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A cross-sectional study on the secondary school students' subjective happiness and attitudes towards mathematics

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ABSTRACT

Students' subjective happiness and attitudes toward learning a subject matter are two factors that could affect learning. These variables are essential for successful instruction. This study ascertained students' subjective happiness and attitudes towards mathematics of secondary school students grouped according to different variables and their relationship. The correlation of the two variables was also determined. Descriptive-correlational research was utilized in the study, and 300 randomly chosen students were chosen as participants. Using two adopted questionnaires, results showed a less happy student compared to the average person and a moderate level of attitude towards mathematics. These results are the same for all variables involved in the study, like sex, year level, family monthly income, daily allowance, and other variables. Results further showed a weak but significant positive correlation between the two variables involved. This suggests that the students' level of happiness may be a potential factor that can influence their attitudes toward mathematics. School stakeholders may find ways to improve students' well-being, happiness, and attitude, which could, in turn, improve mathematics performance.

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1. INTRODUCTION

Mathematics is crucial in building mental discipline among students [1] and is vital in a country's socioeconomic development [2]. Several studies worldwide have determined factors affecting learning mathematics, such as [1], [3]–[5]. These factors involved gender, course levels, students' attitudes toward mathematics, teaching methods, and attitude in class were some of the factors discussed that affect learning [1]–[3]. These pieces of research provided underlying reasons affecting students' learning and utilized better instructional strategies to improve students' performance.

In the Philippines, students' performance in mathematics is alarming. According to the Programme for International Student Assessment (PISA), the country produces the lowest proficiency for young learners in mathematics, as indicated by the 2022 rankings [6]. The Filipino students were considerably low in lessons that required higher-order thinking skills [7]. Research showed fair to poor Filipino students' mathematics performance [8]–[11]. However, there are also some studies [12]–[14] that found different types of learners, low or high-performing, above-average to very-good-level performance in mathematics. These results indicate that different learners are in different learning environments under diverse teachers with varying pedagogical approaches. This could also mean different factors have influenced these learners' learning acquisition.

Happiness is one of the factors affecting learning [15]. It is a foundation of a better life and a goal people pursue [16]. It is a subjective, internal emotion that needs cognition [17], [18] and the state of feeling well or

expressing pleasure in life [1], [19]. Happiness includes affective well-being like joy and pleasure, eudaimonic well-being linking to purpose in life, and evaluative well-being [20]. Happiness studies have received considerable attention [21] and show that the strength of social connection is the strongest predictor of people's health [22]. In an educational setup, it is found that students' happiness is associated with their learning achievement. The happier the students are, the more school achievers they will become [1], [23]–[25].

Students' subjective happiness should be at the forefront of considerable attention in instruction because improving students' school happiness would lead to higher academic achievement [26], [27]. Students' happiness and satisfaction could help them reach their academic goals [28]. Chan *et al.* [29] shared that happiness was associated with students' grades, social relations, school settings, and pedagogy. Happiness is essential in students' learning motivation [23], [30]. This means that a happy student is a motivated learner. However, studies on students' subjective happiness and its associations with positive student outcomes in the educational setting are limited [23], and verification of the possible effects of student happiness, like learning motivation, is lacking [27].

Another factor that could affect students' learning is their attitude toward a subject matter. Attitude is the person's view and evaluation of something or someone, either positively or negatively [31], [32]. It is an emotional and mental entity that drives people to act on things [33]. Attitudes are good predictors of future behavior [34], with generally medium-sized effects [35]. In a school setting, student's attitudes toward school are a good predictor of their academic achievement [1], [36]. This highlights that a student with a positive attitude achieves positive results or vice versa. Attitude is a widely researched construct [37]. In instruction, students should adopt a positive attitude toward the subject matter as an essential characteristic of the affective domain [38]. Positive attitudes were associated with higher achievement [39].

In learning mathematics, research shows that among many students' factors affecting learning, attitude is a crucial contributor to higher or lower performance [40]–[42]. Attitude toward mathematics (ATM) is "a liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless" [43]. A positive ATM could contribute to students' academic success because attitudes toward mathematics affect students' learning and academic performance [44], [45]. Davadas and Lay [4] emphasized several factors, including parental influences, teachers' affective support and instructional strategy, and past academic performance, having a positive relationship to students' attitudes toward mathematics. However, several studies have delved into students' attitudes, like [5], [37], [46], [47]. Moussa and Saali [1], related studies are scarce about students' attitudes towards math.

