by the exclusion criteria [21]. We established as exclusion criteria: i) Students who were not present on the date of data collection; ii) Students who did not complete at least 80% of the questions. This is a non-probability convenience sample. After applying the exclusion criteria to the population of this study, the sample consisted of 289 undergraduate nursing students, about 77.07% of the population.

Of the total sample (n=289), most were female (77.9%), aged between 20 and 21 years (40.5%), held the marital status of single (95.5%) and belonged to the middle-class of Socioeconomic Level (SEL) (39.4%) (**Table 1**). The mean age was 21.29 ± 4.398 years old, the minimum was 18 years old and the maximum 53 years old (data not shown in the table).

Table 1 Sociodemographic characterization of the sample (n = 289)

Variables		Af	Rf (%)
Gender	Female	225	77.9
	Male	64	22.1
Age group	18-19 years old	100	34.6
	20-21 years old	117	40.5
	≥ 22 years old	72	24.9
Marital status	Single	276	95.5
	Married or Cohabiting	13	4.5
Socioeconomic level	Upper class	34	11.8
	Upper Middle class	82	28.4
	Middle class	114	39.4
	Lower Middle class	44	15.2
	Lower class	5	1.7

Total	289	100
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Legend: Af – Absolute frequency; Rf – Relative frequency.

2.2 Material

For data collection, we used a self-completion questionnaire designed for this purpose and adapted for online application. The questionnaire included an introductory note, with a brief explanation about the purpose and importance of participating in the study, the guarantee of data confidentiality, the instructions to answer the questions and the final acknowledgement for collaboration. This instrument was composed of three parts: part I included questions on sociodemographic characteristics, with the household SEL being assessed through the Graffar Scale; part II aimed to assess the level of physical activity through the IPAQ-Short (part not used in this study); part III included the WHOQOL-Bref (Portuguese version of the WHO Abbreviated Tool for Quality of Life Assessment).

The abbreviated version of the WHOQOL is composed of 26 items and is organized into four domains: Physical, Psychological, Social Relationships and Environment, also including a facet on general QoL [15]. The Likert scale used in the construction of the WHOQOL-Bref questionnaire is composed of five response options, with scores from 1 to 5 and higher values in each item reveal better QoL of the respondent [22].

The validation study of the WHOQOL-Bref into Portuguese was carried out through collaboration between researchers from the University of Coimbra [23]. The internal consistency assessed through Cronbach's alpha coefficient, when considering all items was 0.92, being very good and the Domains ranged between 0.64 in the Social Relationships domain and 0.87 in the Physical domain.

2.3 Procedures

The ethical aspects inherent to the development of any scientific research and the recommendations contained in the Declaration of Helsinki were taken into account, safeguarding human rights [21; 24]. Before starting data collection, we sent a request for authorization to the Ethics Committee of the University of Trás-os-Montes e Alto Douro (UTAD), which was approved (Opinion no. 37/2017 of 24/07/2017). A request was also addressed to the authors of the scales that were part of our data collection instrument, who authorized their use. Then, a request for authorization for data collection was addressed to the President of the School in question, who gave her agreement. Subsequently, we contacted the teachers of each class and scheduled a date for data collection in each class. On the scheduled date, we went to the school and within a period of time granted for that purpose, we applied the questionnaires to the students in each class, in the classroom. We gave a brief explanation of the study and asked them to answer all the questions sincerely and anonymously. Students were asked to sign the informed consent form. We waited for the students to complete it and collected the questionnaires immediately. The data collection period took place from October 2 to October 13 of 2017.

The data processing was made by SPSS Software (24.0). We used descriptive statistics, with absolute and relative frequency and mode calculations for all variables and the mean and standard deviation for the variables of measurement level ratio. We also used inferential statistics, having applied the t-Student test and ANOVA and, alternatively, when the variables did not comply with the assumptions for the use of parametric tests, we used the

Mann-Whitney and Kruskal-Wallis tests. We considered the 5% as a level of significance [25].

3 PRESENTATION AND DISCUSSION OF RESULTS

The presentation of the QoL results included the percentages obtained in each response option, means and standard deviation of the score of the items of the WHOQOL-Bref scale, followed by the mean, standard deviation, minimum and maximum scores of the domains, the general facet and global score of the same scale and the relationships between the global score of the scale and the sociodemographic variables of the students in the sample.

3.1 Quality of life

By analysing the percentage of students' answers in each of the items of the WHOQOL-Bref scale, we found that the items that most contributed to a positive perception of QoL were item 4 "What extent do you need medical care to go about your daily life? "How would you rate your mobility (ability to move around by yourself)?", item 3 "What extent do your (physical) pains prevent you from doing what you need to do?", item 5 "How much do you enjoy life?" and item 6 "What extent do you feel that your life has meaning?". These items obtained a higher percentage of answers in the 100 best QoL option. Regarding the mean, it was higher in item 4 (87.46 ± 18.296) and item 15 (84.95 ± 18.117), being above 80 points.

Conversely, we found that the items which least contributed to a positive perception of QoL were: item 26 "How often do you have negative feelings, such as sadness, despair, anxiety or depression?", item 16 "What extent are you satisfied with your sleep?", item 12 "Do you have enough money to meet your needs?", item 14 "What extent do you have opportunities to perform leisure activities?" and item 7 "How well do you concentrate?". Regarding the average, it was lower in item 26 and item 16, standing close to 60 points (Table 2).

Table 2 Percentage obtained in each response option, mean and standard deviation of the score of the items of the WHOQOL-Bref scale

Items	%					Mean±sd
	0	25	50	75	100	
1. How do you rate your quality of life?	0.3	-	15.6	72.7	11.1	73.61±13.614
2. How satisfied are you with your health?	-	2.8	14.2	63.3	19.4	74.91±17.761
3.What extent does your (physical) pain prevent you from doing what you need to do?	0.7	4.2	17	38.8	39.4	78.03±28.085
4.What extent do you need medical care to go about your daily life?	0.3	1.0	9.0	27.7	61.9	87.46±18.296
5.How much do you enjoy life?	0.7	2.8	14.2	46.4	36	78.55±20.262
6.What extent do you feel that your life has meaning?	1.4	4.5	15.2	52.2	26.6	74.57±21.293
7.How well can you concentrate?	0.7	7.3	41.2	45.7	5.2	61.85±18.403
8.How safe do you feel in your daily life?	0.7	0.3	17.3	64.4	17.3	74.31±16.257
9.How healthy is your physical environment?	1.0	1.0	24.2	61.6	12.1	70.37±17.138
10.Do you have enough energy for your daily life?	0.3	3.5	31.8	47.1	17.3	69.38±19.565
11.Are you able to accept your physical appearance?	1.4	5.2	28.0	45.0	20.4	69.46±21.941
12.Do you have enough money to meet your needs?	0.7	9.7	45.3	30.4	13.8	61.76±21.850
13. How easily do you have access to the information you need to organize your daily life?	-	1.0	24.9	58.1	15.9	72.23±16.566
14. What extent do you have opportunities for leisure activities?	1.0	11.1	36.3	42.6	9.0	61.85±21.146
15. How would you rate your mobility (ability to move around by	-	1.4	10.0	36.0	52.6	84.95±18.117

yourself)?						
16. How satisfied are you with your sleep?	4.2	11.4	30.8	42.6	10.7	61.11±24.298
17. How satisfied are you with your ability to carry out your day-to-day activities?	0.7	2.1	19.7	64.4	12.8	71.70±16.889
18. How satisfied are you with your working capacity?	0.3	2.1	25.6	61.2	10.4	69.88±16.493
19. How satisfied are you with yourself?	0.7	4.2	20.8	55.7	18.3	71.79±19.480
20. How satisfied are you with your personal relationships?	0.7	4.2	20.8	54.3	19.4	72.04±19.721
21. How satisfied are you with your sex life?	3.8	4.5	29.4	35.6	25.3	68.77±25.320
22. How satisfied are you with the support you receive from your friends?	0.3	1.7	21.1	55.7	20.4	73.69±17.997
23. How satisfied are you with the conditions of the place where you live?	0.7	3.5	12.5	56.7	26.0	76.13±19.184
24. How satisfied are you with the access you have to health services?	0.3	2.1	24.6	57.4	14.9	71.25±17.526
25. How satisfied are you with the transport you use?	1.0	4.2	19.4	55.7	19.0	72.04±19.942
26. How often do you have negative feelings such as sadness, despair, anxiety or depression?	1.7	9.7	45.3	34.9	7.6	59.32±20.754

Legend: % - percentage; dp – Standard deviation

Table 3 shows that the physical domain had the lowest mean (52.24 ± 10.26), meaning that students had a lower perception of QoL in this domain. On the opposite side is the Social Relationships domain, which had the highest mean (71.49 ± 17.14), meaning that students had a better perception of QoL. In the overall facet, students had a very positive perception of QoL (74.26 ± 13.03). As for the global QoL, students had a positive and reasonable perception (63.48 ± 10.64). Taking 50% of QoL as the cut-off point, we found that most students (87.2%) had a positive perception of QoL.

Table 3 Mean, standard deviation, minimum and maximum of QoL

Domains	Mean	Standard deviation	Minimum	Maximum
Physical	52.24	10.26	11.57	72.86
Psychological	59.97	13.08	8.50	84.17
Social Relationships	71.49	17.14	8.33	100.0
Environment	70.00	12.37	28.13	100.0
General	74.26	13.03	12.50	100.0
Global	63.48	10.64	20.46	87.12

In this study, we found that the social relationships domain had the highest mean (71.49 ± 17.14), in which students had a better perception of QoL. On the opposite side was the physical domain, which had the lowest mean (52.24 ± 10.26), meaning that students had a lower perception of QoL in this domain. Also, a study conducted in the city of Coimbra (Portugal) [26], found that the social relationships domain obtained the highest mean (73.2 ± 16.7), but, unlike the physical domain, the environment domain obtained the lowest mean (69.9 ± 12.1). This divergence between the results of the two studies may be explained by the different origins of the students.

Our results are in line with a research entitled "Quality of life of university students and academic performance", in which 492 students participated, whose objective was to characterize the QoL of students from the areas of Human, Exact and Health Sciences, conducted at the Federal University of Juiz de Fora, Minas Gerais (Brazil) [27], applied the WHOQOL-Bref instrument and found that students from the health area had the highest mean in the social relationships domain (72.9 ± 15.2) and the lowest in the physical domain (50.0 ± 12.1), coinciding with the present study. As for the general QoL, it also presented a positive average (72.5 ± 18.2), higher than the present study, which can be considered good.

The results of the present study are inverted in relation to the domains, taking as standard those obtained in the study entitled "Relationship of the level of quality of life and physical activity in physical education undergraduates", carried out with 85 students of the Physical Education course, in the city of Ponta Grossa (Brazil) [28], in which they analyzed their QoL, by means of the WHOQOL-Bref and concluded that the physical domain was the one that obtained the best average (77.2 ± 10.6) and the environment domain the worst average (61.0 ± 13.1). However, they also concluded that male students obtained the highest values for the physical domain and female students for the social relationships domain, results quite aligned with those of the present study. In opposition to the present study, continue the results of a study called "Analysis of quality of life and level of physical activity in university students", with a sample of 178 university students from a public institution, in the city of Curitiba (Paraná-Brazil) [29], in which the authors found that students of both genders obtained the highest values for the physical domain (82.14 ± 10.85) and the lowest values in the environment domain (62.50 ± 13.99). As for the general QoL, this also showed a positive mean (74.70 ± 13.53), much higher than that of our study, already close to a very good QoL. In general, the measures of central tendency showed a satisfactory QoL for both genders. The results concerning the domains that obtained the highest average are different from study to study and even in the opposite direction. This is the case of the study conducted in the city of Brasília (Brazil) [30], which revealed that the psychological domain was the best assessed (69.6) and the worst was the environment domain (63.3). All these differences between the studies, including the present study, may be explained by the cultural differences between the students who participated in the different studies, with different countries of origin (Portugal and Brazil) and very different realities.

3.2 Relationship between Quality of life and sociodemographic characteristics

Analyzing Table 4, it is observed that there are no statistically significant differences between the mean global QoL score of students with different marital status (t: $p > 0.892$), of students who have and those who do not have student-worker status (t: $p > 0.412$), between students with and without scholarship status (t: $p > 0.605$), between students with and without children (t: $p > 0.115$) and students with different type of cohabitation (ANOVA: $p > 0.575$).

It was found that the mean of the global QoL score presented significant differences between students of different gender (t: $p < 0.003$), with males obtaining a higher mean (66.88) in detriment of females (62.41), thus presenting a better perception of global QoL.

It was also found that the mean score differed significantly between students of different age groups (ANOVA: $p < 0.038$). However, by Tukey's test, which assesses between which groups the statistical difference lies, this difference between the mean score of the global QoL scale was not confirmed (Tukey: $p \geq 0.060$).

The same was observed regarding the mean score of the global QoL of students framed in the different SEL classes, in which there were statistically significant differences (ANOVA: $p < 0.034$) and when the Tukey test was applied, these differences were not confirmed (Tukey: $p \geq 0.062$).

Table 4 Results of the statistical tests between global QoL and socio-demographic variables

Global Quality of Life	n	Mean/ Mean rank	Test value	df	p
Gender					
Male	64	66.88	t =2.998	282	p<0.003
Female	220	62.41			
Age group			ANOVA = 3.312	283	p<0.038 Tukey: p≥0.060
18-19 years old	97	61.18			
20-21 years old	116	64.46			
22 years old and more	71	64.75			
Marital status			t = 1.582	282	p>0.115
Single	271	63.63			
Married/Cohabiting	13	58.87			
Worker-Student status			t = 0.165	282	p>0.869
Yes	9	62.84			
No	275	63.43			
Scholarship			t = 1.729	281	p>0.085
Yes	140	62.29			
No	143	64.48			
Sons			t = 1.488	282	p>0.138
Sim	11	58.75			
Não	273	63.60			
Who do you live with?			ANOVA = 2.402	281	p>0.068
Parents	215	64.29			
Friends	43	61.97			
Alone	12	58.65			
Spouse and sons	12	58.62			
Socio-Economic Level			ANOVA = 2.649	4	p<0.034 Tukey: p≥0.062
Upper Class	34	140.16			
Upper Middle Class	79	160.15			
Middle Class	112	128.23			
Lower Middle Class	44	126.90			
Lower Class	5	62.50			

Legend: df – Degree of freedom; n – Absolute frequency; p – Probability; t – Student test

In our study, male students had better global QoL than female students, with statistically significant differences, as well as students aged 22 years and older in the psychological domain and students in the upper middle class, with a relationship between global QoL and these socio-demographic variables. These results are in line with the results obtained by other studies [31-32], both at national and international level, more often in what concerns gender. The reality in Portugal seems to indicate that the production of studies in this context and with these objectives is scarce.

4 CONCLUSION

The sociodemographic profile of the students participating in this study can be said to be female, belonging to the age group 20-21 years, single, with no student-worker status, no scholarship, no children, living with their parents and belonging to the middle-class SEL.

In turn, the domains of QoL and Global QoL of the students in the sample are very similar to those obtained in other studies and the Global QoL can be said to be good. The domain in which the students' perception is better is the social relationships domain and it is worse in the physical domain, and there is no convergence between the studies as regards the domains which obtained higher mean scores.

There was a relationship between the global QoL of students of different genders, with male students having a better perception of QoL. Thus, gender seems to be the only factor related to Global QoL.

The main limitations of this study are related to the fact that it is not a random sample, and that it is a cross-sectional study. The non-randomized sample is less reliable than the randomized one as regards the generalizability of results. Cross-sectional studies do not allow us to establish cause-effect relationships.

The implications of this study for the professional practice of Community Nursing may reside in the warning that it may constitute for the functional units of Primary Health Care, which are responsible for the educational institution where this study was conducted, about the need for intervention in this group, with the purpose of promoting the QoL and health of these students.

The results were reported to the President of the educational establishment where this study took place, so that it could act as a diagnosis of the situation, particularly in terms of students' QoL. It is important for higher education institutions to be aware of their role in training, which should not only be technical, but also a holistic training of their students.

FUNDING: This work was financially supported by Portuguese national funds through the FCT (Foundation for Science and Technology) within the framework of the CIEC (Research Center for Child Studies of the University of Minho) project under the reference UIDB/00317/2020.

Cofinanciado por:

UIDB/00317/2020
UIDP/00317/2020



CONFLICT OF INTEREST: Authors declare no conflict of interest.

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Quality of Work among Medical Technologists in Selected Urban Areas Caused by Exhaustion, Understaffing and Work Performance

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ABSTRACT

The healthcare industry plays a pivotal role in maintaining the well-being of citizens. However, with the COVID-19 pandemic, it is ironic that the physical and mental condition of those in pursuit of health promotion is now compromised as healthcare professionals (HCP) suffer chronic fatigue. Studies have proven that exhaustion and understaffing negatively influence the well-being of HCPs, and the status thereof is reflected by the quality of their work performance. Despite all these, little is still known if such outcomes also occur in urbanized areas such as Region III of the Philippines, let alone focus on the effects on medical technologists.

Hence, with its objective to assess the quality of work of medical technologists, the current study employed a correlational quantitative research design, and involved participants who are working medical technologists from the urban sector of Region III.

The results of the study showed that the participants experience understaffing and often feel exhausted in their respective workplaces, supported by the correlational test results that understaffing and exhaustion have a high positive correlation ($p=0.000$). However, despite being exposed to both exhaustion and understaffing, their work performances are only sometimes affected because no significant relationship was discovered between exhaustion and work performance. Interestingly, it was also discovered that understaffing and work performance have a low positive correlation ($r=0.218$). Therefore, though understaffing and exhaustion come hand-in-hand, understaffing may slightly enhance the medical technologists' quality of work, while exhaustion bears no significance ($p=.100$) on their work performance.

Keywords: understaffing, exhaustion, work performance, medical technologists

1 INTRODUCTION

This chapter includes the background of the study, the statement of the problem, the objectives of the study, the hypotheses of the study, the significance of the study, the scope of the study, and the definition of terms.

1.1 Background of the Study

One of the events that required a substantial change in the lifestyle of people across the globe, including the Philippines, was the occurrence of the COVID-19 pandemic. As a significant health crisis of the 21st century, this pandemic and its repercussions lead people to realize the importance of health as a vital component of intrapersonal and societal well-being.

Being the governing body responsible for international health promotion and global health responses, the World Health Organization (WHO) was at the forefront of this cause, even before the pandemic. Throughout time, the concept of health has revolutionized to accommodate the evolving perspectives. Health was initially understood as the mere absence of disease as per its Biomedical Concept. However, at present, the most widely accepted Holistic Concept of Health appropriately considers the physical, mental, and social well-being of an individual as equally essential elements of the overall health status of a person.

In line with these concepts, the pioneers of health promotion were healthcare professionals. Over the past years, utmost priority was directed to their benefit as prime movers of the healthcare industry. Thus, enhancing various aspects of the healthcare system became a worldwide movement. In the United States, these professionals specifically constituted the Community Health Worker (CHW) sector of their economy. In 2012, 15 American states ratified laws concerning Community Health Worker (CHW) workforce development and financing, while seven others enacted laws allowing Medicaid reimbursement for specific Community Health Worker (CHW) services (Centers for Disease Control, 2012).

Locally, laws such as Republic Act No. 7305 or the Magna Carta of Public Health Workers were passed for the benefit of health workers as recognition of their essential responsibility in maintaining a high-quality healthcare system.

However, in the circumstance of the COVID-19 pandemic, it was intriguing that healthcare professionals were exhibiting poorer health and performance outcomes despite prior efforts dedicated to their empowerment. Shaukat et al. (2020) reported that this phenomenon was a likely result of both the physical and the mental consequences of continually catering to the needs of COVID-19 patients in isolation facilities. In line with the Holistic Concept of Health earlier presented, the distress experienced by healthcare professionals took a toll on their overall health status as it directly affected their mental aspect. Such controversy existed because the welfare of the healthcare professionals themselves was at stake. Ironically, because of the pursuance of their supposed agenda, the individuals positioned at the frontlines of health promotion were now also suffering from health infirmities they were tasked to help resolve in the first place.

The intrigue that surrounded this subject matter led to various scholarly attempts that investigate the reasons for this worldwide trend. Healthcare exhaustion was detrimental to healthcare professionals' well-being and performance (Wang et al., 2021; Zhang et al., 2020; & Opoku et al., 2021). This was because their occupation predisposed them to chronic physical and mental fatigue (Maslach & Leiter, 2016). In response to these observations, Lasater et al. (2021) further observed that employee understaffing was a concurrent phenomenon that may occur with

healthcare exhaustion. Gohar & Nowrouzi-Kia (2020) agreed by stating the deleterious consequences of understaffing on the long-term progression of the healthcare system as a whole. Garrett (2008) further supported these findings by linking medical errors and employee exhaustion to undermanned healthcare procedures.

Moreover, Cramer et al. (2006) further diversified this field of study by incorporating the novel dimension of demographics. Cramer et al. (2006) realized that demographics play a crucial role in understaffing and fatigue as its effects vary in rural and urban healthcare settings. Nevertheless, even studies that pertained to the same aspect of the subject matter still yielded inconsistent results. Though research findings that pertained to the rural sector were united in their claim of how severe understaffing and fatigue negatively influence healthcare quality of work, otherwise was seen in studies focusing on the urban sector. This matter was observed in the studies of Saijo et al. (2013) and Ameh and Dankyau (2015), where it was further expounded.

Generally, all these researchers and their studies demonstrate that exhaustion and understaffing effects may vary when socioeconomic factors are considered, though further elaboration for a clearer understanding of this phenomenon is still necessary, especially in the urban area.

Constricting the viewpoint to the research locale, the Philippines was not an exception also to the global occurrences mentioned as the healthcare sector was also highly regarded for its purpose. One of the laws passed for the benefit of healthcare workers is Republic Act No. 5527 or otherwise known as The Philippine Medical Technology Act of 1969. Republic Act No. 5527 and its subsequent amendments recognized medical technologists or *medical laboratory scientists* as crucial elements of the Philippine healthcare workforce for their direct involvement in the collection, processing, and analysis of clinical isolates, among others. Medical technologists proved their practice essential with these sworn duties, especially during the pandemic. However, as stated earlier, the Philippine setting also followed the global trend established. Medical technologists also experienced chronic exhaustion due to the increased demands of their occupation.

Despite the abundance of scholarly works that discussed the subject matter at hand, no formal study has yet investigated the medical technologist sector of the healthcare setting, more so on the research locale. Therefore, in line with the aim of the Philippine Medical Technology Act to promote the welfare of Medical Laboratory Scientists, the study identified how understaffing and exhaustion influenced the quality of work of medical technologists in the urban sectors.

1.2 Statement of the Problem

This study assessed the quality of work and its correlation to exhaustion and understaffing among medical technologists working in the urban sector of Region III.

Specifically, it answered the following questions:

1. What is the extent of understaffing, exhaustion, and work performance, based on the workload of the medical technologists in the urban sector?
2. What is the correlation of understaffing, physical and emotional exhaustion to the quality of work of medical technologists?

1.3 Objectives of the Study

General Objective:

In view of the fact that exhaustion was a factor that influenced working conditions, the research evaluated the quality of work among medical technologists from urban areas due to exhaustion and understaffing.

Specific Objectives:

The study:

- Evaluated the extent of understaffing, exhaustion, and work performance, based on workload of the medical technologists in the urban sector of region 3
- Correlated understaffing, physical and emotional exhaustion to the quality of work of medical technologists

1.4 Hypothesis of the Study

H₀: There is no significant relationship between the quality of work caused by exhaustion and understaffing among medical technologists of the urban healthcare sector in Region III

H_a: There is a significant relationship between the quality of work caused by exhaustion and understaffing among medical technologists of the urban healthcare sector in Region III

1.5 Significance of the Study

The findings of this study may be used by authorities in the assessment of how exhaustion affected the quality of care given to patients by medical technologists from urban areas. As this study considered factors such as limited staffing and the workload given to these medical technologists in their respective laboratories and areas, it demonstrated what the turnout of these factors entailed on the work performance of a medical technologist, especially in the circumstance of a global pandemic. This study benefited the healthcare system by pinpointing which aspects should be improved, with the results to be used by the concerned policymakers to decide what approach and guidelines these problems could be solved with.

This was also of significance to the public if the hypothesis of this study was proven as this can entail new guidelines to be implemented to ensure that better patient care will be delivered in these areas of concern by solving a root cause of a lack thereof. With better patient care comes better patient feedback, resulting in better patient healthcare-seeking behavior amongst residents of Region III. This behavior, in turn, may lead to positive health statistics that could serve as motivation in continuing the improvement of the issue of exhaustion and understaffing in medical technologists.

1.6 Scope of the Study

The research examined the correlation between the quality of work with exhaustion and understaffing among medical technologists. The research was conducted at secondary-level laboratories in specific urban areas of Region III from August 2021 to May 2023. The urban sectors of Region III included but were not limited to the Cities of San Fernando and Angeles in Pampanga and the Cities of Bustos, Baliwag, San Rafael, and Pulilan in Bulacan.

The participants of the study were limited to medical technologists as the researchers aimed to aid the inadequate sampling of the current research that focused only on nurses and physicians. The questionnaire consisted of three sections: Exhaustion, Understaffing, and Individual Work Performance. The researchers utilized the Copenhagen Burnout Inventory (CBI), Individual Workplace Performance Questionnaire (IWPQ), and an adapted questionnaire from a study by Chamaru de Alwis to assess the quality of work among the medical technologists caused by exhaustion and understaffing. The factors measured only included the physical and psychological exhaustion factors of personal burnout, work-related burnout, and client-related burnout and their effect on the quality of work. Snowball sampling was employed by the researchers among the medical technologists in the specific health facilities of Region III to measure the extent of understaffing and exhaustion.

1.7 Definition of Terms

The following terms are conceptually defined for better understanding of the study:

Absenteeism contributes to a decreased productivity and service quality of an institution. This can be observed in workplaces that are understaffed and where heavy workloads are given.

Burnout is a result of emotional exhaustion, depersonalization, and reduced personal accomplishment caused by understaffing based on the Multidimensional Theory of Burnout.

Compassion Fatigue is a hazard resulting from burnout that is considered to be occupational in the healthcare setting. This differs from burnout syndrome as it affects the quality of care a healthcare provider delivers to patients.

Coronavirus Disease 2019 or COVID-19 is a respiratory disease that is caused by a novel coronavirus. The COVID-19 pandemic caused a significant health crisis that resulted in the burnout and exhaustion of today's healthcare workers.

Emotional Exhaustion is a state of feeling emotionally drained and tired due to stress accumulation from the work environment. Emotional exhaustion can be a sign of burnout that may be manifested by decreased energy, poor sleep, and lack of motivation, irritability, and absentmindedness. It is correlated to the quality of work of medical technologists.

Exhaustion is the state of being tired and worn out in all dimensions – mentally, physically, emotionally, socially, and spiritually. This state of tiredness is multifactorial, influencing the working conditions of the medical technologists. It is one of the independent variables in the study.

Fatigue is a constant and persistent exhaustion that may be chronic, with a possibility to affect the medical technologists' productivity and daily tasks. It is prevalent in the healthcare setting along with exhaustion and burnout.

Health is not merely the absence of disease or impairment, but it is the state of mental, physical, and social well-being. It refers to the ability of a medical technologist to self-manage and adapt in the face of physical, mental, and social challenges. It is also affected by exhaustion and understaffing.

Healthcare refers to the diagnosis of multidimensional illnesses and diseases, its treatment, recovery, and prevention. It deals with primary (community care), secondary (hospital-based care), and tertiary (specialist hospitals) clinical care.

Healthcare Provider or Healthcare Human Resources are the medically trained professionals that provide healthcare services to patients who seek medical care. Medical technologists are considered as healthcare providers and are the subjects of the current study.

Healthcare Understaffing is the increase in patient demand and shortage in available healthcare providers. This is due to inequitable healthcare distribution and may lead to low-quality health outcomes and poor healthcare delivery. It is one of the independent variables in the study.

Healthcare Quality is the appropriate, consistent, and competent services provided by the healthcare professionals to patients that may be compromised due to factors such as exhaustion and understaffing. This is the dependent variable of the current study.

Individual Work Performance Questionnaire is a survey tool that consists of 18 questions that measures the main dimensions of job performance. Out of the 18 questions indicated in this survey, only 10 was used in the current study to evaluate individual work performance in the workplace of each participant.

Medical Technologists are registered healthcare professionals, aged 23 to 59, that are trained in performing clinical laboratory procedures from Region III urban laboratories and have at least one year of experience.

Pandemic is an outbreak or an epidemic of infectious disease that spreads to several countries worldwide, affecting a large number of people. An example of this is the COVID-19 pandemic, which affects healthcare delivery as it causes understaffing.

Republic Act No. 4688 Administrative Order 2007-0027 is an act concerning the rules and regulations governing the licensure and the regulations of clinical laboratories in the Philippines. It indicates the service capability of secondary clinical laboratories.

Stress occurs when the body's homeostasis is challenged wherein the stress system, located in the central nervous system, mediates the response. It may stem from work demands that contribute to the condition of a person, be it physical, pathological and psychosocial.

The Philippine Medical Technology Act of 1969 or Republic Act 5527 is an act that discusses the registration of medical technologists, their practices, and other purposes. It is one of the laws that are passed for the benefit of healthcare workers, specifically medical technologists.

Understaffing is the lack of medical technologists that affect the fulfillment of tasks in a laboratory. It influences the overall function of a working unit and the quality of work of medical technologists.

Urban is defined as an area that pertains to cities and the communities in the cities where the size of the population per barangay is 5,000 or more. If the majority of the barangays in the municipality has a population of 5,000 or more, the municipality is considered urban.

Workload is the interconnection of the required resources in carrying out a task and the available resources. It is the amount of work that is assigned to and expected from a medical technologist. Workload is measured to assess the risk of burnout and exhaustion and their correlation to quality of work.

Work Performance is a variable that is significantly influenced by syndromes such as burnout and compassion fatigue that may affect a healthcare worker's quality of work

2 METHODOLOGY

This chapter presents the research design, the sampling technique, the instrumentation to be used, the data gathering procedures, the ethical considerations made for this study, and the statistical analysis method utilized for data interpretation.

2.1 Research Design

The study employed a Quantitative Research Design. Notably, it was a Descriptive Correlational type of quantitative research that aimed to identify whether the understaffing and exhaustion in urban healthcare areas impacted the quality of work of medical technologists.

2.2 Sampling

Non-probability Sampling Design, particularly Snowball Sampling, was utilized for this research. Due to COVID-19 pandemic restrictions, target participants that best fit the research criteria were initially chosen based on their convenient accessibility and proximity to the researchers. Consequently, the selected participants were asked to assist the researchers in further identifying other potential participants for the study.

The researchers contacted different secondary clinical laboratories within Region III through e-mail and telephone calls that gathered the estimated target population size for the study. The study also utilized the Raosoft sample size calculator that obtained the minimum sample size. With a 1366 target population size, 95% confidence interval, 50% response distribution, and 7% margin of error, the calculated minimum sample size is 172. The study employed the aforementioned chain-referral sampling method until the sample size was reached.

Medical technologists in the urban healthcare sector were the best-suited subjects of analysis for this study that addressed the inadequate sampling of the existing studies, which focused only on nurses and physicians. Specifically, the participants were limited to medical technologists who worked in urban secondary clinical laboratories of Region III. After the participants accepted the agreement, the research survey questionnaire and formal consent forms were sent through their email.

2.2.1 Inclusion Criteria

Participants chosen for this study were licensed medical technologists between the ages of 23 and 59 who were employed in DOH-licensed clinical laboratories within the urban sector of Region III, the Philippines, with at least a year of employment in their respective institutions. The clinical laboratory could be of any classification based on ownership (government or private), function (clinical pathology or anatomic pathology), and institutional character (freestanding or institution-based), as long as it was classified as secondary based on its service capability.

As stipulated by Republic Act No. 4688 Administrative Order 2007-0027, secondary clinical laboratories are only licensed to perform Qualitative and Quantitative Platelet Determination, Routine Hematology, Routine Urinalysis, Routine Fecalalysis, and Routine Clinical Chemistry. Therefore, procedures in the domains of Immunology, Microbiology, or any other special tests for Chemistry and Hematology cannot be performed by secondary laboratories.

2.2.2 Exclusion Criteria

Medical laboratory technicians, laboratory personnel, retired medical technologists, and participants who were not able or were not willing to sign informed consent were excluded from this study. Moreover, medical technologists working in the rural sector and/or outside Region III were also excluded.

2.2.3 Withdrawal Criteria

Participation in the research study was voluntary. Participants were allowed to withdraw their consent and discontinue their participation or revoke authorization to collect information at any time without penalty, provided that they informed the researchers beforehand. The request to withdraw consent and/or revoke authorization must be written by the participant and signed by at least two researchers. In the circumstance wherein the participant wished to withdraw from further research interventions but authorized the continued collection and use of the information they previously consented to, the data collected prior to withdrawal were still included in the research. In the circumstance wherein the participant withdrew from all research study components and revoked the authorization altogether, all data and information disclosed by the participant were excluded from the analysis.

2.3 Instrumentation

This study made use of an adapted and developed questionnaire that was composed of three sections: Understaffing, Exhaustion, and Individual Workplace Performance, which were all answered using the Likert Five-scale Criteria either from “strongly agree” to “strongly disagree” or “to a very high degree” to “to a very low degree.” These sections of the developed questionnaire were all based on previously used research questionnaires.

Prior to the first section of the questionnaire, demographics about the medical technologist were asked. Given that the study has not correlated any of the demographics to the results, only the following were asked: Occupation, Province of Workplace, and Laboratory level of Workplace. The participant was given the freedom of whether their name would be included in the submission since indicating this was optional as the study will omit identifiers during data processing.

In the first section, the questions under understaffing were all based on the workload aspect of the questionnaire used in a paper by Chamaru De Alwis (2013) on the impact of nursing shortage on job outcomes. This study made use of two questionnaire sets. The first questionnaire, which the nurses answered, was composed of five sections: Demographics, Job Satisfaction, Work Stress Level, Ability to Experience the Emotions of Others, and Workload.

The present study, on the other hand, adopted the fifth section related to workload and modified it to fit the said study. Other questions used in this survey but were not under the “workload” category were modified to be answered by the same Likert scale of the previous questions. Other modifications from this section were just changes to the specifics, which made the questions more medical technology-related, understaffing-related, and topic-related to the present study.

The next section of the questionnaire was the “Exhaustion” section, based on the Copenhagen Burnout Inventory (CBI) by Kristensen et al. (2005), which consisted of questions involving

Personal, Work-related, and Client-related Burnout. In the present study, all three sections were utilized but modified to be more specific for medical technologists. With these modifications, the Client-related Burnout questions were also made more appropriate by making them Patient-related Burnout instead. Also, given that the study only involved exhaustion, the questions were adjusted to be more focused on that matter rather than burnout in general. Aside from this, the Exhaustion section questions were also re-arranged so that the personal, work, and patient-related questions were positioned randomly to avoid question-order bias.

Lastly, the Individual Workplace Performance section of the questionnaire was based on the 18-item Individual Work Performance Questionnaire formulated by Linda Koopmans et al. (2015). This portion of the questionnaire was also modified to be more fit for understaffing and exhaustion on the participants' self-assessed quality of work. This portion of the questionnaire was necessary as this served as the basis for the medical technologist's quality of work.

From all questionnaires used as a basis, 10 questions were collected for each of the three sections. The compiled, modified, and adapted survey questionnaire, comprised 30 questions, utilized a web-based platform, Google Forms, and was distributed through social media and e-mail by a link deployed to medical technologists from secondary laboratories of urban areas in Region III.

2.4 Data Gathering Procedure

The web-based survey was first disseminated to the research participants through a link to access the questionnaire. This data gathering instrument was then distributed until the ideal sample size was attained. The survey was answered at the participants' most convenient time. The researchers gave an ample amount of time for the participants to complete the information needed, wherein the accomplishment of the survey took approximately five to ten (5 to 10) minutes only. The duration of accomplishment of the survey was the extent of participation of the individuals in the study. However, a maximum duration of one (1) month was given to aid to circumstances wherein discrepancies in their answers may need to be reassessed.

This study utilized the criteria mentioned above in the sampling section to meticulously filter the participants, which is a step that was done to ensure that only participants that meet the criteria were included in the final tallying of results since the survey is accessible to anyone through the link deployed. These data collected will then be subjected to the statistical analysis method utilized in this study, discussed in the last section of this chapter.

2.5 Ethical Considerations

The researchers obtained the ethical approval of the Ethics Review Board of the Faculty of Pharmacy before proceeding with data collection. The instruments used in gathering were the Copenhagen Burnout Inventory (CBI) introduced by Krinstensen et al., Individual Workplace Performance Questionnaire (IWPQ) by Linda Koopmans et al., and an adapted questionnaire from a study by Chamaru de Alwis. The authors of the questionnaires were sent with a query through email regarding their authorization and consent to use and modify their questionnaires that will be used as a survey for the study (see Appendix A).

This study utilized the ethical principles of informed consent, confidentiality, and autonomy. The participants, composed of the medical technologists from urban hospitals in Region III, were presented with a consent form composed of information regarding the voluntary participation, risks

and benefits, rights and responsibilities of the participants, and procedure of the data collection and analysis, along with the nature, objective, and the purpose of the research. In cases wherein the participants had questions and inquiries, the researchers' contact information such as names, e-mail addresses, and contact numbers were included, as well.

Confidentiality was maintained through the collection of the participants' personal information that was significant to the study conducted. The information and data that were collected remained restricted from access to outside parties throughout and after the duration of the study. The researchers ensured that no information was disclosed and disseminated to unauthorized persons. The data collected were used for research purposes written on the consent form. In the Results and Discussion section, the participants' hospital or laboratory affiliations were not disclosed, which adhered to the agreement established by both parties. The survey form that contained the confidential data was kept private and exclusive to the researchers directly involved in the study.

Participants were allowed to exercise their right to withdraw from the study at any given point. The principle of autonomy was maintained throughout the study, and the participants were permitted to make decisions as long as the research team was informed. The participant also had the privilege to provide or not provide their reason for withdrawal.

2.6 Data Analysis

This section aided in answering the hypothesis through the determination of the statistical relationship between the quality of work and exhaustion, as well as the quality of work and understaffing among medical technologists.

Data gathered from the responses to the survey questionnaire were grouped, tabulated, and organized with the use of Microsoft Excel. The data were grouped into two: mainly descriptive statistics and inferential statistics, wherein descriptive statistics included the information about the participants, while inferential statistics consisted of the responses per participant. The Microsoft Excel file would be imported into the SPSS Statistics Software, which ran a simple linear regression analysis that distinguished the correlation between the independent (understaffing, exhaustion, and work performance) and dependent (quality of work) variables.

A table for descriptive statistics, which consisted of the participant's information mainly age, gender, and region of workplace, was organized. Frequency and percentage were obtained through the use of SPSS Statistics Software which was further used to compute for the measure of central tendency, specifically mean, median, and mode, with the use of SPSS Statistics Software, as well.

A table for inferential statistics, which consisted of the responses of the participants, was divided per section of the questionnaire, specifically by Understaffing, Exhaustion, and Individual Performance.

These data were imported into the SPSS Statistics Software and ran on simple linear regression. The functions on the top menu: Analyze > Regression > Linear was used to input the independent and dependent variables, which generated tabulated results of the linear regression analysis. In the correlation matrix, the Pearson Correlation determined if there was a correlation between the independent and dependent variables. The ANOVA matrix indicated if the independent variable significantly affected the dependent variable. The sig. column represented the p-value, in which a p-value less than alpha (0.05) indicated a statistically significant relationship between the two variables. Results from the coefficient matrix allowed the researchers to determine the extent of

change in the value of the independent variable that affected the dependent variable. The ‘t’ column indicated if a significant relationship between the two variables existed. In contrast, the Unstandardized B column indicated the direction and extent of the relationship of the independent to the dependent variable.

3 RESULTS AND DISCUSSION

This chapter presents an interpretation of the data obtained by the researchers and the ideas that these results suggest in answering the research problems.

3.1 The Extent of Understaffing of the Medical Technologists in the Urban Sector

Table 1 The Extent of Understaffing of the Medical Technologists in the Urban Sector

Understaffing	Mean	Interpretation
In the last month, my shifts were often extended because of the lack of another medtech.	2.1491	Agree
I had to do more mandatory overtime this month due to the lack of manpower.	2.2895	Agree
I have done more voluntary overtime this month.	2.4561	Agree
The staff shortage in my workplace leads to my increased workload.	2.0351	Agree
Compared to the last month, the amount of overtime done by me has increased.	2.6228	Neutral
I often see multiple delays experienced in the laboratory.	2.9737	Neutral
In one shift, I often engage with non-medtech tasks (administration, housekeeping, statistics preparing, etc.)	2.4825	Agree
During the last month, there were several times I had to work on another medtech task, rather than what I am usually in charge with.	2.2105	Agree
I feel that there is a poor quality of supporting staff.	2.4737	Agree
There are tasks I do on my own even if they are to be done with the help of others.	2.3158	Agree
Overall Mean	2.4009	Agree

(Interpretation: 4.21-5.0 strongly disagree; 3.41-4.20 disagree; 2.61-3.40 neutral; 1.80-2.60 agree; 1.00-1.80 strongly agree)

Presented in Table 1 is the Extent of Understaffing of the Medical Technologists in the Urban Sector. The responses were gathered with their corresponding interpretation based on the Likert scale.

The statements, “I often see multiple delays experienced in the laboratory” with a mean of 2.9737 and “Compared to the last month, the amount of overtime done by me has increased” with a mean of 2.6228 were both interpreted as neutral. Concurrently, the participants agree with the following statements about the extent of understaffing among medical technologists: “In one shift, I often engage with non-medtech tasks” ($x=2.4825$); “I feel that there is a poor quality of supporting staff” ($x=2.4737$); “I have done more voluntary

overtime this month” ($x=2.4561$); “There are tasks I do on my own even if they are to be done with the help of others” ($x=2.3148$); “I had to do more mandatory overtime this month due to the lack of manpower” ($x=2.2895$); “During the last month, there were several times I had to work on another medtech task, rather than what I am usually in charge with” ($x=2.2105$); and “In the last month, my shifts were often extended because of the lack of another medtech” ($x=2.1491$). Table 1 also demonstrated that the participants generally agreed to these statements regarding their understaffing experience as an overall mean of 2.4009 was obtained.

As mentioned in the study by Metcalf et al. (2018), understaffing is defined as an instance when the organization failed to fulfill its purpose due to a lack of employees or a shortage of human forces. During times of understaffing in the healthcare system, there was a significant stressor on the human workforce, and the quality of care given to patients was significantly decreased (Hudson & Shen, 2015).

Among the statements in the questionnaire, the two neutral interpretations were the highest being the “Compared to the last month, the amount of overtime done by me has increased” and “I often see multiple delays experienced in the laboratory.” The participants were neutral when it came to the increase in overtime in comparison to the last month. As mentioned by Metcalf et al. (2018), the increased workload may lead to ambiguity, confusion, overload, and conflict among healthcare workers. This claim was supported by Twigg et al. (2015), who stated that deviation from the primary goal of providing healthcare was observed when these attributes contributing to an increase in workload were experienced.

However, the results of the study did not completely coincide with this finding, as medical technologists were neutral about the increase in the amount of overtime for the past month. A probable cause was that the medical technologists had adapted to the amount of workload with the same amount of time given in order to still meet the goal of providing healthcare. This instance usually happens due to a lack of awareness and recognition of the effects of understaffing. In fact, Hudson and Shen (2015) mentioned that understaffing was an issue that received none to little recognition in the workplace but deserved utmost attention because of the drawback resulting in both the performance and the well-being of the Healthcare Human Resources. However, considering that their field of work required them to be more attentive to their outputs than to whom they could delegate their tasks to, they had to compensate while still delivering quality results to issue accurate reports about the patients’ state of being.

Furthermore, the study’s related literature indicated that health care providers are prone to medical errors such as interruptions and rushed treatment due to heavy workload from understaffing (Metcalf et al., 2018). Glette et al. (2017) also supported these claims as they mentioned that late administration of medication, difficulty in administering medication, and incorrect administration or non-administration of therapy were often observed when understaffing occurred. Metcal et al. (2018) even mentioned that the flow of information could either slow down or be even completely impeded, depending on the degree of understaffing.

However, the results of this study did not completely correlate to these literatures as well, as medical technologists were neutral in the delays, such as turnaround time and treatment, experienced in the laboratory. With the urge to maintain and provide proper healthcare to patients, medical technologists compensated to avoid turnaround time and treatment delays. Hence, the primary goal of giving quality care to patients was still met, despite the evident understaffing.

On the other hand, the participants generally agreed with the rest of the statements on understaffing. The participants agreed that a lack of human resources resulted in the extension of their shifts and increased the likelihood of mandatory overtime. These findings were supported by the study of Green et al. (2013). They observed that absenteeism of healthcare professionals and other healthcare quality problems arose from factors such as understaffed workload levels. Tourigny et al. (2019) also expound on the validity of these claims. They stated that consequences of absenteeism caused by understaffing included burnout, stressful workloads, shifting rotation, and patient care standards. Results of the current study were consistent with these as the working hours of the medical technologists are often affected as they need to work for additional hours to accomplish the numerous workload due to lack of staffing.

In addition, participants also agreed that more voluntary overtime was done. This finding was coherent with the study of Metcalf et al. (2018), who stated that demand for services was continuously increased in a labor-intensive environment setting. A labor-intensive environment supposedly affects the quality of care given to the patient, as a lack of staff equated to increased individual tasks. However, since results from these tasks were expected in a certain period, present staff needed to purposely accomplish their tasks well as accurately as possible despite the shortage of staff. This may be why the findings of this study demonstrated that although the medical technologists were understaffed, they were neutral with delays and overtime.

In addition, the participants have agreed that staff shortages in the workplace led to an increased workload. This problem was consistent with the study conducted by Metcalf et al. (2018). Their study realized that the lack of staff equated to increased individual tasks for the available healthcare professionals. Increased workload also often led to higher error rates and poorer quality of care due to increasing occurrences of improper use of resources (Twigg et al., 2015). Such outcomes were also observed based on the results of the current study as the participants agreed that in one shift, they often engaged with non-medtech tasks (administration, housekeeping, statistics preparation).

Correspondingly, Banchani & Tenkorang (2014) stated that workload resulted from the fact that the number of workers was inadequate. Furthermore, workers had to attend to more clients than usual as compensation for the overwhelming range of duties and responsibilities. This was consistent with the results as the participants also agreed that there were several circumstances wherein, they had to work on another medical technologist's task rather than what they are usually in charge of.

Meanwhile, Tourigny et al. (2019) stated that understaffing increased absenteeism due to burnout and stressful workloads. As absenteeism increased, the medical technologists were given heavier workloads due to understaffing. Smart et al. (2013) also mentioned that an increase in workload contributed to fatigue, as well as absenteeism among the healthcare providers.

Generally, medical technologists are given tasks that are beyond their role as well as tasks that were assigned to their fellow medical technologists. Furthermore, the participants also agreed that there was a poor quality of supporting staff and that there are tasks they do on their own, even if they should be done with the help of others. The study conducted by Metcalf et al. (2018) mentioned that coordination and information exchange were critical in achieving favorable outcomes. Coordination and collaboration in the workplace reduced the burden caused by understaffing in a healthcare organization.

Since the participants agreed on the previously mentioned statements, based on those established by Metcalf et al. (2018), it was evident that there was a lack of camaraderie among medical technologists within their respective workplaces. This claim can also be correlated to the extent of understaffing felt by the medical technologists. Moreover, Hudson and Shen (2015) also mentioned that giving recognition was highly important in boosting the productivity and well-being of healthcare workers. Poor quality of supporting staff lacked this attribute, which may be the explanation as to why there was a high extent of understaffing felt by the medical technologists.

3.2 The Extent of Exhaustion of the Medical Technologists in the Urban Sector

Table 2. The Extent of Exhaustion of the Medical Technologists in the Urban Sector

Physical and Emotional Exhaustion	Mean	Interpretation
How often do you think “I can’t take it anymore”?	2.4649	often
Do you feel that every working hour is tiring for you?	2.1316	often
How often are you emotionally exhausted?	2.0614	often
Are you tired of working with patients?	3.1667	sometimes
Do you have enough energy for family and friends during leisure time?	2.4737	often
How often do you feel weak and susceptible to illness?	2.2982	often
How often do you feel worn out?	1.9649	often
Do you feel worn out at the end of the working day?	1.8596	often
How often do you feel tired?	1.8333	often
How often are you physically exhausted?	1.8158	often
Overall Mean	2.2070	often

(Interpretation: 4.21-5.0 never; 3.41-4.20 almost never; 2.61-3.40 sometimes; 1.80-2.60 often; 1.00-1.80 always)

Table 2 presents the Extent of Exhaustion of the Medical Technologists in the Urban Sector, specifically the results that pertained to the degree of both Physical and Emotional Exhaustion experienced by the participants of the study. The first three questions in the table corresponded to emotional exhaustion, while the latter seven pertained to physical exhaustion.

According to the mean values obtained for each response, the participants generally responded “sometimes” ($x=3.1667$) to the question “Are you tired of working with patients?”. The participants also generally answered “often” for the questions “Do you have enough energy for family and friends during leisure time” ($x=4737$) and “How often do you think ‘I can’t take it anymore’?” ($x=2.4649$). They also responded “often” to all of the succeeding questions regarding exhaustion: “How often do you feel weak and susceptible to illness,” ($x=2.2982$); “Do you feel that every working hour is tiring for you,” ($x=2.1316$);

“How often are you emotionally exhausted,” ($x=2.0614$); “How often do you feel worn out,” ($x=1.9649$); “Do you feel worn out at the end of the working day,” ($x=1.8596$); “How often do you feel tired,” ($x=1.8333$); and “How often are you physically exhausted” ($x=1.8158$).

Table 2 also demonstrates how the participants often felt exhausted in general, as an overall mean of 2.2070 was obtained for the questions under healthcare exhaustion.

Wang et al. (2021) discussed how healthcare workers were vulnerable to the stresses of emotional exhaustion in the workplace. The findings of their study showed that the majority of the nurses and physicians they observed experienced such exhaustion even before the pandemic. Although the current study results were not specific to quantifying the workers experiencing exhaustion, the consistency of its results with the claims of other studies that healthcare exhaustion occurred in the workplace shed light on the finding that medical technologists from urban secondary laboratories in Region 3 often experience emotional exhaustion.

The emotional exhaustion experienced by the medical technologists was congruent with that of the results from Table 1 as it validated how exhaustion felt by the participants was concurrent with the understaffing in their workplace. This can also be seen in the study of Gutsan et al. (2018), who proved that increasing the understaffing in the workplace institution produced an increase in the risk of emotional exhaustion for workers. Furthermore, with particular emphasis on the fourth to the tenth question, based on the data obtained, physical exhaustion is evident among medical technologists as six (6) out of seven (7) physical exhaustion-related survey questions were interpreted as often, with mean values ranging from 1.80 to 2.60. These results corroborate previous studies by Maslach and Leiter (2016) and Hert (2020), which revealed that healthcare workers (HCWs) were exposed to a continual sense of tiredness or exhaustion.

Patient-related physical exhaustion demonstrated the highest mean among exhaustion-related questions and was the only question categorized under “sometimes.” This may be attributed to the fact that although medical technologists suffer from physical exhaustion, they have often set the matter aside to maintain professionalism and dedication to their profession, which involves patient communication and interaction. This finding was congruent with the study of Khasne et al. (2020), who emphasized how healthcare workers neglected exhaustion to comply with their work demands. However, their continuous neglect of exhaustion can increase their strain, which resulted in unfavorable outcomes related to productivity, job satisfaction, and organizational citizenship behaviors that can affect them daily (Odonkor, S. & Frimpong, K., 2020).

The majority of the participants demonstrated physical exhaustion caused by work fatigue, particularly the feeling of being tired and worn out at the end of every working day, in which these results appeared to be consistent with the aforementioned study by Odonkor & Frimpong (2020). In addition to this, medical technologists also experienced weakness and susceptibility to illnesses.

Generally, the results were in accord with previously presented studies which consensus was that the overburden of workload physically and mentally exhausted healthcare workers, and exposes them to a high risk of experiencing distress which was detrimental to their well-being and performance (Wang et al., 2021; Zhang et al., 2020; & Opoku et al., 2021).

3.3 The Work Performance of the Medical Technologists in the Urban Sector

Table 3. The Work Performance of the Medical Technologists in the Urban Sector

Work Performance	Mean	Interpretation
I managed to plan my work so that I finished it on time.	2.3333	often
I kept in mind the work result I needed to achieve.	2.1140	often
I was able to set priorities.	2.4737	often
I managed my time well.	2.4737	often
On my own initiative, I started a new task when my old tasks were completed.	2.5614	often
I worked on keeping my job-related knowledge up-to-date.	2.3596	often
I took extra responsibilities.	2.6579	sometimes
I actively participated in meetings and/or consultations.	2.5965	often
I complained about minor work-related issues at work.	3.4561	almost never
I made problems at work bigger than they were.	3.4474	almost never
Overall Mean	2.6474	sometimes

(Interpretation: 4.21-5.0 never; 3.41-4.20 almost never; 2.61-3.40 sometimes; 1.80-2.60 often; 1.00-1.80 always)

The work performance of medical technologists in the urban sector presented in Table 3 indicated the mean values of the responses to work performance questions.

Based on the responses, “I complained about minor work-related issues at work” obtained the highest mean ($x=3.4561$), which was interpreted as “almost never.” The same interpretation was also obtained for the statement, “I made problems at work bigger than they were” ($x=3.4474$). On the other hand, the statement “I took extra responsibilities” was interpreted as sometimes ($x=2.6579$), while the statement “I actively participated in meetings and/or consultations” ($x=2.5965$) followed by “On my own initiative, I started a new task when my old tasks were completed” ($x=2.5614$) were both interpreted as “often.” Two of the statements, specifically “I was able to set priorities” ($x=2.4737$) and “I managed my time well” ($x=2.4737$), also resulted in an interpretation of “often.” While the responses for the rest of the statements: “I worked on keeping my job-related knowledge up-to-date” ($x=2.3596$); “I managed to plan my work so that I finished it on time” ($x=2.3333$); and “I kept in mind the work result I needed to achieve” ($x=2.1140$), were also interpreted as “often.” Overall, the questions for work performance obtained a mean value of 2.6474, which suggests the participants only experience hindrances to the proper performance of their respective duties “sometimes”.

In Stenfors’s (2013) study about the Association of Psychosocial Working Conditions and Cognitive Complaints, cognitive overload was described as having an extensive information intake accompanied by a more significant number of work tasks to be kept in mind at the same time. This cognitive overload may be overwhelming as it takes time and

effort to focus and refocus. The fatigue that this brings may affect work performance negatively and may result in the development of “cognitive complaints” since both their mental and physical strengths are exhausted.

However, the participants of this study stated that they “almost never” complained about work-related issues at work, even if they were minor, and they “almost never” made problems at work escalate into bigger problems. This finding contradicted the claims of Stenfors (2013), wherein a decline in performance is evident in employees with emotional and cognitive exhaustion, leading to complaints. Although, other factors should be considered, such as good employee motivation in the form of benefits and compensation (Osborne & Hammoud, 2017), that could alleviate the emotional demands of the employees in the workplace.

The medical technologists who participated in this study often volunteered to start pending tasks and sometimes took up extra tasks once done with theirs. This attribute may result from sub-optimal staffing levels, wherein instead of being a specialty-based laboratory scientist, the workplace conditions forced the medical technologists into being multidisciplinary to compensate for the lack of staff in each area (Osaro & Chima, 2014). This may also be correlated to one of the questions and its interpretation under Table 1, stating that overtime was a common issue due to the amount of workload per employee and that there were tasks done on their own that should have been done with the help of other medical technologists.

In contrast with the study of Metcalf (2018), which investigated the effects of staffing to work performance, specifically management decisions and work outcomes, the medical technologists who participated in this study managed their time well. They were able to set priorities given the heavy workload. The quality of work was not compromised as well, despite the understaffing. Metcalf’s data demonstrated that medical errors were often the result of the lack of staff in hospital settings due to their labor-intensive environment. However, statistically speaking, this did not negatively affect the work performance of the current study’s participants. The studies presented could also suggest that such an outcome was obtained because existing standard operating procedures (SOPs) were followed, and there were good organizational systems in the institutions despite being understaffed.

Overall, the results of the study differ from other literature due to different work conditions and settings, and work expectations, as medical technologists are expected to accomplish their tasks efficiently in order to deliver accurate and precise results for the proper diagnosis of each patient.

3.4 The Relationships among Exhaustion, Work Performance, and Understaffing

Table 4. The Relationships among Exhaustion, Work Performance, and Understaffing

		Exhaustion		Work Performance		Understaffing	
	mean	Pearson r		Pearson r		Pearson r	
		r	p-value	r	p-value	r	p-value
Understaffing	2.4009	0.727	0.000				

Exhaustion	2.2070			0.155	0.100		
Work Performance	2.6474					0.218	0.020

Table 4 presented the results of the Pearson r test that was used to identify not only the possible relationships among understaffing, exhaustion, and work performance of the medical technologist participants but also their strengths and their directions.

Based on the values obtained, there was a significant (p-value = 0.000) high positive correlation between understaffing and physical and emotional exhaustion ($r=0.727$). This finding was supported by the study of Smart et al. (2013), who stated that fatigue, the chronic form of exhaustion that precipitated from understaffing, led to absenteeism. Furthermore, Sheward et al. (2005) reinforced this significant relationship between understaffing and exhaustion by demonstrating that increased healthcare professional-to-patient ratio also increased the risk of emotional exhaustion and job dissatisfaction.

A possible reason for this was that, as mentioned earlier, exhaustion-induced sickness absence (SA) had already been a phenomenon that occurred in the healthcare industry. Hence, more of it may be expected in the current period of the COVID-19 pandemic, where the medical care workforce was all the more stretched to its maximum. Such agreement among these studies mentioned with this particular result of the current study acknowledged that understaffing compromised the high quality of service that was supposedly provided by the healthcare workforce, as Smart et al. (2013) mentioned.

Generally, these studies were summarized by Gohar & Nowrouzi-Kia (2020) by mentioning that staff shortage was proved to bear negative consequences to the healthcare setting, locally or globally.

On the other hand, the values also showed a significant (p-value= 0.020) low positive correlation between understaffing and work performance ($r=0.218$). Inga-Berrosapi and Rodríguez (2019) mentioned that healthcare providers constituted a vital component of the healthcare system known as the human health resources (HHR). Dostie (2018) emphasized that the human element being pertained to play the most critical role in the innovation of the healthcare industry.

This result of the current study was also in alignment with the outcomes of the related literature presented, specifically that of Nkomazana et al.'s (2015) study. This was because of their discovery that shortage in healthcare staffing was significantly related to healthcare work performance as the former impeded the supposedly steady supply of trained professionals who provided the most optimal work performance.

However, it was noticeable that the results of the current study demonstrated a positive relationship between understaffing and work performance, albeit only low. In comparison, the Nkomazana et al. (2015) suggested a negative relationship between the two. A possible reason for this disparity was that the current study focused on the relationship between the two variables in the urban setting. In contrast, the study of Nkomazana et al.'s (2015) focused on the rural one. As Hudson and Shen (2015) stated, understaffing in one workplace was not similar to the same phenomenon in another.

Initially, Inga-Berrosapi and Rodríguez (2019) mentioned that a possible reason why such occurrence might have been observed in the current study was that the human healthcare

resources were the least prioritized. This claim was due to the lack or absence of health reform projects whose objectives were supposed to improve the said human resource. Hudson and Shen (2015) also supplied evidence to the claim of Inga-Berrosi and Rodríguez (2019) as they discovered that the human healthcare element received little to no recognition and overall support, despite needing the most.

However, understaffing resulted from the overwhelming influx of medical needs in the urban setting in the face of an adequate workforce, as described by Roos (2013), and not from the lack of healthcare workers as in the rural healthcare setting. Because of this, impediments to the work performance of medical technologists in the urban sectors may not necessarily result from understaffing. Hence, as discovered by the researchers, understaffing maintained a significant yet still weakly positive relationship with work performance, suggesting a slight improvement in their work performance despite the pressure brought by understaffing.

However, the Pearson r test proved no significant correlation (p -value= 0.100) between exhaustion and work performance ($r=0.155$). Gaines & Jermier (2017) regarded exhaustion as an impediment to an individual's ability to accomplish his predetermined tasks. However, Maslach & Leiter (2016) clarified this assertion by Gaines & Jermier (2017) through the identification that it was fatigue, the chronic form of exhaustion as was mentioned by Michielsen et al. (2007) to be the devitalizing aspect of tiredness. Still, this finding is consistent with the statement of Reith (2018) that the constant need for the presence of healthcare workers contributes to their exhaustion. Since the tool used assessed exhaustion, a non-significant relationship may have resulted.

Despite these, Hert (2020) still alluded to exhaustion as an inhibitor of high-quality healthcare worker performance. The possible reason the outcome was observed for the current study was that although the participants often experience exhaustion, its persistence does not commensurate with the number of times they feel that their work performance is affected, let alone impaired.

Moreover, though there have been studies reporting the negative influence of exhaustion on the work performance of healthcare workers, there has been none that focused mainly on the medical technology workforce setting. As such, though Rogers (2008) stated that the work performance is adversely affected by exhaustion, fatigue, and burnout, a generalization was made because their study only featured nurses, similar to the study of Patel et al. (2018), who focused only on physicians or doctors. This “contradiction” between the results of the current study and those of the published studies may be due to the scarcity of literature. Because of the current study’s specific focus, the medical technology profession, there is a lack of studies with a parallel focus and objective as that of the current research.

In the end, despite the disparity between the results of the study and those which have already been published in the current literature, all these still point to the need of recognizing healthcare exhaustion and understaffing in order to promote high quality work performance as was stated by Wanchum Xu et al. (2020).

4 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

The findings of this study reported that understaffing was a prevalent factor present in the participants' workplace, with the workload exceeding the number of staff present at a time. This led to the overcompensation of the present staff in order to meet the demands of the workplace as their tasks as healthcare workers were vital in the diagnosis and treatment of patients.

This shortage may be accompanied by medical errors due to time constraint from all the pending tasks at hand as one study suggested, but the extent of work performance of this study found that the participants only experienced mild hindrances and work restrictions despite the conditions of their workplace. This claim is supported by the fact that the medical technologists managed to set their priorities and finish their tasks, even willing to go overtime "sometimes" to finish the tasks for each day.

Although this compensation led to adequate work performance, this attribute often left the medical technologists exhausted due to the workload. This observation was valid as all answers to the questions regarding exhaustion were answered with "often," except when they were asked if the participants were tired of working with patients.

In addition, though understaffing in the respective workplaces of the medical technologists resulted in physical and emotional exhaustion, such exhaustion was proven to bear no effect on their work performance, while understaffing improved the quality of their work. This could suggest that medical technologists were still able to properly contend with the increasing demand for their services as they might have developed coping mechanisms whose discussions are beyond the scope of the current study. This inference supported the findings of the study because both understaffing and exhaustion bore no negative influence on the work performance of the medical technologists in the urban sector, in contrast to the consensus presented by the collection of related studies.

4.2 Recommendation

Since this study was done only within Region III, there may be discrepancies if done in other urban areas of the Philippines. Aside from this, results may differ if conducted in rural laboratories and hospitals, as the current study was carried out in an urban setting. Therefore, it is recommended that the study be tested in urban areas of different regions to discern if these studies would be consistent with the findings of the current study. It may also be recommended that a study regarding urban versus rural quality of work in a single region, under the context of work performance to identify variances in the results between the different categories of communities.

APPENDIX A: QUESTIONNAIRE

Name:

Occupation:

Workplace (Name of Laboratory/Hospital and Province):

Do you work in a secondary laboratory (yes/no):

UNDERSTAFFING					
QUESTION	1 (Strongly Agree)	2 (Agree)	3 (Neutral)	4 (Disagree)	5 (Strongly Disagree)
1. In the last month, my shifts were often extended because of the lack of another medtech					
2. I had to do more mandatory overtime this month due to the lack of manpower					
3. I have done more voluntary overtime this month					
4. The staff shortage in my workplace leads to my increased workload					
5. Comparing to the last month, the amount of overtime done by me has been increased					
6. I have often seen multiple delays experienced in the laboratory					
7. In my one shift, I often engage with non-medtech tasks (administration, housekeeping, statistics preparing, etc.)					
8. During the last month, there were several times I had to work on another medtech's task, rather than what I am usually in-charge with					

EXHAUSTION INVENTORY					
QUESTION	1 (Always)	2 (Often)	3 (Sometimes)	4 (Almost never)	5 (Never)
1. How often do you feel tired?					
2. How often are you physically exhausted?					
3. Do you feel worn out at the end of the working day?					
4. Are you exhausted in the morning at the thought of another day at work?					
5. Are you tired of working with patients?					
6. Do you sometimes wonder how long you will be able to continue working with patients?					
7. How often are you emotionally exhausted?					
8. How often do you think? "I can't take it anymore"?					
9. Do you feel that every working hour is tiring for you?					
10. Do you have enough energy for family and friends during leisure time?					
11. How often do you feel worn out?					
12. How often do you feel weak and susceptible to illness?					
QUESTION	1 (To a very high degree)	2 (To a high degree)	3 (Somewhat)	4 (To a low degree)	5 (To a very low degree)
1. Is your work emotionally exhausting?					
2. Do you find it hard to work with patients?					

3. Do you find it frustrating to work with patients?					
4. Do you feel fatigued because of your work?					
5. Does it drain your energy to work with patients?					
6. Do you feel that you give more than you get back when you work with patients?					
7. Does your work frustrate you?					

Individual Work Performance					
QUESTION	1 (Always)	2 (Often)	3 (Sometimes)	4 (Almost never)	5 (Never)
1. I managed to plan my work so that I finished it on time					
2. I kept in mind the work result I needed to achieve					
4. I was able to set priorities					
5. I managed my time well					
6. On my own initiative, I started a new task when my old tasks were completed					
7. I took on challenging tasks when they were available					
8. I worked on keeping my job-related knowledge up-to-date					
9. I worked on keeping my work skills knowledge up-to-date					
10. I came up with creative solutions for new problems					
11. I took extra responsibilities					

12. I continually sought new challenges in my work.					
13. I actively participated in meetings and/or consultations					
14. I complained about minor work-related issues at work					
15. I made problems at work bigger than they were					
16. I focused on the negative aspects of the situation at work instead of the positive aspects					
17. I talked to colleagues about the negative aspects of my work					
18. I talked to people outside the organization about the negative aspects of my work					

ACKNOWLEDGEMENT

The researchers would like to express their sincere gratitude and appreciation to everybody who in one way or another helped and extended their support for the completion of this research study.

They particularly convey their innermost appreciation and gratitude to:

Ms. Laarni E. Gloriani, RMT, MSc, MSMT, research adviser, for her utmost support that provided the researchers with not only a strengthened manuscript from her valuable comments and suggestions, but also opportunities that they are grateful to experience;

Mr. Ronelle Villares, research statistician, for sharing unselfishly his statistical and technical knowledge in the conduct of this study. Without his help, the results of this research could not have aided in improving the system of the healthcare industry;

Mr. Albert R. Castillo, LPT, research grammarian, for devoting his valuable time in editing the grammar of the manuscript. Without him, the research would not have been successfully submitted on time. His kindness and determination will be the source of inspiration in future endeavors;

Research Respondents, for offering a portion of their time to answer the research questionnaires. Their full cooperation drove this study to its successful completion;

Parents of the Researchers, for their love, support, patience, and assistance, particularly for shouldering the expenses throughout the conduct of this study;

And above all, to God Almighty, for His wisdom and glory that blessed the researchers throughout the whole study. Without His utmost grace, this study would not have been successful.

FUNDING: This research received no external funding.

CONFLICT OF INTEREST: The authors of this study declare no conflict of interest.

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Relationship between Perceived Stress and Coping Mechanisms among Medical Technology Students in a University in Manila, Philippines: A Cross-sectional Descriptive Study

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Background: The COVID-19 pandemic necessitated a sudden shift from traditional learning to an e-learning setting. Medical technology students may have different coping strategies according to their perceived stress levels.

Objective: This study aimed to assess the relationship between perceived stress and coping mechanisms among Medical Technology students at a university in Manila.

Methods: A cross-sectional, descriptive study was conducted using an online survey involving 365 undergraduate Medical Technology students in May 2022. The perceived stress scale (PSS-10) and Brief Coping Orientation to Problems Experienced (COPE) inventory were used to assess perceived stress and coping strategies, respectively. Pearson's correlation was used to examine the relationship between the two.

Results: The majority of the students had moderate perceived stress (n=291, 79.7%), 66 (18.1%) had high perceived stress, and 8 (2.2%) had low perceived stress levels. Among the categories of coping styles, the most dominant was problem-focused coping (M=3.55), whereas avoidant coping was the least utilized and had the lowest mean (M=2.36). Perceived stress was weakly associated with problem-focused coping, ($r=0.107$; $p=0.020$), and emotion-focused coping, ($r = 0.387$; $p<0.001$), while a moderate relationship was observed between perceived stress and avoidant coping, ($r=0.411$; $p<0.001$).

Conclusion: There is a relationship between perceived stress and all categories of coping strategies. Results of the study imply that the COVID-19 pandemic affects university students' mental health and well-being to some degree. The authors recommend including other variables affecting perceived stress and coping mechanisms.

Keywords: *Brief COPE, Coping Mechanisms, Medical Technology Students, Perceived Stress, PSS*

Reverse Transcription Loop-Mediated Isothermal Amplification in Detecting HIV-1 Infection: A Systematic Review

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ABSTRACT

Different diagnostic methods have been developed to detect the human immunodeficiency virus 1 (HIV-1) throughout the years. As science progresses, new methods which may be better than the traditional methods, such as loop-mediated isothermal amplification (LAMP), were invented. This systematic review aims to investigate RT-LAMP's performance in diagnosing HIV-1 in terms of its specificity and sensitivity. Relevant studies published between January 2000 to April 25, 2022, involving the sensitivity and specificity of the detection of HIV-1 in human blood samples using RT-LAMP were collected. Articles were identified through a search of PubMed and ScienceDirect databases. Out of 664 articles screened, eight articles were included in the study with consideration of established inclusion and exclusion criteria. A highly variable diagnostic value for RT-LAMP was observed in the systematic review as seen in its sensitivity values ranging from 53.85% to 100%. The specificity values, however, had a smaller range of 94.1% to 100%. Thus, the authors conclude that RT-LAMP might not yet be a valuable tool in the diagnosis of HIV-1.

KEYWORDS: HIV-1, RT-LAMP, Sensitivity, Specificity

1 INTRODUCTION

The human immunodeficiency virus (HIV) is considered as a significant challenge in the field of public health in the span of a century. The current worldwide epidemic is caused by HIV-1 or human immunodeficiency virus type 1. HIV-1 belongs to the Lentivirus genus in the Retroviridae family. The acquired immunodeficiency syndrome or AIDS is caused by this virus. Its life cycle includes the following: (1) fusion and entry, (2) reverse transcription, (3) integration and translation, (4) viral protein formation, and (5) assembly. Notably, once it enters the host through mucosal surfaces and goes to the bloodstream, it attaches to the CD4+ T-lymphocyte. The virus is cleared from the blood through the lysis of infected cells brought about by the host's humoral and cellular responses, but this normally does not put an end to viremia. Once the infected CD4+ T-lymphocytes die, it will deplete CD4+ T-lymphocytes leading to a progressive dysregulation of the host's immune system in a span of years up to decades. This virus coexisting with opportunistic infections can ultimately hasten the host's death (Cassis-Ghavami et al., 2009; Catallozzi, 2008).

As per the recommendations of the World Health Organization (WHO), HIV virological assays that are designed for clinical diagnosis should have a minimum sensitivity of 95% but ideally more than 98% and a minimum specificity of 98% or more under ideal laboratory conditions.

Some of the most commonly used techniques to detect human immunodeficiency virus type 1 infections are enzyme-linked immunosorbent assay (ELISA), p-24 antigen test, and polymerase chain reaction (PCR). Each with its advantages and disadvantages.

Enzyme-linked immunosorbent assay (ELISA) is recognized to be the gold standard of immunoassays. ELISA is among the first-generation HIV antibody tests which used viral lysate antigens and only detected the IgG antibody of HIV-1. Currently, a fourth-generation ELISA is used, which can detect both HIV antibodies and p24 antigens, which makes early detection possible. It can identify specific protein antibodies and antigens even with small amounts of test samples. For HIV, the specimen of choice is blood or saliva. ELISA is used as a rapid antibody screening test and is accompanied by Western blot to be diagnostic. In addition, ELISA has 100% sensitivity as well as 99.9%-100% specificity when tested on 9,150 specimens (Alexander, 2016; Alhaji & Farhana, 2021; Yeom et al., 2006). ELISA's high sensitivity has its downfalls; it can cause false-positive results, which have been reported in different populations such as women who recently gave birth, people who were recently vaccinated against influenza or hepatitis B, patients who underwent multiple blood transfusion, patients with autoimmune diseases, patients with cirrhosis due to alcohol use, and patients with malaria and dengue infections (Wai & Tambyah, 2002). Hence, the protocol of confirming positive results with Western blot is recommended.

Western blot is a method that is used to separate and identify proteins. This method uses a mixture of proteins that will be separated based on their molecular weight, therefore allowing researchers to identify them by their type through gel electrophoresis (Mahmood & Yang, 2012). This method is used to confirm the presence of HIV-1 antibodies from licensed enzyme immunoassay (EIA) kits. Positive ELISA tests use Western blot as a confirmatory test and have a 98% sensitivity and specificity (Cordes et al., 1995). The Western blot or immunoblot assay may display up to nine bands in the electrophoresis to confirm the presence of HIV-1 proteins (Jackson et al., 1997). The ELISA-Western blot algorithm has been used for a long time. There are cases where the Western blot fails to detect an acute HIV infection, which delays the patient's antiretroviral therapy. For this reason, healthcare providers should be open to new and improved diagnostic methods for HIV (Medina-De la Garza et al., 2021).

Antigen assays are also helpful in identifying the presence of HIV. The detection of HIV-1 p-24 antigen is an example of an antigen assay and it can detect HIV-1 after 16 -17 days of exposure to the virus. This test uses a monoclonal antibody in order to capture the HIV-1 p24 antigen which will then be detected by a another antibody. The result of the entire process will be in the form of a colorimetric readout. The p-24 antigen test has a specificity that can be up to 99.92%, while its sensitivity can be up to 99.0%. However, the p-24 antigen test will no longer become effective after 45 days from the onset of infection. Thus, antigen tests that detect HIV-1 p24 should be performed with a non-reactive serological screening test, and not as a stand-alone test (Weiss & Cowan, 2004).

Polymerase chain reaction (PCR) is currently the gold standard test in HIV screening. It is a nucleic acid test in which reverse transcription of HIV RNA occurs, and DNA copies are replicated through a continuous process of repetitive reactions. Synthetic primers that complement the border of each side of the area of interest are used for DNA PCR amplification. In theory, PCR can double the number of nucleotide areas of interest with each cycle. This doubling process will lead to a sufficient amount of DNA used for analysis (Weiss & Cowan, 2004). Theoretically, PCR tests are said to have 100% sensitivity and specificity. However, in clinical practice, HIV-1 DNA PCR assays appeared to have 96-99% sensitivity in the eclipse phase (3-7 days from exposure and infection), where viral DNA is within undetectable quantities (Lakshmi, 2011).

Nucleic acid amplification is a very valuable discovery in science. Nucleic acid amplification has been used in detecting infectious diseases and biotechnology, food quality control, and environmental studies. PCR has been widely used in detecting infectious diseases throughout the years because of its simplicity and reliability (Wong et al., 2018). It requires a high-precision thermal cycler since this process requires heat to denature the targeted double-stranded DNA to become single-stranded to initiate DNA synthesis. However, it is not accessible to private clinics and small laboratories because it requires sophisticated equipment. Throughout the years, scientists have been developing new amplification techniques that can overcome the limitation of PCR. Notomi et al. (2000) discovered an isothermal amplification technique that has the ability to amplify DNA efficiently, rapidly, and with high specificity.

The loop-mediated isothermal amplification (LAMP) is a new molecular technique known for its sensitivity and specificity toward the target DNA because it is capable of detecting six sequences of a target DNA using four primers and a DNA polymerase with strand displacement activity. LAMP consists of two different steps: non-cyclic and cyclic steps. The cyclic steps use an inner primer that holds the sense and antisense strand sequences of the target DNA to initiate LAMP (Sahoo et al., 2016). The strand of DNA primed by an outer primer will release a single-stranded DNA that will serve as the template for DNA synthesis. This template will be primed by the second inner and outer primers that will hybridize to the other end of the target, producing a stem-loop DNA structure. Another inner primer will be hybridized to the loop of the product and will initiate displacement DNA synthesis, creating the original stem-loop DNA and a new stem-loop DNA that is twice as long. This cycling reaction process will continue and accumulate 10⁹ copies of the target in under an hour in an isothermal condition between 60°C and 65°C, an amount much higher than what PCR can produce. The end products are stem-looped DNA with inverted repeats of the target and multiple loops formed by annealing between inverted repeats in the same strand. In theory, LAMP is highly sensitive because it can recognize the target DNA by six distinct sequences, followed by four direct sequences expected to amplify the target (Notomi et al., 2000). This essential quality of LAMP is highly significant to the medical community as well as the general public, as it aids in augmenting the assurance of HIV-1 diagnosis. As HIV testing is normally equipped with highly purified virus antigens (Kimmig, 1990) and

diagnostic algorithms, the emergence of LAMP would only exemplify virus recognition, especially in different instances like seroconversion.

Point-of-care (POC) rapid nucleic acid amplification testing (NAAT) methods that are easy to interpret, have a rapid turnaround time, do not require complicated equipment, and demonstrate high sensitivity and specificity are an exemplar to detect acute HIV-1 infection as early and as accurately as possible. An HIV-1 RT-LAMP that is capable of RNA and DNA detection in one reaction tube simultaneously has been evaluated for use in the laboratory as a rapid NAAT method. It exhibited promising results such as detecting the infection one to three weeks earlier in seroconverting patients compared to an antibody test. Aside from being a rapid POC NAAT, it can also be an option in certain laboratory settings because of its lower cost and faster turnaround time. This method has the potential to become a supplemental or confirmatory test alongside other methods (Rudolph et al., 2015).

The incongruence of the findings of primitive records and the absence of any systematic review on the diagnostic performance of RT-LAMP on HIV-1 calls for the need to summarize the existing findings of all relevant literature to provide more accessible evidence for professionals. The results of the accumulated studies will be summarized in the first systematic review on the performance of RT-LAMP in the detection of HIV-1 infection.

2 METHODS

2.1 Eligibility criteria

Table 1 Inclusion and Exclusion Criteria according to PICOS ("Population, Intervention, Comparison, Outcomes, and Study Design")

Parameter	Inclusion Criteria	Exclusion Criteria
Population	Blood samples of patients aged 0 to 99, both sexes	No HIV-1 positive blood samples
Intervention	Loop-mediated isothermal amplification method and its variants	No loop-mediated isothermal amplification and its variants utilized
Comparison	Not applicable	
Outcomes	Detection of HIV-1, sensitivity, specificity, true positive, true negative, false positive, or false negative	No HIV-1 detected, without sensitivity, specificity, true positive, true negative, false positive, and false negative
Study design	Case-control, cohort, case report, and experimental studies Published between 2000-2022	Animal studies, literature review, expert opinion, letters to the editor, conference reports, and cross-sectional studies Published before 2000 Papers not published in English

Table 1 shows the PICOS utilized to specify the inclusion and exclusion criteria of the primitive records in the systematic review. The study must include a population of blood samples of patients within the range 0 to 99 years old of both sexes, have used the loop-mediated isothermal amplification method as the diagnostic method, and have reported the sensitivity, specificity, true positive, true negative, false positive, or false negative in the clinical diagnosis of HIV-1 infection. The study must be a case report, case-control, cohort, or experimental study published from January 2000 to April 25, 2022. Studies that did not use HIV-1 positive blood samples and LAMP and its variants as the diagnostic method were excluded. In addition, studies without specificity, sensitivity, true positive, true negative, false positive, and false negative as variables were also excluded. The review also excluded animal studies, literature reviews, expert opinions, letters to the editor, conference reports, and cross-sectional studies. The researchers also barred research articles published before January 2000 and articles not published in English from being included. This systematic review followed the “preferred reporting items for systematic reviews and meta-analyses” (PRISMA) guidelines (Page et al., 2021).

2.2 Information sources

The researchers searched PubMed and ScienceDirect databases for research articles that will be included in this systematic review. The research articles were collected from both databases on October 16, 2021, and were screened on October 20, 2021. The articles were updated and screened once more on April 25, 2022.

2.3 Search strategy

For both databases, keywords, and filters were utilized in searching for articles. The keywords were typed as ("LAMP" OR "loop-mediated isothermal amplification") AND ("HIV-1") AND ("Sensitivity" OR "Specificity" OR "TRUE NEGATIVE" OR "TRUE POSITIVE" OR "FALSE NEGATIVE" OR "FALSE POSITIVE"). The articles were filtered from January 1, 2000, to April 25, 2022, and only those categorized as research articles and case reports were taken for screening.

2.4 Selection process

The researchers decided which studies to include and exclude in the systematic review by utilizing the constructed PICOS. Seven independent reviewers manually screened 94 to 95 records out of the 664 primitive records. The journals gathered were evaluated by the article title, body, and full text.

2.5 Data collection process

From the eight qualified reports, two reviewers collected data from each report independently. Data were deliberated among the proponents by their appropriateness and relevance to the study before synthesis.

2.6 Data items

The results collected from the studies included in this paper are the clinical sensitivity and specificity of LAMP in detecting HIV-1 infection. In considering the common factors of the gathered studies, the researchers decided to collect the said results because these results

were relevant to answering the objectives of this systematic review paper. It was maximized to provide an excellent quality output.

The researchers extracted information such as the author's name, publication year, study design, number and type of sample, and the sensitivity, specificity, true positive, true negative, false positive, and false negative results of the diagnostic methods used. These parameters were used to evaluate the diagnostic performance of the reverse transcription loop-mediated isothermal amplification (RT-LAMP) in detecting HIV-1 infection.

3 RESULTS

A total of 664 primitive records were screened using the research parameters indicated in the PICOS of the study, 643 of which were retrieved from ScienceDirect, while the remaining 21 were retrieved from PubMed (Figure 1). Upon screening, seven articles were removed as duplicates. A further 649 articles were excluded from the list due to the following reasons: articles diagnosing a different condition (n=29), articles not using human blood (n=5), articles that used a method other than RT-LAMP (n=600), and articles that did not discuss the specificity, sensitivity, true positive, true negative, false positive, or false negative in the study's results (n=10), articles that were not written in English (n=3), an article from a book chapter (n=1), and an abstract only article (n=1). After screening, the researchers retrieved eight articles to be included in the review.

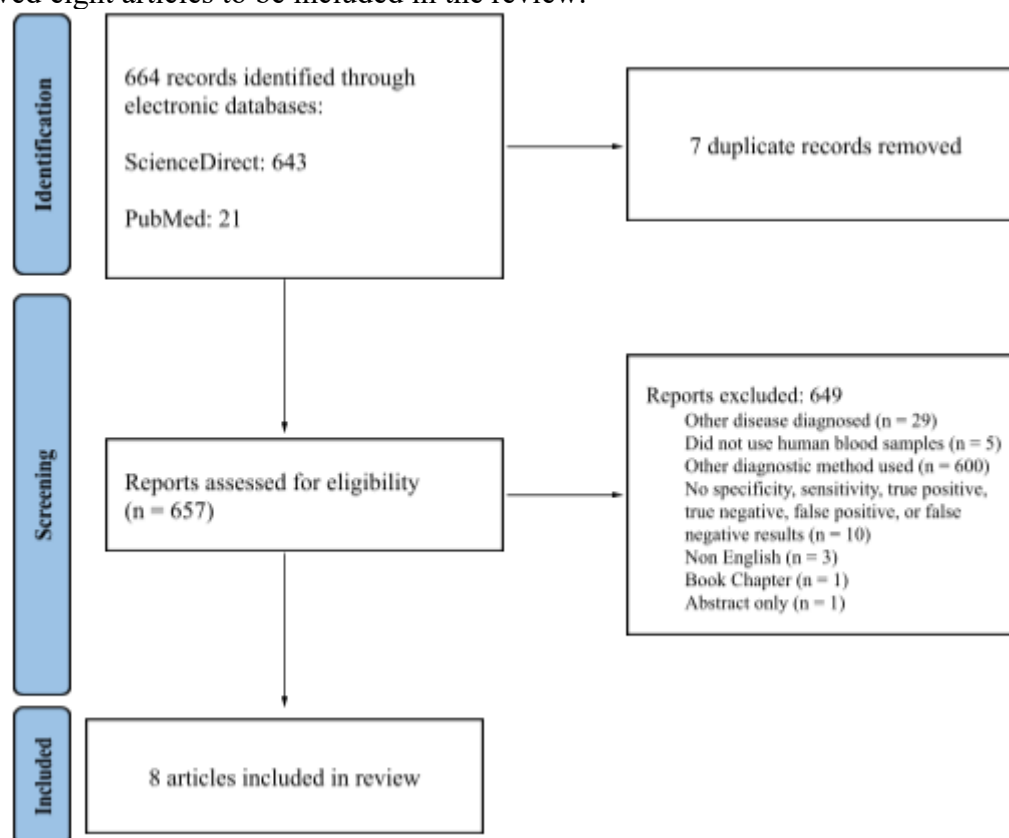


Figure 1: PRISMA Flow Diagram Presenting The Detailed Search Strategy

All articles were published in English between the year 2008 to 2022. There were four paired tests, and one internal validity, external validity, proof of concept, and immunologic study included in the review. Of which three articles were from China, two from America, and one from Japan, Germany, and the United Kingdom (Figure 2).

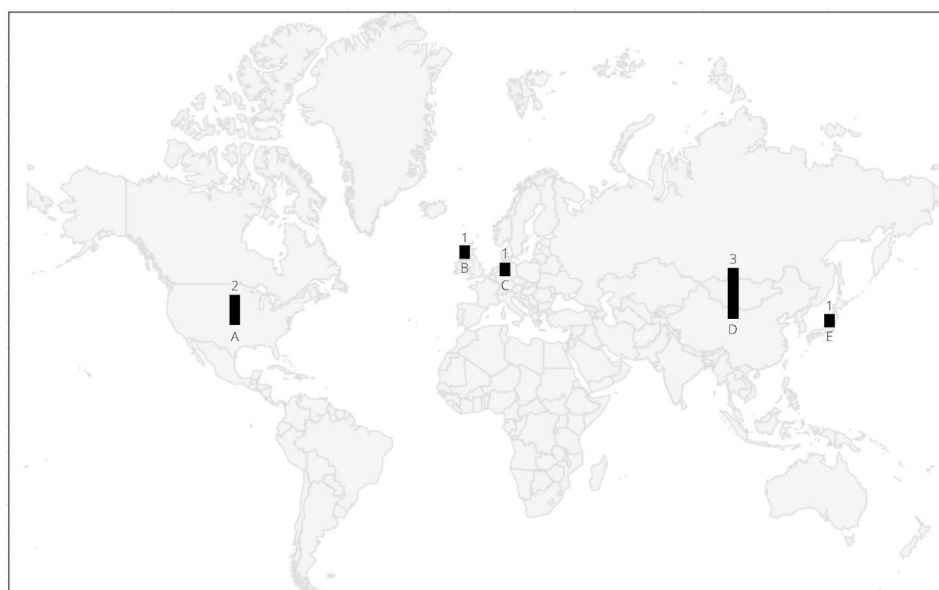


Figure 2: Geographical distribution of included studies and the number of articles per country
(a)USA (b)UK (c)Germany (d)China (e)Japan

Among the eight articles, four used plasma samples, while the other four studies each used whole blood and plasma, cell culture supernatant and plasma, and serum. In addition, one article did not specify the type of blood sample used. In terms of the index test, three utilized different types of RT-LAMP, namely, hydrogen ion-selective RT-LAMP, pH RT-LAMP, and variant-tolerant RT-LAMP, whereas the five others used the conventional RT-LAMP in examining the sample for HIV-1. These data are summarized in Table 2. Table 3 summarizes the outcomes of the included studies.

Table 2 General Characteristics of Included Studies

Author, Year, Setting	Design	Sample Size	Sample	Index Test	Index Test Gene Target	Reference Test
Curtis et al., 2008, USA	Experimental (Internal Validity)	10	Plasma sample, whole blood samples	RT-LAMP	Protease and p24	PCR and RT-PCR
Curtis et al. 2018, USA	Experimental (Immunologic)	61	Plasma samples	RT-LAMP	Integrase	EIA and Western Blot
Gurralla et al., 2016, England	Experimental (Proof of Concept)	991	Plasma samples	pH RT-LAMP	Integrase	VERSANT HIV-1 RNA 3.0 Assay (bDNA)
Hosaka et al., 2009,	Experimental (External	97	Plasma samples	RT-LAMP	Integrase	HIV Ab testing

Japan	Validity)					(AxSYM HIV 1/2 gO) and PCR
Kong et al., 2021, China	Comparative Accuracy (Paired test)	57	Serum samples	H ⁺ -RT-LAMP	Not specified	RT-qPCR
Li et al., 2021, China	Comparative Accuracy (Paired test)	127	Plasma samples	Variant-tolerant RT-LAMP	Integrase	RT-qPCR
Odari et al., 2014, Germany	Comparative Accuracy (Paired test)	346	Plasma samples	RT-LAMP	Integrase	Abbott m2000rt system (RT-qPCR)
Zhao et al., 2012, China	Comparative Accuracy (Paired test)	171	Serum samples	RT-LAMP	Integrase	Western Blot and ELISA

Table 3 Results of Included Studies

Studies, year	True Positive (TP)	False Negative (FN)	False Positive (FP)	True Negative (TN)	Total Sample	Sensitivity	Specificity	Limit of detection
Heat-treated Plasma Samples								
Curtis et al., 2008	3	2	—	—	5	60%	—	100 to 1000 RNA copies/tube
Whole Blood Samples								
	4	1	—	—	5	80%	—	
Curtis et al. 2018	50	11	—	—	61	81.97%	—	10 ⁴ RNA copies/mL (94.3%)
Tube assay								
Gurralla et al., 2016	824	177	0	18	991	82.32%	100%	10 RNA copies (lowest)
								>1000 RNA copies/reaction (95%)

	On-chip assay							
	93	71	0	18	164	56.7%	100%	>1000 RNA copies/reaction (88.8%)
Hosaka et al., 2009	56	0	0	41	97	100%	100%	120 copies/mL
Kong et al., 2021	39	1	1	16	57	97.5%	94.1%	10 copies per tube
Li et al., 2021	39	6	0	37	82	86.67%	100%	< 18 copies per reaction (95%)
Odari et al., 2014	203	28	1	114	346	87.88%	99%	1.2×10^3 copies/mL
Zhao et al., 2012	18	0	0	153	171	100%	100%	155 copies/mL (100%)

4 DISCUSSION

With the continuous spread of HIV-1 despite the establishment of therapeutic measures, early detection of the virus—seroconversion included (Odari et al., 2014), is still significant in the prognosis, control, and prevention of the infection. In spite of prevailing conventional methods effectively detecting the peak levels of viremia and mucosal shedding of HIV-1 during acute infection, they are still posed as ineffective due to their cost, high-technical skill requirement, and sophisticated equipment. This is in particular with indigent areas and immediate care health facilities where resources are limited. The opportune introduction of RT-LAMP in the detection of HIV-1 highly suits the factors lacking in the diagnosis of HIV-1 with its rapid and cost-effective advantages. With its turnaround time of sixty (60) minutes at most, compared to the two to three (2-3) hours of RT-PCR and PCR marked a huge cut down on the intensiveness of conventional procedure. The formation of a magnesium-pyrophosphate by-product, appearing as white precipitate indicative of a positive result, enables the visualization of the reaction through turbidity. Interpretation of undetected results is enhanced under UV irradiation with Fluorescent Detection Reagent and intercalating dye or the addition of a nucleic acid stain, such as PicoGreen. Since the assay is under isothermal conditions, amplification of the RNA and/or DNA of HIV-1 does not need the aid of sophisticated equipment such as thermocyclers (Curtis et al., 2008; Hosaka et al., 2009).

The range of sensitivity of RT-LAMP situated in the lower limit of detection (1000 copies/mL) compared to that of plasma viral load that may extend from 10^3 - 10^8 viral

copies/mL, will reach a detection rate of 95% (Curtis et al., 2008; Gurralla et al., 2016). Consequently, this makes it inferior to the UltraSensitive in-vitro Assay (Roche), but still superior to the Standard Assay kit with 400 copies/ml and conventional RT-PCR assays with 4-fold sensitivity (Zhao et al., 2012). Nonetheless, an increase in sensitivity is possible by increasing the volume of the overall reaction mix that elevates its detection capacity — remarkable for infection with low range viral loads (Curtis et al., 2008; Hosaka et al., 2009). Direct heating of the samples is another proposed alternative, giving a higher sensitivity than RNA extraction. In doing so, detection of proviral DNA and/or RNA which endures throughout infection warrants diagnosis of individuals beyond the primary infection (Hosaka et al., 2009). Regardless, confidence in the said remedies needs further investigation (Odari et al., 2014).

The primer in RT-LAMP accounts for six primers, including four specific primers and isothermal Bst DNA polymerase (loop primers), which equips the method to distinctively detect eight regions of the target sequence. Analysis of the agreement between seronegative samples and negative samples run under PCR showed total specificity, supporting the case (Hosaka et al., 2009). This feature promotes the high specificity of the method and the low probability of false-positive results (Hosaka et al., 2009; Zhao et al., 2012). Even so, reports of negative samples may still present non-typical amplification suspiciously caused by the self-reactivity of oligonucleotides in the reaction (Curtis et al., 2008). Thereon, the design and optimization of the primers are vital in the performance of RT-LAMP.

RT-LAMP is also presented as an ideal confirmatory test for HIV-1. Although the lacking degree of RT-LAMP in its sensitivity, specificity, reproducibility, and potential for automation detain the method to be categorized as such (Zhao et al., 2012). At the outset, primers of RT-LAMP specifically recognize the M group of HIV-1. In a study from Japan, 56 group-M HIV-1 out of 57 HIV-1 strains are detected, missing one group-O strain (Hosaka et al., 2009). Other studies share the same finding wherein a lower limit of quantification at 9.8×10^3 detects group-M samples within the value (Odari et al., 2014). Multiplexed integrase primers have recently demonstrated detection of the diverse subtypes of HIV-1 Group-M viremia while having a consistent detection rate (Curtis et al. 2018), which somehow answers the raised question about the universal use of RT-LAMP, and its detection of other subtypes.

Today, improvements in the development of the assay brought a variant-tolerant RT-LAMP technique which resolves the issue by having an 85.7% advance on the positive detection rate of the conventional RT-LAMP visualized with lateral flow strips or another colorimetric version (Li et al., 2021). Meanwhile, in a study by Gurralla et al., a novel low-buffer HIV-1 pH-LAMP was incorporated with a complementary metal-oxide-semiconductor (CMOS) chip allowing multiplex assay under one run (Gurralla et al., 2016).

With the characteristics of RT-LAMP being a rapid and easy diagnostic tool, integration of the diverse variety of HIV-1 viremia will exemplify its point-of-care and resource-constrained setting. Further exploration on the detection of RT-LAMP is still extensively needed, specifically to construct a technique that covers all subtypes including recombinant forms (CRFs) and unique recombinant forms (URFs) of the HIV-1 M group.

4.1 Limitations

The conclusions from 3 out of 8 studies were made for modified versions of the RT-LAMP, which may in turn affect the overall result of this review to assess the performance of RT-LAMP. However, this review does not analyze the differences among the modified RT-LAMPs used in the evidence. There is also a lack of standardization in the diagnostic accuracy of the studies, particularly the protocols which vary among laboratory sites. These

include the pretesting or confirmatory testing of samples, preparation of samples, type of samples used and their collection, and the RNA and DNA extraction process.

Another limitation of the evidence is the incomplete reporting of the studies. Among the eight studies, two did not directly identify the clinical specificity and sensitivity of RT-LAMP, whereas one study did not directly identify the specificity. In other studies, the clinical specificity and sensitivity of RT-LAMP were calculated using the samples with amplifications below the limit of detection reported, possibly causing low sensitivity results. Other factors for the low sensitivity reported in the studies are the various technologies used and the possibility of the new RT-LAMP assays not being established well enough during their publication. Furthermore, the sample sizes of the studies varied from one another, some having as low as five while others had as high as 991 samples.

Systematic reviews have no minimum number of studies required, but due to the overall low number of studies included in this review, further research is desired to have a better unanimity from the collected and analyzed data. Additionally, a meta-analysis of the pooled data was not performed due to time constraints. Thus, the quantitative analysis of the diagnostic value of RT-LAMP in the diagnosis of HIV-1 is not available.

4.2 Implications of the study

This systematic review aims to investigate the RT-LAMP's performance in diagnosing HIV-1 based on its sensitivity and specificity. It was accomplished by including relevant studies that involved the specificity and sensitivity in detecting the presence of HIV-1 in human blood samples using RT-LAMP. Consequently, a practical contribution of the results of this systematic review is that the RT-LAMP is not yet suitable to be used as a diagnostic tool for HIV-1 despite the given knowledge that the technique is cost-effective and simple. The sensitivity results of RT-LAMP for HIV-1 as a diagnostic tool shows that its chance of being used for clinical purposes is not yet plausible. With this paper's results, the medical field will be provided accessible evidence on the diagnostic performance of RT-LAMP and may allow improvements to this alternative diagnostic method for HIV-1. It is believed that this systematic review is timely in both the general public and medical community, given that roughly 84% of HIV-infected people around the globe were aware of their HIV status in 2020, and there is still a remaining 16%, approximately 6 million people, who didn't have access to HIV testing services ("The Global HIV/AIDS Epidemic," 2021).

For future systematic reviews, the inclusion and utilization of more journal articles will be necessary to refine and further strengthen the results. The paper could be improved as discussed in the limitations of the study in the area of studies that should be included. This is necessary to have a better foundation for the results and a more credible output. Moreover, a meta-analysis of the aforementioned journal articles is recommended to provide quantitative analysis.

5 CONCLUSION

A systematic review of eight studies showed inconsistency in the diagnostic value for RT-LAMP, as seen in its sensitivity values ranging from 53.85% to 100% and specificity values ranging from 94.1% to 100%. However, the RT-LAMP technique's short turnaround time, ease of use, and cost-effectiveness make the assay a promising tool for diagnosing HIV-1. Thus, the authors conclude that RT-LAMP might not yet be a valuable tool in diagnosing HIV-1. However, several limitations, including the credibility of the studies, differing sample sizes and units reported, the inclusion of novel RT-LAMP assays, and the absence of a meta-

analysis of the pooled data, leave room for further improvement in future studies and reviews on the same topic.

ACKNOWLEDGEMENTS: We would like to thank our thesis adviser Ian Paulo C. Gigante, RMT, LPT, MPH, for the guidance and expert assistance he has provided during the course of this paper. We also wish to thank Giovanni De Jesus Milanez, Ph.D., and Oliver Shane Dumaol, RMT, MSMT, CBO (University of Santo Tomas Faculty of Pharmacy, Manila, Philippines) for their methodological advice.

REGISTRATION AND PROTOCOL: This systematic review is not registered.

FUNDING: The authors declare that this systematic review received no external funding.

CONFLICT OF INTEREST: The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT: All relevant data are included in the paper or its supplementary information.

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Stories of Unsung Heroes: Lived Experiences of Filipino Contact Tracers in the Implementation of Contact Tracing During the COVID-19 Pandemic

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ABSTRACT

Contact tracing is a control measure used globally to identify all possible close contacts of COVID-19 patients. Countries known to have successfully curbed the COVID-19 spread, like China, Japan, and South Korea, implemented contact tracing as part of their pandemic response. The Philippines also started contact tracing in the early days of the pandemic. However, more than a year after the contact tracing implementation, the country still experienced its highest single-day increase of COVID-19 cases. Filipino contact tracers are one of the forefronts of this pandemic since the efficacy of the country's pandemic interventions partly relied on their work and the challenges that affected their work process. Thus, this study explored the lived experiences of contact tracers to understand their views on contact tracing in the Philippines and its effectiveness against the COVID-19 spread. This qualitative study uses a descriptive phenomenological approach to gain insights and subjective responses from the participants. This study conducted online interviews with twelve (12) participants, and the responses were recorded, transcribed, and subjected to thematic analysis using MAXQDA qualitative data analysis software. From the analysis, five (5) themes that focused on the experiences and challenges of contact tracers emerged, namely: (1) *Contact tracing experiences*, (2) *Healthcare skills and preparedness*, (3) *Health education challenges*, (4) *Resource mobilization*, and (5) *Social impact of COVID-19*. Moreover, this study generated a geographical distribution to visualize the breakdown of the participants' shared challenges and experiences: the used contact tracing method, contact tracers' educational background and training, lack of resources and manpower, patient cooperation, privacy issues, contact tracing delays, contact tracers' physical and mental health issues, political issues, and health inequities. The challenges identified through the lived experiences of Filipino contact tracers may contribute to the preparation and enhancement of contact tracing interventions for future surges and novel infectious diseases.

Keywords: Contact tracing, contact tracers, COVID-19, close contacts

Survival Assessment Among Seropositive HIV Patients with Pulmonary Tuberculosis Undergoing Highly Active Antiretroviral Therapy Using Hematological Parameters and CD4 Count in a Hospital in Batangas, Philippines

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Introduction

Recent studies have shown that hematological parameters are correlated with early mortality among individuals with Human Immunodeficiency Virus (HIV). This study aimed to assess the survival and risk of death among seropositive Filipino HIV patients with and without Pulmonary Tuberculosis (PTB) undergoing Highly Active Antiretroviral Therapy (HAART) using hematological parameters and CD4 count.

Methods

Retrospective analysis was applied to assess 80 randomly selected alive or deceased HIV-seropositive patients regardless of PTB co-infection and HAART status by utilizing results from the hematological parameters mentioned from January 1, 2014 to January 1, 2019 in a secondary hospital in Batangas. Subgroups consisting of seropositive-HIV patients considering PTB co-infection and HAART status were also analyzed. Collected data were subjected to statistical treatment using survival analysis, particularly the Cox proportional hazard regression.

Results

Regardless of HAART status and PTB co-infection, platelet count [HR = 0.987, 95% CI: 0.978 to 0.996, $p=0.006$] and CD4 count [HR = 0.984, 95% CI: 0.976 to 0.991, $p<0.001$] are significant factors for the risk of death among HIV patients.

Conclusions

Platelet and CD4 count are crucial predictors of the risk of death among HIV patients. A larger sample size, along with a 1:1 male-to-female ratio, suggest a higher probability of having more significant hematologic parameters for the assessment of the survival and risk of death among HIV patients regardless of PTB co-infection and HAART status.

Keywords: CD4 count, Co-infection, HIV, Pulmonary Tuberculosis

THE ADAPTIVE BEHAVIORAL IMMUNE SYSTEM DURING THE EMERGENCE OF COVID-19 VARIANTS: THE CONCERN AND PREVENTATIVE HEALTH BEHAVIORS AMONG ADULTS IN THE NATIONAL CAPITAL REGION, PHILIPPINES

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ABSTRACT

The adaptive behavioral immune system is a complex network of behavioral mechanisms that involves the cognitive and affective system of the body to prevent contact and transmission of infectious pathogens. This descriptive correlational quantitative study aimed to investigate the relationship between the adaptive behavioral immune system and COVID-19 variants in terms of concerns and preventative health behaviors of National Capital Region residents aged 18-65 years old. Data on socio-demographics, COVID-19 exposure, behavioral immune system, COVID-19 variants concerns, and COVID-19 preventative health behaviors were collected from 517 respondents through an online survey. Descriptive statistics, Spearman ranking correlation, and p-value determination were used as statistical tools. Results show that respondents demonstrate a high germ aversion and a low perceived infectability and majority exhibit concern and engage in preventative health behaviors. The correlation and p-value determination of germ aversion, perceived infectability, COVID-19 variants concern, and preventative health behaviors all share a positive weak but significant relationship, in contrast to previous studies. The positive weak correlation between germ aversion and perceived infectability with COVID-19 variants concern and preventative behaviors may be due to the increased vaccine coverage, increasing complacency of Filipinos, implementation of less-restrictive protocols, and previous studies being mostly conducted during the peak of the pandemic. Furthermore, the results of the study may be used to allow professionals to consider the behavioral immune system as another factor in implementing the appropriate response measures in managing community movement, establishing information materials, and developing implementing guidelines for the general public regarding COVID-19 variants.

Keywords: *Behavioral Immune System, Germ Aversion, Perceived Infectability, COVID-19 Variants, COVID-19 Variants Concern, Preventative Health Behaviors*

The Assessment of the Knowledge, Attitudes, and Practices towards COVID-19 Minimum Public Health Standards among Selected Fully Immunized Individuals in the National Capital Region

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ABSTRACT

As of March 2022, 65 out of 84 million vaccine-eligible Filipinos are currently fully vaccinated (Department of Health, 2022). However, despite being fully vaccinated, everyone is still expected to comply with the Minimum Public Health Standards (MPHS), given the risk of transmitting the virus. The present study aimed to determine the level of Knowledge, Attitudes, and Practices (KAP) towards COVID-19 MPHS among fully immunized individuals in the National Capital Region (NCR). Moreover, the correlation between selected socio-demographic profiles and KAP was investigated. A descriptive correlational study was conducted among 204 fully immunized individuals with selected vaccine categories and varying demographic profiles. The data obtained were categorized based on Bloom's Cut-off point distribution (60%) and were analyzed using Pearson Correlation and Linear Regression. Upon analysis, the participants have demonstrated Fair Knowledge, Positive Attitudes, and Good Practices. The Pearson correlation model identified a significant positive correlation between KAP scores. The magnitude of the correlation between Knowledge to Attitudes and Practices was weakly positive, while the correlation between Attitudes to Practices was moderately positive. Furthermore, the linear regression analysis has shown a significant relationship between vaccine category and highest educational attainment with Knowledge and Practices, occupation with Practices, and none for Attitudes. Despite the moderate to high overall KAP, concerns of non-adherence to identified preventive measures were demonstrated, which are crucial in continuous transmission control. Therefore, to bridge the gap identified between KAP, implementation of health education and reinforcement of preventive measures must be emphasized to mitigate the transmission of COVID-19.

KEYWORDS: COVID-19, immunization, preventive measures, knowledge, attitudes, practices, public health

1 INTRODUCTION

Out of 84 million vaccine-eligible citizens, 65 million are already fully immunized in the Philippines as of March 2022 (Department of Health, 2022). As more individuals get vaccinated, there is a rising concern about the possible change in their compliance to the Minimum Public Health Standard (MPHS) towards COVID-19, contributing to the increased risk of virus transmission. The MPHS serves as the primary and most effective preventive measure against disease transmission, including handwashing, proper coughing or sneezing etiquette, wearing a face mask, physical distancing, and isolation (Department of Health, 2020). Hence, adherence to these after vaccination is still essential in managing the pandemic. A previous study in Israel showed evidence suggesting vaccine rollouts may decrease individuals' adherence to preventive behaviors (Rahamim-Cohen et al., 2021). Additionally, there is only limited local literature concerning the knowledge, attitudes, and practices (KAP) towards MPHS. With this, the study aimed to determine the level of KAP toward COVID-19 MPHS among selected fully immunized individuals. Moreover, researchers investigated the correlation between selected sociodemographic profiles and obtained KAP scores.

2 METHODOLOGY

2.1 Study Design and Sampling Method

This study utilized a quantitative descriptive correlational research design and a snowball sampling method to gather selected participants through crowdsourcing and referrals. Researchers prepared an informed consent and a questionnaire composed of Close-Ended (Yes/No) and 4-point Likert scale questions to collect the needed information properly. The questionnaire consisted of inquiry sections adapted from six related journals, modified to gauge the study's objectives, and subjected to Cronbach's Alpha for validation.

2.2 Participants

The present study constituted 204 participants who qualified based on the established inclusion criteria: individuals aged 18-59 years old; those belonging to eligible groups A1 (frontline health workers), A3 (persons with comorbidities), A4 (essential economics personnel), or A5 (indigent population); complete primary vaccination series two weeks before the study; and resident of the National Capital Region.

2.3 Data Collection and Method of Analysis

The research team conducted their data collection by online crowdsourcing through various social media platforms like Facebook, Instagram, and Twitter, with a caption and a publication material containing the link to the survey and the contact information of the principal investigator. The online tool: Google FormsTM was used to conveniently obtain and monitor the questionnaire responses from the target participants. The data obtained were categorized based on Bloom's Cut-off point distribution of < 60%, 60-79%, and ≥ 80% was subjected to statistical analysis using Pearson Correlation and Linear Regression to test the study's hypothesis.

2.4 Limitations of the Study

This study only involved 204 participants who qualified based on the inclusion criteria and had consented to their participation voluntarily. This study did not cover the participants' potential eligibility for at least one vaccine-priority group. Researchers only assessed the data based on one's applied category as declared in the questionnaire and seen on their vaccination card. Additionally, researchers did not include those belonging to the A2 (Senior Citizen group) as data was challenging to obtain through the studies' electronic survey. Furthermore, there was a significantly low vaccination rate among the elderly population (WHO, 2021). With this, researchers anticipated a probable insufficient representative data of the said group.

2.5 Ethical Considerations

Throughout the study, the researchers upheld the Data Privacy Act of 2012 (RA 10173) to ensure that all participants' private, personal, or sensitive information was held confidential and protected. The researchers have removed all possible conditions that may harm the participants while engaging in this research. An informed consent, complying with the existing ethical standards and requirements approved by the Ethics Board of Committee, was provided to the interested participant before answering the research questionnaire. Eligible participants were given a choice of either consenting to participate or to decline. The data gathered was used for the sole purpose and fulfillment of this research. The data was stored in a restricted Google Drive that the investigators could only view but not download. All data were only available to the researchers, research staff, and the ethics committee board. Outside parties had no access unless the law required the disclosure of such information. The researchers ensured the removal of identity-specific information (i.e., name, email address, and vaccination card picture) before they relaid vital data to the statistician for data analysis. This guaranteed anonymity, emphasizing the participants' right to privacy and confidentiality.

Furthermore, this study was presented to various research platforms and may also be published in journals. Consequently, the study results, including the analysis of the data, and generalized data, will be available to the public, not including any of the participants' personal information.

3 RESULTS

Table 1 Socio-Demographic Profile of Participants

Socio-Demographic Variables		Frequency (%)
Gender	Male	51 (25.0%)
	Female	153 (75.0%)
Vaccination Category	A1 - Healthcare Worker	32 (15.7%)
	A3 - Persons with Comorbidities	64 (31.4%)
	A4 - Uniformed Personnel & Essential Workers	52 (25.5%)
	A5 - Indigent Population	56 (27.5%)
Highest Educational Attainment	Elementary level	1 (0.5%)
	High school level	28 (13.7%)
	Tertiary level	128 (62.7%)
	College graduate	47 (23.0%)
Occupation	Employed	45 (22.1%)
	Not employed/Student	159 (77.9%)

The sociodemographic profile of the 204 fully immunized participants living in NCR is shown in Table 1. The majority of the participants (75%) were female, 128 of 204 were in university education (62.7%), and 159 of 204 were unemployed (77.9%). Since the percentages in the vaccine category are nearly identical, there is no apparent evidence of variability.

Table 2 Knowledge, Attitudes and Practices Level of the Participants on COVID-19 MPHS

	Bloom's Category	Scores (%)	Frequency (%)	Mean	SD
Knowledge	Poor	≤ 17 (<60%)	56 (27.55%)	19.23	3.98
	Fair	18-23 (60%–79%)	114 (55.9%)		
	Good	24-30 ($\geq 80\%$)	36 (16.7%)		
Attitudes	Negative	≤ 7.7 (<60%)	17 (8.3%)	10.88	1.80
	Uncertain	7.8-10.3 (60%–79%)	40 (19.6%)		
	Positive	10.4-13 ($\geq 80\%$)	147 (72.1%)		
Practices	Poor	≤ 15.9 (<60%)	23 (11.3%)	20.998	3.62
	Fair	16.0-21.3 (60%–79%)	62 (30.4%)		
	Good	21.4-27 ($\geq 80\%$)	119 (58.3%)		

As seen in Table 2, the mean Knowledge score among all participants was $19.23/30 \pm 3.98$ denoting “Fair Knowledge” according to Bloom’s cut-off point. Almost all agreed that COVID-19 is a serious disease (99.5%); correctly answered droplets (99%) and contact with infected surfaces (98.5%) as the mode of transmission; and correctly identified elderly (97.5%) and adults with chronic diseases (99%) as the most at-risk group to COVID-19 infection. In addition, the majority could correctly answer questions related to COVID-19 symptoms. In terms of the MPHS, a high percentage of participants correctly identified the

following as effective preventive measures: wearing medical masks (99.5%), avoiding crowded places (100%), isolating infected individuals (99%), hand-sanitizing/washing (98.5%), reducing transmission with isolation and treatment (99%), and proper social distancing of more than one meter apart (93.1%). On the contrary, crucial Knowledge gaps were evident such as more than half agreed that COVID-19 virus transmission is possible through eating wild animals (54.9%), there is an effective cure (56.4%), and that antibiotics is an effective treatment (48.5%).

Moreover, the participants have a “Positive Attitude” with a mean score of $10.88/13 \pm 1.80$ (Table 2). The majority of the participants (>80%) answered *Always* in all questions under the categories of personal hygiene, wearing of face mask, and social distancing. Meanwhile under the category of isolation and contract tracing, the majority answered *Always* only towards the following: willing to practice social distancing for as long as it takes to keep themselves and others safe; staying at home when they are not feeling well; and willing to self-isolate and work from home for 7-14 days if necessary. On the other hand, only less than half of the participants (<50%) answered *Always* when asked if they agree that COVID-19 will be successfully controlled (73; 35.8%) and if they will contact a health worker whenever they have symptoms such as fever, cough, and sore throat (86; 42.2%).

The overall mean practice score among the 204 participants was 20.998 ± 3.62 , which is under the classification of "Good Practices" in Bloom's cut-off points (Table 2). Specifically, the majority of the participants (>80%) have shown good practice towards the following: performing handwashing before and after handling food (165; 80.9%); covering one's mouth when sneezing or coughing (183; 89.7%); performing handwashing after coming from outside (180; 88.2%); performing handwashing using soap and water (173; 84.8%); throwing used tissues into the bin (181; 88.7%); turning away from people when coughing or sneezing (191; 93.6%); wearing of face mask in crowded places (202; 99%); wearing of face mask in uncrowded places (169; 82.8%); avoiding contact with an infected individual (191; 93.6%); staying at home when feeling flu-like symptoms (179; 87.7%); monitoring of temperature when not feeling well (168; 82.4%); and carrying of hand sanitizer and alcohol (182; 89.2%).

Table 3 Correlation between Knowledge, attitude, and Practices towards COVID-19 MPHS

	Correlation Coefficient Value (r)		
	Knowledge Score	Attitude Score	Practices Score
Knowledge Score	1	.235**	.185**
Attitude Score	.235**	1	.609**
Practices Score	.185**	.609**	1

Note. **. Correlation is significant at values <0.01 (2-tailed).

The table above includes the determined correlation values between the KAP towards COVID-19 MPHS. The findings demonstrate a significant positive correlation ($p < 0.001$) between the KAP scores of the respective samples. Despite the weak magnitude of the correlation between Knowledge scores to attitude ($r = 0.235$) and practices ($r = 0.185$), the correlation of attitude to practices scores is moderately positive.

Particular contrasting sentiments displayed the weak positive correlation between knowledge and attitudes among participants' answers. For example, all participants agreed with the statement that avoiding crowded places is effective in the prevention of the spread of this disease (100%). However, not all (89.7%) believed that social distancing measures are always necessary and will significantly reduce the transmission of this disease. Furthermore, almost all (99.5%) stated that wearing face masks is effective against the contraction of COVID-19. Nevertheless, not all (88.7%) believe that wearing face masks is essential and that they do not only follow this practice because the government mandates it. Another finding regarding a weakly positive correlation between knowledge and practices is that despite having a high knowledge score on droplet transmission (99%), only 59.3% of the participants stated that they perform handwashing prior to touching their eyes and noses.

Following this, the data also presented a moderately positive correlation between the participants' attitudes and practices. The majority presented a positive attitude concerning social distancing, having answered *Always* in all three (3) questions about this (183:89.7%; 164: 80.4%; 170; 80.3%). However, one of the Practices chosen weakly supports this finding since only 51% of the participants stated that they maintain a distance of at least two (2) meters between other people when in public.

Table 4 Knowledge, Attitudes, and Practices According to Socio-demographic Variables

Variable	Knowledge	Attitude	Practices
	<i>b</i> 95% CI [LL, UL]	<i>b</i> 95% CI [LL, UL]	<i>b</i> 95% CI [LL, UL]
Sex			
Male	-.117	-	-
Female	.117	-.277 [-.869, .314]	.012 [-1.147, 1.172]
Vaccination Category			
A1	1.543 (.060, 3.026)*	.520 [-.277, 1.317]	1.581 [.018, 3.143]
A3	.022	.049 [-.616, .714]	1.230 [-.073, 2.534]
A4	-.070	.189 [-.546, .924]	1.894 [.454, 3.335]*
A5	.044	-	-
Highest Educational Attainment			
Elementary level	.032	-1.559 [-5.179, 2.060]	3.082 [-4.014, 10.179]
High school level	.041	-.411 [-1.162, .341]	-.041 [-1.515, 1.433]
Tertiary level	1.252 [.136, 2.368]*	-	-
College graduate	-.060	-.317 [-1.292, .659]	2.030 [.117, 4.1123.942]*
Occupation			
Employed	-.063	-	-
Not employed/student	.063	.308 [-.664, 1.281]	2.796 [.889, 4.703]

Note. * indicates $p < 0.05$. *b* = unstandardized regression weights. *UL* and *LL* = Upper and lower limits of a confidence interval, respectively.

As shown in Table 4, the results show no sufficient evidence that ($p > 0.05$) the level of KAP differed according to gender. Hence, there is no correlation between the gender of the participants and their KAP level towards COVID-19 MPHS. With regards to vaccination category, there is a significant difference in the Knowledge score among individuals under A1 or the healthcare workers ($p = 0.047$), indicating that the perceived Knowledge scores of A1 are higher by 1.543 (95% CI: 0.06 to 3.03). Meanwhile, the vaccination category is not correlated with the attitude towards COVID-19 MPHS. Moving onto the levels of practices, participants under A1 ($p = 0.047$) and A4 category or essential workers ($p = 0.010$) had a perceived practice score higher by 1.581 (95% CI: 0.018 to 3.143) and 1.894 (95% CI: 0.454 to 3.335) respectively compared to those who fall under A5 or indigent population. Based on the study, it was observed that individuals under the tertiary level had a significant difference in the Knowledge score ($p = 0.028$) which is higher by 1.252 (95% CI: 0.14 to 2.37) compared to other educational levels. However, the results showed no significant difference in the attitude scores ($p > 0.05$) according to educational attainment. In addition to this, the perceived

practice scores exhibit a significant difference ($p=0.038$) in college graduate individuals, which is higher by 2.030 (95% CI: 0.117 to 3.942) than tertiary levels. This study showed no significant difference in the Knowledge and attitude scores ($p>0.05$) according to occupation. Therefore, there is no correlation between the occupation and the Knowledge and attitude scores towards COVID-19 MPHS. On the contrary, unemployed individuals had a practice score ($p=0.004$) higher by 2.796 (95 CI: 0.889 to 4.703) than those employed.

4 DISCUSSION

4.1 Knowledge, Attitudes and Practices toward COVID-19 and the MPHS

The present study assessed the correlation of the level of KAP of selected fully immunized individuals in the NCR. Results showed that the general population demonstrated a fair level of knowledge, a positive attitude, and good practices towards COVID-19 MPHS. These findings were consistent with numerous international studies (Bazaid et al., 2021; Sulistyawati et al., 2021; Twinamasiko et al., 2021; Masoud et al., 2021; Majam et al., 2021, and Hatabu et al., 2020). The local study of Lau et al. (2020), on the other hand, reported contrasting findings where its Filipino participants showed low knowledge on certain effective preventive measures (i.e., avoiding crowded places and social distancing) and low overall attitude towards COVID-19. Moreover, the same study published contradictory results with regard to the participants' practices on preventive measures as only 28% of its participants adhered to the practice of wearing face masks. This difference may be attributed to the time when the research was conducted. The study of Lau et al. (2020) was done in the early months of the pandemic, while the present study was conducted in the following year. Considering the positive increase in the current study's results, this highlights the continuous improvement of the Filipinos' knowledge, attitudes and practices over time.

Despite the overall increased KAP levels, researchers still detected several knowledge gaps and concerning behaviors towards the COVID-19 MPHS. For instance, more than half of the participants still have misconceptions about its transmission (i.e., animal contact) and treatment (i.e., existing cure and antibiotic use). The former is supported by the study of Azlan et al. (2020), which found that only 35.7% of its participants knew that eating or touching animals could not result in infection. Meanwhile, a study in Malaysia reported similar results regarding antibiotic use, where the general public believed that antibiotics are effective viral treatments and should be prescribed when experiencing flu-like symptoms (Chang et al., 2021). Notably, this gap may be attributed to the lack of information dissemination on such matters, exacerbated by widespread misinformation and overreliance on social media to gain information (Tuppall et al., 2021).

In terms of attitudes, the studies of Puspitasari et al. (2020) in Ethiopia and Fetansa et al. (2021) in China presented contrasting results where the majority of their participants agreed that COVID-19 might be controlled. A reason for this may be associated with the differences in the citizens' confidence in their government in terms of controlling the COVID-19 crisis. The studies conducted in Ethiopia and China show that their participants are confident that their governments will be able to control the crisis (Fetansa et al., 2021; Puspitasari et al., 2020). On the other hand, a study in the Philippines stated that their participants disagreed that the government is doing enough to control the spread of COVID-19 and believed that the Department of Health (DOH) is not effective in addressing COVID-19 problems (Bautisa et al., 2020). Aside from this, only 86 (42.2%) of the participants responded that they always contact a health worker whenever they have symptoms such as fever, cough, and sore throat.

This is similar to the findings of Konjengbam et al. (2021), wherein only 41.6% of their participants agreed to contact a health worker in a similar situation. These findings may signify that there is still a need for better reinforcement of the MPHS as well as a need to improve government plans and policies in controlling the COVID-19 crisis.

Lastly, significant gaps in the participants' Practices in terms of hand hygiene, social distancing, and health-seeking practices have been observed. These are supported by Masoud et al. (2021), wherein a gap between the wearing of face masks in general (52%) compared to the wearing of masks in a crowded place (82%) has been ascertained. Moreover, the identification of gaps in the present study may present a lapse leading to contradictory results, as seen in the study by Urbán et al. (2021), as only 36.8% of the participants showed full adherence to the practices corresponding to COVID-19 preventive measures. The current study found these relevant for implementing programs regarding public awareness of COVID-19 MPHS.

4.2 Correlation Between Knowledge, Attitude and Practices towards COVID-19 MPHS

In order to further evaluate and understand the significance of the participants' knowledge, attitudes, and practices, it is vital to present the correlation between these three (3) parameters. The magnitude of correlation for the values generated between knowledge scores to attitude ($r=0.235$) and practices ($r=0.185$) is deemed weakly positive. The discovered weakly positive correlation between knowledge, attitudes, and practices is similar to the studies by Masoud et al. (2021), Wright et al. (2021), Tuppal et al. (2021), and Sari et al. (2020).

Masoud et al. (2021) presented this similar pattern between knowledge to attitudes and practices and attitudes to practices. A stronger correlation between attitudes and practices is indicative of the furtherance of objectives since the sole promotion of auxiliary knowledge would be insufficient (Masoud et al., 2021). Meanwhile, Wright et al. (2021) emphasized that predictions from health models and empirical evidence from previous epidemics and the COVID-19 pandemic suggested that less concerned individuals about contracting the virus tend to show reduced compliance despite the possession of high knowledge. A weak positive correlation of knowledge to attitudes may signify knowledge as a vital component that shapes attitudes; however, several other factors can appreciably affect this. Moreover, this may be due to decreased motivation for vaccinated individuals to yield due to lowered health risk perception and complacency (Wright et al., 2021). In addition to this, Tuppal et al. (2021) exemplified this similar pattern between knowledge and practices and attitude and practices. Finally, Sari et al. (2020) exemplified this through a weak correlation between knowledge and attitudes.

This study exhibited the correlation of attitude to practices as moderately positive. This finding is further substantiated by Masoud et al. (2021), in which the researchers discussed that their results presented a stronger correlation between attitudes and practices. The researchers from the same study further emphasized their recommendations to enhance individuals' knowledge, attitudes, and practices toward COVID-19. In order to develop individuals' practices, adequate knowledge and positive attitudes must be targeted by future interventions since the sole promotion of auxiliary knowledge would be insufficient in itself (Masoud et al., 2021). This claim was further supported by Salman et al. (2020), wherein it was recommended that health regulators utilize various electronic communication approaches

to increase Knowledge of COVID-19 further and eventually develop preventive practices for various individuals.

4.3 Socio-demographic Factors correlated with Knowledge, Attitude and Practices

Gauging people's Knowledge, Attitudes, and Practices is crucial in providing baseline information which eventually aid in the determination of gaps within Knowledge, beliefs, and actions. These measures aid in shedding light on the factors which contribute to such understanding and behavioral patterns. In the research locale, the assessment of the KAP level on compliance to minimum public health standards and determination of the factors influencing the KAP scores have a pertinent role concerning the cases of infections and deaths in COVID-19. Furthermore, this identifies gaps necessary for the implementation of COVID-19 MPHS.

Shrestha et al. (2021) and Limbu et al. (2020) revealed that healthcare workers have higher knowledge levels than non-healthcare workers as the former are expected to be more educated considering the increased COVID-19 risk exposure within their workplace. Their responsibility of being equipped with the correct health information will ensure their protection and, most especially, their patients. Moreover, Bautista et al. (2020) revealed that healthcare and non-healthcare personnel tend to comply more with the appropriate preventive practices against COVID-19. Consequently, the collective adherence to proper practices will serve as a primary intervention in effectively decreasing the COVID-19 transmission and disease burden in communities.

A high percentage of knowledge is seen in higher levels of education due to increased access of students on various social media platforms, considering the current online educational setup (Erfani et al., 2020). Hence, this gives them greater awareness regarding transmission, symptoms, and risk groups. On the other hand, Hatabu et al. (2020) highlighted that perceived higher practice scores of college graduates could be attributed to their advanced understanding, encouraging beneficial behaviors such as avoiding contact with others and washing hands.

Bajaj et al. (2021) and Chai et al. (2022) reported that the decreased practices of employed individuals are probably due to their extensive daily exposure outside and confinement to crowded workplaces compared to non-workers. Therefore, their inconsistency in complying with the protocols may result in low practice scores. Furthermore, non-workers have more access to health information about COVID-19 published online since they have more time browsing their social media accounts than employed people.

5 CONCLUSION

Overall, the general population demonstrated fair knowledge, positive attitudes, and good practices towards COVID-19 MPHS. A weakly positive correlation was exhibited between knowledge score to attitudes and practices, while moderately positive between attitudes score to practices. Moreover, there was a significant relationship between vaccine category and highest educational attainment with knowledge and practices, occupation with practices, while none for attitudes. The present study provided a benchmark of the KAP of selected fully immunized individuals towards COVID-19 MPHS in NCR. Furthermore, this emphasizes the importance of continuing health education and reinforcement of

implementing strategies to enhance knowledge, maintain a positive attitude, and highlight good practices towards COVID-19 to mitigate the transmission of the disease.

For future studies, researchers recommend an increase in participant size, change in setting, or involvement of different age groups. While the current study holds an equal distribution of participants per city within NCR, it is notable that women and the unemployed sector were over-represented in the sample. With this, researchers also recommend a more systematic and probability-based sampling method to attain a greater diversity among the participants and more generalizable and representative results.

ACKNOWLEDGEMENTS: The researchers of this study would like to express their gratitude and wholehearted appreciation to all participants, for this study would not have been completed without their cooperation; various acquaintances for disseminating the survey questionnaire across social media platforms; Mr. Jerome Jimenez for sharing his expertise in research and statistics-aiding the researchers in the analysis and interpretation of the results; Dr. Abushok, Mr. Bazaid, Ms. Sulistyawati, and Dr. Twinamasiko and their research teams, for consenting to the adaptation of their data collection tool questionnaires; The UST Faculty of Pharmacy Research Ethics Committee, who ensured that the study satisfies all ethical procedures; Asst. Prof. Julius Eleazar Jose, Ph.D., and Ms. Canellie Canlas, MSMT, for providing significant suggestions as primary reviewers; Prof. Edilberto P. Manahan, Ph.D., for imparting his wisdom and aiding the researchers throughout the entire course of the study; and finally; Almighty God, for giving the researchers the grace to persevere, working hand-in-hand with one another to complete their study, despite limited resources and challenges faced during this difficult time of pandemic and government predicaments.

FUNDING: This research received no external funding.

CONFLICT OF INTEREST: The research team of the present study declares that no parties have provided either financial or non-financial support. Moreover, for the duration of the study, any external affiliations with organizations that may influence the study variables and outcomes were not observed. As such, the authors disclose that no conflicts of interest were observed in the duration of the study.

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The Association of ALT, AST, & LDL and Hypertension Among Patients of a Multispecialty Secondary Clinical Laboratory in Plaridel, Bulacan

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ABSTRACT:

The prevalence of hypertension in the Philippines remains high, accounting for 602.4 cases per 10,000 population. Aside from high cholesterol levels, recent studies documented a trend between hypertension and liver diseases. Thus, several researchers have tried to observe the relationship between liver parameter levels, such as aspartate aminotransferase (AST), alanine transaminase (ALT), and low-density lipoprotein (LDL), and the prevalence of hypertension. To this day, the association between these variables remains unestablished as the exact mechanism for their relationship is still unclear, deeming further research necessary. Therefore, the study aimed to determine the association between hypertension and elevated AST, ALT, and LDL among patients from a Clinical Laboratory in Plaridel, Bulacan. With the belief that there is an association between the liver parameters and hypertension, cross-sectional research design was employed to elucidate the prevalence of a disease in a population at a given time and establish relationships between study variables. Through purposive sampling, secondary patient data were analyzed via the chi-square test of independence and binary logistic regression. Results showed that the liver parameters ALT, AST, & LDL had a significant relationship with hypertension. Specifically, there was a 1.71 times higher prevalence of acquiring high blood pressure with elevated LDL levels than those with normal LDL levels. Meanwhile, those with elevated ALT and AST levels demonstrated a higher risk of 1.51 times and 1.65 times the prevalence of acquiring hypertension, respectively, than those with normal ALT and AST levels. This implied that individuals with elevated liver parameters have greater chances of developing hypertension.

Keywords: ALT, AST, LDL, hypertension, normotensive, hypertensive

The Effect of Pandemic-Related Pregnancy Anxiety On Neonatal Outcomes Amidst the Covid-19 Pandemic In A Secondary Hospital In Balanga City, Bataan, Philippines

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ABSTRACT

The emergence of a worldwide pandemic from COVID-19 inevitably led to compromising all sectors of health, particularly among pregnant women. Because maternal anxiety is proven to affect neonatal outcomes, the study objectifies to assess the effects of pandemic-induced maternal anxiety among pregnant women in a secondary hospital in Balanga City, Bataan. Upon employing a quantitative design, two sets of neonatal data, each obtained before and during the pandemic, as well as survey questionnaires for expecting mothers were deployed to assess pandemic-related pregnancy anxiety. A total of 73 samples per set – pre-pandemic, during-pandemic, and pregnant women in their third trimester were all obtained and subjected to statistical analyses. Respondents were found to be having experienced COVID-19-related

perinatal anxiety, primarily about the risks brought by the disease to their pregnancy. Among them, 8.2% exhibited significant levels of COVID-19-related anxiety in accordance with the CAS scale, 35.6% on the CPAS-11 scale, and 43.8% for AnCAn scale. Statistically negative significant relationships ($p < 0.05$) were found between COVID-19-related anxiety symptoms and APGAR (1 and 5 MIN) scores, birth weight, and birth length. A significant negative correlation was observed between birth length and symptoms of nausea ($r = -.26$, $p < .05$), while a significant relationship was found between the birth lengths ($p = 0.17$) of the newborns before and during the pandemic. Conclusively, COVID-19-related maternal anxiety symptoms have an effect on the neonatal outcomes of newborns during the pandemic. These results highlight the implication of screening for maternal mental health in pregnancy management.

KEYWORDS: Anxiety, Birth length, COVID-19 Pandemic, Neonatal Outcomes, Pregnancy

1 INTRODUCTION

The current outbreak of the coronavirus causing COVID-19 (SARS-CoV-2) has reported more than 200 million cases worldwide as of August 31, 2021, over 2 million of which originate in the Philippines (John Hopkins University & Medicine, 2021; World Health Organization, 2021). Comparably ill-equipped to other nations, the Philippine healthcare system is severely compromised by the pandemic, with limited access to sufficient services (“COVID-19: An Ongoing Public Health Crisis in the Philippines,” 2021). As a case in point, the maternal health sector in the Philippines is affected.

Pregnancy, in itself, is already difficult due to the biopsychosocial changes women experience (Adalia et al., 2021). Because of the particular healthcare needs of pregnant women, they are more vulnerable to respiratory virus infections (Kotlar et al., 2021). COVID-19 and its associated restrictions as a new risk factor, including the probability of increased anxiety during pregnancy, is possibly observed.

Several quantitative measurements were used to assess neonatal outcomes, which evaluate a newborn's condition at birth. In the Appearance, Pulse, Grimace, Activity, and Respiration (APGAR) scoring system, newborn screening data and birth weight, length, and circumference serve as the neonates' parameters; which can be used for statistically related stressors (Hasanjanzadeh, 2017; Azizi, 2018). In addition, survey questions and anxiety-specific assessments such as the Coronavirus Anxiety Scale (CAS) form, the Coronavirus Pandemic Anxiety Scale (CPAS-11) form, and the Antenatal Coronavirus Anxiety Scale (AnCAn) were deployed to respondents to detect, identify, and evaluate any present anxiety symptoms that can affect neonatal outcomes (Lee, 2020; see also Bernardo et al., 2020; Tikka et al., 2021).

With all things considered, the study primarily aims to find the effect of pandemic-induced maternal stress and anxiety on neonatal outcomes by evaluating quantitative data on infants and detecting signs of anxiety symptoms from their mothers.

2 RESULTS

2.1 Patient Demographics

The respondents were mainly 24 to 28 years old. 71.2% of the respondents were married. Most of the respondents had higher educational attainment at 93.2% and were fully employed at 49.3%.

2.2 Common COVID-19-Related Maternal Anxiety Symptoms

According to the CAS scale, the majority of the respondents reported that they did not feel nauseous (67.1%), dizzy, lightheaded, or faint (67.1%), have loss of appetite (65.8%) nor paralysis (60.3%) in response to exposure to coronavirus information. A portion of respondents did not encounter insomnia and sleeping problems but 38.4% reported rare to frequent episodes of sleeping discomfort in less than a day or two (Table 1).

Table 1. Frequency of Coronavirus Anxiety Scale (CAS) Form Scores

Category	Never	Rare	Several days	More than 7 days	Nearly every day
I felt dizzy, lightheaded, or faint when I read or listened to news about the coronavirus	49 (67.1)	16 (21.9)	7 (9.6)	1 (1.4)	0 (0)
I had trouble falling or staying asleep because I was thinking about the coronavirus	33 (45.2)	28 (38.4)	7 (9.6)	5 (6.9)	0 (0)
I felt paralyzed or frozen when I thought about or was exposed to information about the virus	44 (60.3)	23 (31.5)	5 (6.9)	1 (1.4)	0 (0)
I lost interest in eating when I thought about or was exposed to information about the coronavirus	48 (65.8)	21 (28.8)	3 (4.1)	1 (1.4)	0 (0)
I felt nauseous or had stomach problems when I thought about or was exposed to information about the coronavirus	49 (67.1)	19 (26.0)	4 (5.5)	1 (1.4)	0 (0)

* Unit of measurement = number of respondents (% of the whole)

According to the CPAS-11 scale, most of the respondents did not have difficulty breathing (64.4%), feeling restless or agitated (57.5%), faster heartbeat (50.7%), difficulty falling asleep (45.2%), worried about dying (45.2%), nor had difficulty relaxing (42.5%) (Table 2). The remaining indicators manifested as anxiety symptoms felt several days in the past two weeks. Among these, the respondents appeared to panic when people sneezed or coughed near themselves (45.5%) and when placed under circumstances in which they were unable to practice hand hygiene frequently (42.5%). (Table 2).

Table 2. Frequency of Coronavirus Pandemic Anxiety Scale Form (CPAS-11) Scores

Category	Never	Several days (past two weeks)	More than half the days (past two weeks)	Nearly every day (past two weeks)
Worried that I or someone in my family might get infected	10 (13.7)	29 (39.7)	18 (24.7)	16 (21.9)
Felt panic thinking about being near a hospital or clinic for whatever reason	27 (37.0)	29 (39.7)	12 (16.4)	5 (6.9)
Felt panic when I or someone else around me coughs or sneezes	12 (16.4)	31 (42.5)	17 (23.3)	13 (17.8)

Felt bothered that I cannot wash or sanitize my hands as frequently as I want to	14 (19.2)	31 (42.5)	14 (19.2)	14 (19.2)
Felt faster heartbeat	37 (50.7)	20 (27.4)	11 (15.1)	5 (6.9)
Felt restless or agitated	42 (57.5)	14 (19.2)	15 (20.6)	2 (2.7)
Found it difficult to fall or stay asleep	33 (45.2)	24 (32.9)	10 (13.7)	6 (8.2)
Had difficulty relaxing	31 (42.5)	26 (35.6)	7 (9.6)	9 (12.3)
Had difficulty breathing	47 (64.4)	18 (24.7)	7 (9.6)	1 (1.4)
Worried about dying	33 (45.2)	24 (32.9)	9 (12.3)	7 (9.6)
Worried about family and/or friends dying	17 (23.3)	24 (32.9)	10 (13.7)	22 (30.1)

* Unit of measurement = number of respondents (% of the whole)

2.3 Risk Factors Contributing to COVID-19-Related Maternal Anxiety

According to the AnCAn scale, most of the respondents did not worry or fear about the lack of childbirth-related rituals and customs (56.2%), fetal harm from sanitizer use (45.2%), lack of social support (35.6%) and breastfeeding (34.2%). Majority of the respondents experiencing anxiety every day for the past two weeks mainly had worry for the risk of the fetus possibly acquiring coronavirus infection (39.7%). This is followed by worries on social media news on COVID-19 (38.4%), care of newborn during the pandemic (38.4%), and delivery/labor risks for COVID-19 (38.4%). (Table 3).

Table 3. Frequency of The Antenatal COVID-19 Anxiety Scale (AnCAn) Scores

Category	Never	Several days (past two weeks)	More than half the days (past two weeks)	Nearly every day (past two weeks)
Worries or fear related to the risk of Corona Virus infection due to pregnancy	9 (12.3)	26 (35.6)	17 (23.3)	21 (28.8)
Worries or fear related to fetus having the risk of Corona Virus infection	6 (8.2)	29 (39.7)	11 (15.1)	27 (37.0)
Worries or fear about ante-natal checkups/scans due to the risk of Corona Virus infection	13 (17.8)	26 (35.6)	15 (20.6)	19 (26.0)
Worries or fear about delivery/labor due to risk of Corona Virus infection	10 (13.7)	28 (38.4)	12 (16.4)	23 (31.5)
Worries or fear about breastfeeding due to risk of Corona Virus infection to the newborn	25 (34.2)	23 (31.5)	11 (15.1)	14 (19.2)
Worries or fear about care of the newborn child during the Corona Virus pandemic	13 (17.8)	28 (38.4)	12 (16.4)	20 (27.4)
Worries or fear about harm to fetus due to increased use of sanitizer	33 (45.2)	20 (27.4)	10 (13.7)	10 (13.7)

Worries or fear due to others in the household not maintaining enough sanitization	14 (19.2)	28 (38.3)	20 (27.4)	11 (15.1)
Worries or fear on hearing social media and news reports related to Corona virus pandemic	19 (26.0)	28 (38.4)	13 (17.8)	13 (17.8)
Worries or fear about less access to medicines because of Corona Virus related lockdown	21 (28.8)	22 (30.1)	19 (26.0)	11 (15.1)
Worries or fear about not having childbirth-related rituals and customs (God bharai, baby shower, aqiqah, etc.)	41 (56.2)	22 (31.1)	4 (5.5)	6 (8.2)
Worries and fear regarding lack of social support (emotional, domestic, financial, social relationships, and workplace) during pregnancy or after birth of the baby in the context of the Corona Virus pandemic	26 (35.6)	24 (32.9)	11 (15.1)	12 (16.4)

* Unit of measurement = number of respondents (% of the whole)

2.4 Neonatal Outcomes from Mothers with Significant COVID-19-Related Anxiety

Of the 73 respondents, 6 (8.2%) mothers exhibited probable levels of anxiety according to the CAS scale, 26 (35.6%) using the CPAS-11 scale, and 32 (43.8%) when the AnCAn scale was used (Table 4). Of the 73 respondents, 6.8% of the patients (n = 5) exhibited significant anxiety levels using the three scales (Table 5). Total APGAR scores at the first and fifth minutes were normal, with more than half of the newborns not requiring a total APGAR reading at the tenth minute. Newborn outcomes of birth weight, birth length, and head circumference were all within normal limits. Age of gestation for most was term and within 38-40 weeks of gestational age. Newborn weight compared to gestational age was also termed appropriate for more than half of the neonates. Findings showed that the newborn screening results from mothers with significant anxiety levels in all three scales had values outside of normal limits. The newborn screening results showed hemoglobinopathies, G6PD deficiency, and congenital hypothyroidism.

Table 4. Neonatal Outcomes from Mothers with Significant Levels of COVID-19 Anxiety according to the Anxiety Scales

Category		CAS (n = 6)	CPAS-11 (n = 26)	AnCAn (n = 32)
Type of Delivery	Caesarian	6 (100)	20 (76.9)	26 (81.3)
	Natural Spontaneous Delivery	0 (0)	6 (23.1)	6 (18.8)
APGAR Score (1 minute)	≥9	0 (0)	0 (0)	21 (65.6)
	7-8	5 (83.3)	18 (69.2)	0 (0)
	≤6	1 (16.7)	8 (30.8)	11 (34.4)
APGAR Score (5 minute)	≥9	4 (66.7)	12 (46.2)	15 (46.9)
	7-8	1 (16.7)	9 (34.6)	12 (37.5)
	≤6	1 (16.7)	5 (19.2)	5 (15.6)

APGAR Score (10 minute) 9	$\geq$	0 (0)	1 (3.8)	3 (9.4)
		1 (16.7)	5 (19.2)	7 (21.9)
	7-8	0 (0)	2 (7.8)	2 (6.3)
	≤ 6	5 (83.3)	18 (69.2)	20 (62.5)
	N/A			
Newborn screening	Within Normal Limits	3 (50)	23 (88.5)	28 (87.5)
	Others	3 (50)	3 (11.5)	4 (12.5)
Birth weight (g)	> 4, 000	0 (0)	0 (0)	1 (3.1)
	2, 500 – 4, 000	5 (83.3)	22 (84.6)	28 (87.5)
	< 2500	1 (16.7)	4 (15.4)	3 (9.4)
Birth length (cm)	> 60	0 (0)	0 (0)	0 (0)
	45.7 – 60	4 (66.7)	19 (73.1)	27 (84.4)
	< 45.7	2 (33.3)	7 (26.9)	5 (15.6)
Head circumference (cm)	LGA	0 (0)	1 (3.8)	2 (6.3)
	AGA	5 (83.3)	22 (84.6)	27 (84.4)
	SGA	1 (16.7)	3 (11.5)	3 (9.4)
Age of Gestation (weeks)	> 42	0 (0)	0 (0)	0 (0)
	38 – 42	4 (66.7)	21 (80.8)	25 (78.1)
	≤ 37	2 (33.3)	5 (19.2)	7 (21.9)
Weight for Gestational Age	PRETERM-LGA	0 (0)	1 (3.8)	1 (3.1)
	TERM-LGA	0 (0)	0 (0)	2 (6.3)
	PRETERM-AGA	2 (33.3)	4 (15.4)	5 (15.6)
	TERM-AGA	4 (66.7)	20 (76.9)	23 (71.9)
	PRETERM-SGA	0 (0)	1 (3.8)	1 (3.1)
	TERM-SGA	0 (0)	0 (0)	0 (0)

* Unit of measurement = number of respondents

Table 5. Neonatal Outcomes from Maternal COVID-19 Related Anxiety

Category				Maternal Anxiety (n = 5)
Type of Delivery	Caesarian			5 (100.0)
	Natural Spontaneous Delivery			0 (0)
APGAR ≥ 9	Score	(1 minute)		0 (0)
				4 (80.0)
		7 – 8		1 (20.0)
		≤ 6		
APGAR Score (5 minute)		≥ 9		3 (60.0)
		7 – 8		1 (20.0)
		≤ 6		1 (20.0)

APGAR Score (10 minute) 9	$\geq$	0 (0)
		1 (20.0)
	7 – 8	0 (0)
	≤ 6	4 (80.0)
	N/A	
Newborn screening	Within Normal Limits	2 (40.0)
	Others	3 (60.0)
Birth weight (g)	> 4, 000	0 (0)
	2, 500 – 4, 000	4 (80.0)
	< 2500	1 (20.0)
Birth length (cm)	> 60	0 (0)
	45.7 – 60	3 (60.0)
	< 45.7	2 (40.0)
Head circumference (cm)	LGA	0 (0)
	AGA	4 (80.0)
	SGA	1 (10.0)
Age of Gestation (weeks)	> 42	0 (0)
	38 – 42	3 (60)
	≤ 37	2 (40)
Weight for Gestational Age	PRETERM-LGA	0 (0)
	TERM-LGA	0 (0)
	PRETERM-AGA	2 (40.0)
	TERM-AGA	3 (60.0)
	PRETERM-SGA	0 (0)
	TERM-SGA	0 (0)

* Unit of measurement = number of respondents (% of the whole)

2.5 Correlation of Neonatal Outcomes and COVID-19-Related Maternal Anxiety

Regarding neonatal outcomes and maternal anxiety, according to the CAS scale, anxiety symptoms of nausea or stomach problems towards coronavirus information had a weak negative correlation with birth length ($r = -0.260$; $p = 0.026$) (Table 6).

Table 6. Correlation of CPAS-11 and neonatal outcomes

Symptoms		APGAR (1 min)	APGAR (5 min)	Birth Length	Birth Weight
CPAS-11 1 Worry over family members contracting the infection	<i>r</i>	-0.27	-0.244	-0.305	
	<i>sig</i>	0.021	0.037	0.009	
CPAS-11 11	<i>r</i>	-0.325	-0.293		

Worry about possible death of family and/or friends	<i>sig</i>	0.005	0.012	
CPAS-11 4	<i>r</i>	-0.245		
Bothered by not being able to wash/sanitize hands	<i>sig</i>	0.037		
CPAS-11 2	<i>r</i>		-0.231	-0.399
Panic over being near a hospital or clinic	<i>sig</i>		0.05	0.000
				0.012
CPAS-11 6	<i>r</i>	-0.247	-0.235	-0.249
Restless or agitation	<i>sig</i>	0.035	0.045	0.034
CPAS-11 5	<i>r</i>			-0.251
Faster heartbeat	<i>sig</i>			0.032
CPAS-11 7	<i>r</i>	-0.247		
Difficulty in falling/staying asleep	<i>sig</i>	0.035		
CPAS-11 8	<i>r</i>	-0.255		
Difficulty in relaxing	<i>sig</i>	0.029		

* $p < 0.05$

Regarding neonatal outcomes and maternal anxiety according to the CPAS-11 scale, worrying over family members of the same household contracting COVID-19 was found to have a weak negative correlation with both APGAR (1 min) ($r = -.27$) and APGAR (5 min) ($r = -.244$). Meanwhile, birth length demonstrated a moderate negative correlation ($r = -.305$). Another symptom correlated with neonatal outcomes was worry about the possible death of family or friends during the COVID-19 pandemic. The results showed a moderate negative correlation between the said symptom and APGAR scores in the 1st ($r = -.324$) and a weak negative correlation on the APGAR score (5min) ($r = -.293$). The symptom of being bothered when unable to wash/sanitize hands also correlated with neonatal outcomes. This symptom had a moderate negative correlation with APGAR (1 min) ($r = -.325$). Panic over being near a hospital or a clinic has also negatively correlated with neonatal outcomes. The said symptom was negatively correlated with APGAR score (5 min) ($r = -.231$; weak relationship), birth length ($r = -.3999$; moderate relationship). However, no or negligible correlation was found with birth weight ($r = .012$). Restlessness/agitation and faster heartbeat were also found to have a weak negative correlation with APGAR (5 min) score ($r = -.247$), birth length ($r = -.235$), and birth weight ($r = -.249$). Lastly, both difficulty in falling/staying asleep ($r = -.247$) and difficulty in relaxing ($r = -.255$) had weak negative correlation with neonatal outcomes (Table 6).

2.6 Comparison of Neonatal Outcomes Pre- and During COVID

Comparison of neonatal outcomes pre-and during COVID. Neonatal outcomes APGAR scores (1 Min) ($p = 2.724$), APGAR Score (5 Min) ($p = .279$), age of gestation (WKS) ($p = .097$), and birth weight (g) ($p = .94$) between neonates born before and during the pandemic have no significant relationship (Figs. 1a 1b, 1c, and 1d). On the other hand, neonatal data on birth length (cm) during the pandemic ($p = .017$) was significantly low and showed a significant difference from neonates born in the previous years (Fig. 1e) Head circumference ($p = .754$) had weak evidence correlating neonatal outcomes before and during the pandemic (Figs. 1f).

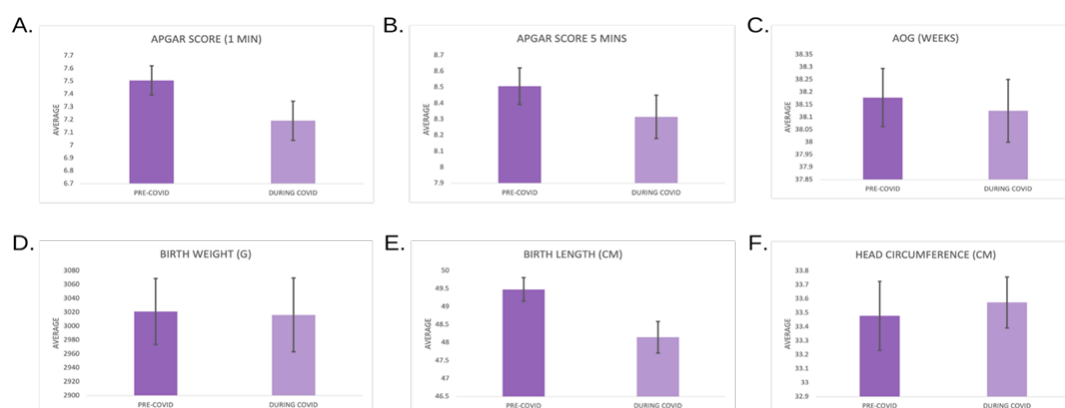


Figure 1. Bar graphs of ANOVA scores of neonatal outcomes from pre-COVID years and during COVID. (A) Bar graph of ANOVA scores of APGAR score (1 min) from pre-covid years and during covid. (B) Bar graph of ANOVA scores of APGAR score (5 min) from pre-COVID years and during COVID. (C) Bar graph of ANOVA scores of age of gestation from pre-covid years and during covid. (D) Bar graph of ANOVA scores of birth weight from pre-COVID years and during COVID. (E) Bar graph of ANOVA scores of birth length from pre-COVID years and during COVID. (F) Bar graph of ANOVA scores of head circumference) from pre-COVID years and during COVID.

3 DISCUSSION

The findings have shown that COVID-19-related maternal anxiety correlates with neonatal outcomes. A portion of the respondents reported rare to frequent episodes of sleeping discomfort. Anxiety is often correlated with sleeping problems as abundant feelings of fear and worry induce mental hyperarousal, which prevents ease of sleep. Sleep deprivation then further exacerbates feelings of tension and anxiety (El Sayed et al., 2021). Duration of anxiety symptoms may range from several days to more than seven days in a span of two weeks (Abas et al., 2021). The current study's results are aligned as the respondents experienced symptoms of panic when people sneezed or coughed near themselves and when placed under circumstances in which they were unable to practice hand hygiene for "Several days in the past two weeks." The non-compliance to covering one's nose and mouth prior to sneezing aroused anxiety levels as contact with respiratory droplets is the primary mode of transmission of the infection (Akdeniz, 2020). With this, associated behavioral changes are observed, as seen in some individuals who have become more persistent in maintaining hand hygiene and wearing gloves for increased protection (Barzilay et al., 2020). On the analysis of anxiety reports

regarding COVID-19 contraction, participants were most anxious about family members contracting the virus (Hafner, 2020). In addition, irrational decisions were made as COVID-19 cases surged with patients only seeking treatment as a last resort as many opt to forgo treatment due to fears of being near emergency rooms and doctor's offices (Igundunasse et al., 2022).

Increased breastfeeding frequency during the pandemic was attributed to the desire for newborn babies to obtain proper nourishment. Adequate nourishment of newborn babies was prioritized as a coping mechanism to combat COVID-19 infection (Ahlers-Schmidt et al., 2020). Pregnant mothers disagreed that the use of sanitizers or alcohol-based cleansers affected their unborn offspring. Instead, they were more inclined to practice hand- sanitizing more frequently to reduce COVID-19 contraction (Mortazavi et al., 2021). The majority of the respondents experiencing anxiety every day for the past two weeks mainly had worry and fear about the clinical outcomes for themselves and their unborn fetuses. Pregnant mothers had fears about the health care they will receive during delivery/labor some opting to refuse visitation for antenatal checkups in an attempt to reduce the likelihood of infection (Rauf et al., 2021; Mirzaie et al., 2022).

Similar to previous studies, the newborn outcomes were all within normal limits despite experiencing COVID-19-related anxiety (Lee, 2016). On the other hand, the current study's findings showed that mothers with significant anxiety levels had values outside of normal limits for congenital hypothyroidism in the newborn screening results. TSH levels may be increased in healthy, normal newborns and may be associated with multiple factors. Contributing factors included acute stress during labor which may increase TSH levels (Giesbrecht et al., 2022).

In previous studies, fear of COVID-19 was associated with reduced birth length, while other factors' degree of relationship was not considered strong (Pallangyo et al., 2020). A moderate and a weak negative correlation were observed between worrying about the possible death of family and/or friends during the COVID-19 pandemic and the APGAR scores in the 1st and 5th minute, respectively. The fear of contracting COVID-19 and being subjected to mandatory quarantine limited the seeking of antenatal health care resulting to low attendance in maternal hospitals and clinics (Yildirim et al., 2020). The lack of antenatal care led to lower APGAR scores (1 min) and poor neonatal outcomes, including stillbirth. In addition, a moderate negative correlation between APGAR (1 min) and symptoms of panic when unable to wash/sanitize hands were observed. A direct correlation was observed between exhibiting worries and the frequency of preventive behavior engagement (Farrell et al., 2020). Among all behaviors enumerated, non-participation in public transportation and persistent handwashing was the most recurrent among the population. COVID- 19 transmission to fetuses was a widely recognized stressor that promoted frequent handwashing behaviors during pregnancy (Akgor et al., 2021). Additionally, exhibiting panic over being near a hospital or a clinic was weakly negatively correlated with APGAR score (5 min) and moderately negatively correlated with birth length. The deployment of the Hospital Anxiety and Depression Scale (HADS) showed that most participants feared hospital acquired COVID infection during clinical follow-ups and delivery (Mor et al., 2020). In the first COVID-19 peak, a higher number of stillbirths was noted due to the fear of infection contraction during visits to hospital vicinities. As consultation attendance was compromised, a parallel increase was perceived in the stillbirth rate (Ogunyemi et al., 2018). Restlessness/agitation and faster heartbeat were also negatively correlated with APGAR (5 min) score, birth length, and birth weight. Untreated anxiety was shown to correlate with adverse effects on neonatal outcomes, including a low APGAR score (5 min) of less than 4 (Garabiles et al., 2019). In addition, being significantly restless more than usual should be of concern during pregnancy or postpartum and that a faster heartbeat or palpitation may also be a physical symptom of panic disorder (Javelot & Weiner, 2021; Odenhaal et al., 2019).

However, increasing maternal heart rate at 34+ weeks of gestational age was also positively associated with a significant increase in birth weight (Murata et al., 2021). Sleep quality as in difficulty falling/staying asleep and difficulty in relaxing showed weakly negatively correlation with neonatal outcomes, especially on the neonate's APGAR scores (Oktriani & Putra, 2020; Aalrazek et al., 2016). Maternal sleep duration contributed to the incidence of low birth weight and gestational age, with at least 9 hours of sleep favoring better outcomes (Oktriani & Putra, 2020; Chmielewska et al., 2021).

APGAR Score (5 Min) between neonates born before and during the pandemic was analogous to the APGAR Score (1 Min) p-value. Both parameters indicated no significant relationship before and during the COVID-19 pandemic. In congruence, APGAR (5 min) scores of less than seven during the pandemic remained similar to scores pre- pandemic and no statistical differences were found in the neonates born before and after the implementation of COVID-19 labor (Chao et al., 2021; Handley et al., 2021). 10.5% of singleton births before the pandemic were preterm, and 9.5% of singleton births were premature during the pandemic (Berghella et al., 2019). However, different findings were also found in the decrease of preterm births during the COVID-19 pandemic which may be due to variations among pandemic protocols and the population (Berghella et al., 2019; Du et al., 2021). Birth head circumference in the current study also showed weak evidence of a correlation between the neonate groups. These findings are consistent with the results of past studies (Kirchengast & Hartmann, 2021; Muin et al., 2021). Based on the data on live births in a tertiary level hospital in Beijing, China, low birth weight had a prevalence of 3.04% before the pandemic and 3.01% prevalence during the pandemic. Contrary to the scores on the outcomes mentioned, birth length showed significant neonatal differences before and during the pandemic. Previous studies share similar results with the newborn length being higher during the pandemic than the mean newborn length of the previous years (Krejcie et al., 1970). The highest mean birth length was also recorded during the COVID-19 lockdown phase (Muin et al., 2021). Increased birth length may be associated when lifestyle changes among pregnant women during the lockdown period. Environmental and emotional stress and decreased physical activity may have also increased gestational weight gain among pregnant women (Du et al., 2021).

4 METHODOLOGY

A correlational and comparative analysis research design was adapted to determine the relationship between maternal anxiety and neonatal outcomes and whether there is a significant relationship between the neonatal outcomes of infants born before the pandemic and during the pandemic. Data collection was done using online survey forms and managed by the partner Obstetrician-Gynecologist. The study was approved by the UST Faculty of Pharmacy Research Ethics Committee under the approval code FOPREC-222-035. Upon reaching the end of the research period, all findings of the study were communicated to the partnered hospital, which then has the full liberty to communicate the results with the respondents.

4.1 Sample Selection

The criteria for the sample selection of the study excluded pregnant mothers clinically diagnosed with mental illnesses. Based on the hospital's data, a population of 89 mothers gave birth from September to November in 2019. To come up with a population of mothers who gave birth from September to November in 2019, the Chi-square of the 95% confidence level was obtained at 3.84 in accordance with the chi-square distribution table, while the population proportion was at 0.5, and the margin of error was set at 0.05. This yielded the desired sample

size of 73 respondents feasible for this study, which are singleton pregnant mothers consulting Hospital A, a secondary hospital in Balanga City, Bataan.

4.2 Data Collection

The first section of the questionnaire consisted of demographic and socioeconomic questions. The second part assessed the COVID-19-related anxiety levels of the participants by utilizing the Coronavirus Anxiety Scale (CAS), Coronavirus Pandemic Anxiety Scale (CPAS-11), and Antenatal COVID-19 Anxiety Scale (AnCan).

The data collection ran from February 2022 until April 2022 only. The co-implementor of the study was a selected OB-GYNE practitioner who volunteered to deploy the online survey. The survey closed after obtaining a total of 73 responses from the participants.

4.3 Statistical Analysis

The multimethod research design involved detailed quantitative data analysis using the IBM® SPSS® Statistics software platform for epidemiological studies. Frequency of the data was done by calculating the mean. One-way ANOVA test and Spearman's correlation were used for comparison and correlation, respectively.

5 CONCLUSION

Overall, COVID-19-related maternal anxiety symptoms correlate with neonatal outcomes. Among the respondents who exhibited maternal anxiety symptoms, the symptom with the highest frequency was the feeling of panic when people sneeze or cough in close proximity to themselves, and when placed in circumstances where they could not practice hand hygiene frequently. The main pandemic-induced risk factor contributing to maternal stress concerns the fetus acquiring Coronavirus infection. Some neonatal outcomes were found to be outside normal limits among the respondents who exhibited anxiety symptoms, including reports of hemoglobinopathies, G6PD deficiencies, and congenital hypothyroidism. A significant negative correlation was found between mothers who experienced nausea or stomach problems and birth length resulting from COVID-19-related maternal anxiety. There is also a significant negative correlation between the APGAR scores (1 MIN) and (5 MIN), birth length, and birth weight. Finally, it was identified that there is a significant relationship between the birth lengths of newborns that were born before and during the COVID- 19 pandemic. In conclusion, COVID-19-related maternal anxiety levels affect the neonatal outcomes of newborns during the pandemic. These highlights the implication of maternal mental health screening in pregnancy management and monitoring in obstetric settings.

ACKNOWLEDGEMENTS: We would like to express our sincerest gratitude to Prof. Edilberto P. Manahan, PhD, as our thesis adviser. We would also like to thank Dr. Leonora De Guia Medina, MD, as the co-implementer of this study. Additionally, we acknowledge Mr. Jerome A. Jimenez, MOM, for his assistance in data and statistical interpretation. We also recognize Ms. Leilanie R. Verzosa, M.Ed., RGC, RPm, LPT, for her assistance in the validation of our survey questionnaire, and Prof. Zendel Rosario M. Taruc, PhD, for her aid in the validation of the Filipino translation of the adapted surveys. We also acknowledge Prof. Sharman A. Lee, PhD, Dr. Prabha S. Chandra, MD, and Dr. Allan B.I. Bernardo, MS, M.Phil., PhD., for allowing us to utilize the CAS, AnCan, and the CPAS-11 respectively. We would also like to thank Prof. Julius Eleazar D.C. Jose, MSMT, MA, PhD, and Ms. Ruth R. Bangaoil, MSMT, for evaluating our study as our final defense panelists. Lastly, we acknowledge the

University of Santo Tomas as well as the Faculty of Pharmacy for allowing us to fulfill this study.

FUNDING: This research received no external funding

CONFLICT OF INTEREST: Authors declare no conflict of interest.

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The Impact of COVID-19 Vaccine Brands on Vaccine Uptake among Medical Technology students from a Tertiary School in Manila

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ABSTRACT

Introduction: The Coronavirus pandemic has urged several medical professionals and government agencies to extensively recommend public immunization. Following the manufacture of COVID-19 vaccines, authorities turn to vaccination hoping to improve the state of the pandemic. However, portions of the population are still hesitant to get vaccinated despite its availability. Vaccine uptake was also affected due to misinformation circulating on various platforms. The researchers aimed to determine if Medical Technologist students from a tertiary school in Manila have personal preferences for the COVID-19 vaccine.

Materials and Methods: With 327 Medical Technology students participating in the research, a snowball sampling technique was utilized. The collated data underwent a Chi-square test where a p-value of >0.5 was considered to be statistically significant. Descriptive statistics were used to narrate the frequency, percentage, and mean of the distribution of the responses with the demography and the questions which were in the survey.

Results: Almost ninety-nine percent (98.9%) of respondents believed that it was very important to get vaccinated against COVID-19. Regarding vaccine preference, this study found that preference for vaccine brands does not have a significant effect on students' decision to get vaccinated ($\beta = -15.612$, $p > 0.05$).

Conclusions: Widening the population and focusing on areas of low vaccination rates are recommended for future research. 96.6% of respondents wished to know more about these vaccine brands; therefore, proper dissemination of vaccine information is recommended among school institutions and LGUs.

Keywords: COVID-19, brand preference, vaccine uptake

The Prognostic Significance of Red Cell Distribution Width – Coefficient of Variation (RDW-CV) in Evaluating COVID-19 Severity Among Fully Vaccinated Patients Aged 18 Years Old and Above in a Tertiary Hospital in Lipa City, Batangas

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ABSTRACT

Red Cell Distribution Width-Coefficient of Variation (RDW-CV) may serve as a prognostic tool for assessing COVID-19 severity. However, its validity, utilization, and optimal cutoff value as a potential severity indicator for fully vaccinated COVID-19 patients demand further investigation. Thus, this study aims to establish the RDW-CV cutoff value as a COVID-19 severity indicator, determine its sensitivity and specificity, and assess the RDW-CV values in categorizing fully vaccinated and unvaccinated severe and non-severe Filipino COVID-19 patients aged 18 years old and above. A retrospective research approach was conducted to evaluate the complete blood count of 64 hospitalized RT-PCR(+) COVID-19 patients. The total sample population was divided into 4 subgroups having 16 participants each and was categorized according to their COVID-19 disease severity and vaccination status. After the adjustment for the effect of age, the RDW-CV [AUC = 0.95 (95% CI: 0.87-1.00)] identified the severity of fully vaccinated COVID-19 patients with an optimal cutoff value of $\leq 13.71\%$, having 93.8% sensitivity and 81.2% specificity. On the other hand, the RDW-CV [AUC = 0.99 (95% CI: 0.97-1.00)] determined the severity of unvaccinated COVID-19 patients with an optimal cutoff value of $\geq 13.37\%$, having 100% sensitivity and 93.7% specificity. Results revealed that increased RDW-CV is predictive of severe COVID-19 in unvaccinated patients while decreased RDW-CV is predictive of severe COVID-19 in fully vaccinated patients; however, findings necessitate further evidence. Additionally, establishing RDW-SD values for fully vaccinated COVID-19 patients is recommended for a robust standalone prognostic indicator.

KEYWORDS: COVID-19 severity, Prognostic indicator, RDW-CV, SARS-CoV-2

The Relationship Between Occupational Factors And Retention Intentions In Midwives At The Budi Kemuliaan Mother And Child Health Care

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ABSTRACT

The growth of hospitals in Indonesia from year to year continues to increase. This growth is directly proportional to the demand for human resources as the driving force of the organization. It is challenging for management to obtain and maintain quality human resources to continue working in their hospitals. The problem of turnover of health workers in health service institutions in Indonesia is a problem that has often occurred. The same problem is also faced by Budi Kemuliaan Mother and Child Health Care. This research is a quantitative study with a cross-sectional design. The total sample was 111 midwives, while the data analysis used univariate and bivariate analysis. The analysis showed that 55.9% of midwives had retention intentions at RSIA Budi Kemuliaan. A significant employment factor affecting midwife retention intentions are Age, period of work and career opportunities. Midwives with a age > 34 year old 2.79 times more willing to stay at RSIA Budi Kemuliaan than midwives with perceptions. Midwives with long period of work 2.98 times more willing to stay at Budi Kemuliaan Mother and Child Health Care than midwives with perceptions. Midwives with positive perception of career opportunities are 2.95 times more willing to stay at Budi Kemuliaan Budi Kemuliaan Mother and Child Health Care than midwives with negative perceptions. Fairness in career opportunities is the impetus that motivates midwives to stay afloat. Each midwife is given the same opportunity according to her competence and skills. However, what needs attention is the relatively small career opportunities, so the opportunity for career development is also going rather slowly.

KEYWORDS: Retention Intention of Midwife, Carrier Opportunities

1 INTRODUCTION

Turnover intention is a classic problem faced by health care institutions in Indonesia, especially hospitals. The growth rate of hospitals in Indonesia from year to year continues to grow is undoubtedly accompanied by the increasing demand for human resources that are the driving force of the organization. Data from the Central Statistics Agency shows an increase in the number of hospitals in Indonesia from 2017-2021, with 370 general and special hospitals (1). This growth will undoubtedly cause increasingly fierce competition, especially in non-government hospitals. Each hospital will strive to improve the quality of services by completing facilities and, of course, being supported by qualified human resources.

Health workers are the spearhead of hospital services. Hospitals make various efforts to improve the quality of health workers starting from the selection process, training and development, compensation, and others. On the other hand, hospitals also compete to obtain qualified health workers. This condition provides benefits to health workers. With the experience and training gained in previous organizations, health workers have an excellent opportunity to move to a more promising organization in the future. On the contrary, the transfer of employees will provide losses for the hospital, both in terms of costs, resources, and employee motivation (2).

Based on several research results, it shows a relatively high turnover rate, such as in Sumatera Barat at 24.3% (3), in Bogor at 13% (4), in Surabaya 2014-2016 at 13.67%, 13.69%, 16.91% (5). The turnover rate at Budi Kemuliaan Budi Kemuliaan Mother and Child Health Care from 2018-2020 is also relatively high, namely 16.9%, 11.2%, and 13.6% (6). According to Gillies (6), the turnover rate of nurses in a hospital typically ranges from 5-10%. Above 10% is considered as the high category. Some of the factors that cause turnover include individual characteristics, factors related to work, external environmental factors, and other factors (7). This study wants to find out the relationship between factors related to work and midwife retention intentions at Budi Kemuliaan Budi Kemuliaan Mother and Child Health Care Jakarta.

2 METHODOLOGY

This study used a cross-sectional study design. The population in this study was all implementing midwives who worked at Budi Kemuliaan Budi Kemuliaan Mother and Child Health Care Jakarta, with a total sample of 111 people. The sampling method uses simple random sampling. Researchers carried out the data collection process using questionnaires. The instrument used is a questionnaire containing a list of questions/attitude statements related to variables of individual characteristics, retention intention, compensation, job design, and career opportunities.

The charging time is approximately 30 minutes. The data is obtained by meeting each midwife according to her workspace. Each of them requested to fill out a questionnaire independently. All instruments have been examined for validity and reliability. The collected data is then processed by calculating the total score for all questions on each variable and then categorized with a cut of point median. The univariate analysis determines the distribution of data per variable. In contrast, bivariate analysis determines the relationship between retention intention variables and age variables, marital status, length of service, job design, compensation, and career development.

3 RESULTS

The results of this study show that 55.9% of midwives desire to continue working at Budi Kemuliaan Budi Kemuliaan Mother and Child Health Care Jakarta. Table 1 below shows that most of the respondents who want to survive in individual characteristics are over the age of 34 years (68.5%), marital status is married (59.3%), and service period is above 12 years (69.1%). Based on factors related to work, it is known that among respondents who have a desire to survive, 60% of them have a positive perception of job design, 62.9% have a positive perception of the compensation received, and 68.3% show a positive perception of career opportunities at Budi Kemuliaan Budi Kemuliaan Mother and Child Health Care.

The Chi-Square test results in several significant factors ($\alpha = 5\%$) related to employee retention intentions, including age, length of service, and career opportunities. Midwives who have an age of >34 years 2.79 times have a desire to survive compared to the age of ≤ 34 years (95% CI: 1.28-6.06). From the perspective of the character of individuals, midwives with a service life of >12 years 2.98 times have a desire to survive compared to midwives with a service period of ≤ 12 years. Based on work-related factors, midwives who have a positive perception of job design 1.82 times have a desire to survive compared to midwives who have a negative perception (CI 95%: 0.79-4.21). While midwives who have a positive perception of compensation 2.16 times have a desire to survive compared to midwives with negative perceptions (CI 95%: 0.99-4.74), and midwives who had a positive perception of career opportunities 3.28 times had a desire to survive compared to midwives who had negative perceptions (CI 95%: 1.50-7.19).

Table I. Frequency Distribution and Bivariate Analysis of Individual Characteristics and Work Factors towards Midwife Retention Intentions at Budi Kemuliaan Budi Kemuliaan Mother and Child Health Care Jakarta

Variable	Category	Retention Intention		Odds (95% CI)	Ratio	P-value
		Yes	No			
		n (%)	n (%)			
Individual Characteristic						
Age	>34 years	37 (68.5)	17 (31.5)	2.79 (1.28-6.06)		0.015
	≤34 years	25 (43.9)	32 (56.1)			
Marital Status	Married	51(59.3)	35 (40.7)	1.86 (0.76-4.56)		0.260
	Single	11(44.0)	14(56.0)			
Period of Work	>12 years	38 (69.1)	17 (30.9)	2.98 (1.37-6.50)		0.010
	≤12 years	24 (42.9)	32 (57.1)			
Occupational Factors						
Job design	Positive	48 (60.0)	32 (40.0)	1.82 (0.79-4.21)		0.230
	Negative	14 (45.2)	17 (54.9)			
Compensation	Positive	44 (62.9)	26 (37.1)	2.16 (0.99-4.74)		0.081
	Negative	18 (43.9)	23 (56.1)			
Career Opportunities	Positive	43 (68.3)	20 (31.7)	3.28 (1.50-7.19)		0.005
	Negative	19 (39.6)	29 (60.4)			

* $p < 0.05$

4 DISCUSSION

Retention intentions are employees' intentions to stay afloat in an organization. The results of the analysis showed the proportion of midwives who had the intention to survive and who were not almost balanced. Based on several submitted statements regarding retention intentions: 48.6% of midwives expressed their desire to move to another hospital if they got a better offer; while 59.4% of midwives expressed their desire to survive in the next year; 54% of midwives stated that they would still stay for the next three years; 55.8% of midwives stated that still wanted to survive for the next five years; 69.4% stated that they would survive even though many of their colleagues left and got a better job. If analyzed further, it can be seen that there is an indecisive attitude toward midwives because although they state that they will still survive, they are willing to move if they get a better job offer. According to the researcher's view, it is likely that the midwife has the intention to move but does not want to find a job on her own or indeed has not found a better job. Mobley (9) states that the availability factor of alternative jobs will influence an employee's decision to leave or stay in the current personalization. It is a warning for Budi Kemuliaan Mother and Child Health Care because, if left unchecked, it will make a negative contribution to the performance of the hospital. Wingfield and Berry stated that employee turnover that exceeds normal limits will harm the organization (10).

The age factor is considered to encourage midwives to stay afloat, based on an analysis of age factors significantly affecting retention intentions in midwives. Midwives who have the desire to survive are in the age range above 34 years. The results of this study are also in line with Suryani's research (11) at Hermina Daan Mogot Hospital Jakarta, which stated that 71.7% of nurses who still want to survive are in the age range of old adulthood. Muclas (12) stated that the older an employee is, the less likely it is to change jobs because the older you get, the more difficult it will be to get a job. Companies tend to choose younger employees with lower salary considerations, easier to manage, more updated on knowledge and technology, more energetic, and so on. Another theory states that the age and length of work will be directly proportional to the increase in productivity because the more experienced and the ability to be honed and wiser in making decisions (12). Younger employees will quickly move because there are still many job opportunities, and smaller family responsibilities, and they do not yet have a solid attachment to the organization (11).

Some studies indicate that married employees have a more minor desire to change jobs than unmarried ones (8)(14). However, this statement is not supported in this study. This statement shows that the percentage of desire to survive in married midwives is almost the same as unmarried ones. This is because all midwives are women, if they stop there is still a husband who will be responsible for the fulfillment of family needs.

According to Robin (13), the length of service affects the employee's desire to stay or leave his organization. The results of this study showed that the proportion of retention intentions in midwives with more extended working periods was more significant than that of newer ones; namely, 69.1% of employees with more extended working periods tended to be comfortable with their work and work environment. If they change jobs, they must adapt to the new work and the environment. Senior midwives at Budi Kemuliaan Mother and Child Health Care usually occupy certain positions. In addition, senior midwives also have the opportunity to become clinical instructors who will guide students at the Budi Kemuliaan Mother and Child Health Care Midwifery Academy. This opportunity is also accompanied by

additional compensation as well as training and knowledge uptake so that the mentoring process runs well.

The design of the work includes responsibility, work autonomy, work flexibility, working conditions, and continuity of work and life (14). The results of the analysis showed that most midwives stated that the design of the work at Budi Kemuliaan Mother and Child Health Care was good. However, of all midwives who positively perceived the job design, only 60% stated that they still want to survive. According to the midwife, the workload given exceeds capacity; besides that, there is still work done outside of the midwife's job description. The hospital rarely holds refreshing activities.

The midwife's perception of the compensation given by Budi Kemuliaan Mother and Child Health Care is quite good, but it does not significantly affect the midwife's desire to survive. According to the midwife, the basic salary received is adequate. It is just that it is still imbalanced compared to the workload. Bonuses and incentives are still not following the achievement of performance, and the salary difference between new and old employees is not much different. On the other hand, there is adequate additional compensation such as pension insurance, health insurance including family, leave, children's education fund assistance, and so on. Providing reasonable compensation will motivate employees to stay in the organization and not want to move to another organization (15).

Based on the analysis results, career opportunities have a significant relationship with retention intentions in midwives at Budi Kemuliaan Mother and Child Health Care. 68.3% of midwives who positively perceive career opportunities state that they still want to survive. On the other hand, 60% of midwives who have a negative perception of career opportunities state that they have no intention of staying at the hospital. According to Panggabean (16), career opportunities are one of the factors that motivate a person to work, survive or move from an organization. Career planning at Budi Kemuliaan Mother and Child Health Care is going well, and midwives are given regular training. In addition, midwives are also given equal opportunities in terms of promotion. It is just that the available career opportunities are still small. Senior midwives usually fill positions with a relatively long term of office.

5 CONCLUSION

Majority of the midwives at Budi Kemuliaan Mother and Child Health Care have the desire to survive. Factors of age and length of service can influence the midwife's decision to stay. Although hospitals provide justice in career opportunities, hospitals need to develop policies related to career development systems and tenure to increase career opportunities for midwives, especially outstanding employees.

ACKNOWLEDGEMENTS: We would like to thank the management and all midwives at Budi Kemuliaan Mother and Child Health Care Jakarta and the Faculty of Health Sciences UIN Syarif Hidayatullah Jakarta for facilitating this research.

FUNDING: This research received no external funding

CONFLICT OF INTEREST: Authors declare no conflict of interest

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PUBLIC HEALTH CONFERENCE
1-3 NOVEMBER 2022
BANGKOK, THAILAND
CONFERENCE PROCEEDINGS

ISBN 978-86-87043-83-1