There is always a constant discussion on how students effectively learn mathematical concepts and skills, and knowledge in the literature is still growing because it is incomplete. Thus, determining another factor that would be correlated to students' attitudes towards mathematics, like students' subjective happiness, especially in a developing country like the Philippines. This study is essential since it adds to the literature the descriptions of the relationship between the ATM and students' subjective happiness in a secondary school setup. The study is novel because no studies ascertained the relationship between students' attitudes toward mathematics and their subjective state of happiness after the pandemic. Furthermore, the study presents several variables involved, such as the time students study their lessons, classroom conduciveness, and teachers' facilitative capacity, which would provide additional information to the literature. Finally, studies like this would be very helpful for policymakers since they provide fresh perspectives on what to include as their focus to effectively impart mathematics knowledge and skills by including factors like secondary school students' state of happiness. This research ascertained the relationship between students' subjective happiness and attitude towards mathematics. Specifically, it sought to answer the following:

- How happy are the students based on the subjective happiness scale when grouped according to: i) sex assigned at birth, ii) year level, iii) daily allowance, iv) family monthly income, v) time spent studying in mathematics, vi) teacher facilitating support (yes or no), and vii) conducive learning environment (yes or no)?
- What is the student's level of attitude towards learning mathematics when grouped according to: i) sex assigned at birth, ii) year level, iii) daily allowance, iv) family monthly income, v) time spent studying in mathematics, vi) teacher facilitating support (yes or no), and vii) conducive learning environment (yes or no)?
- Is there a significant relationship between students' subjective happiness and their attitude towards mathematics?

2. METHOD

2.1. Research design

This study utilized descriptive correlational research. The descriptive correlational research design provided answers about the relationship between the variables under study. In the study, students' subjective happiness and their ATM were determined, described, and explained in certain phenomena.

2.2. Research respondents

Secondary school students (grades 7-12) of the Visayas State University Integrated High School (VSUIHS) were the study's respondents. A stratified random sampling was utilized using year level and strand as strata. A total of 300 respondents from the population of 650 students were chosen. A permission letter was sought from the institution's principal before the study was conducted. Table 1 shows the demographic profile of the students who voluntarily participated in the research.

Table 1. Demographic profile of the secondary school students in terms of sex, year level, daily allowance, family monthly income, time spent studying in mathematics, teacher facilitating support, and conducive learning environment

Variable	Frequency category	Variable category	Frequency	Percent	Valid percent
Sex	Valid	F	176	58.70	58.70
		M	124	41.30	41.30
		Total	300	100.00	100.00
Year level	Valid	7	58	19.30	19.30
		8	49	16.30	16.30
		9	44	14.70	14.70
		10	47	15.70	15.70
		11	57	19.00	19.00
		12	45	15.00	15.00
		Total	300	100.00	100.00
Daily allowance (Php)	Valid	0-50	32	10.70	10.90
		51-100	99	33.00	33.80
		101-150	94	31.30	32.10
		151-200	37	12.30	12.60
		200-above	31	10.30	10.60
		Total	293	97.70	100.00
	Missing	System	7	2.30	
	Total		300	100.00	
Family monthly income (Php)	Valid	12,082.00-48,328.00	157	52.30	54.70
		48,328.00-144,984.00	111	37.00	38.70
		144,984.00 and above	19	6.30	6.60
		Total	287	95.70	100.00
	Missing	System	13	4.30	
	Total		300	100.00	
Time spent studying in hours per week	Valid	0-2.5	121	40.30	40.40
		2.5-5.0	110	36.70	36.80
		5.1-7.5	31	10.30	10.40
		7.6-10	22	7.30	7.40
		10.1 above	15	5.00	5.00
		Total	299	99.70	100.00
	Missing	System	1	0.30	
	Total		300	100.00	
Facilitative	Valid	No	6	2.00	2.00
		Yes	292	97.30	98.00
		Total	298	99.30	100.00
	Missing	System	2	0.70	
	Total		300	100.00	
Conducive	Valid	No	40	13.30	13.40
		Yes	258	86.00	86.60
		Total	298	99.30	100.00
	Missing	System	2	0.70	
	Total		300	100.00	

2.3. Research locale

This study was conducted at the VSUIHS, Visayas State University, Baybay City, Leyte. The school is in the eastern part of the Visayas Region in Central Philippines under the Baybay City division. The researchers administered the survey in each classroom.

2.4. Research instrument

Two research instruments were utilized in the conduct of the study:

a. Subjective happiness scale

This scale is a 4-item scale of global subjective happiness adopted from Lyubomirsky and Lepper [48]. "Two items ask students to characterize themselves using both absolute ratings and ratings relative to peers, whereas the other two items offer brief descriptions of happy and unhappy individuals and ask respondents the extent to which each characterization describes them. The four items showed good to excellent internal

consistency, with alpha's ranged from 0.79 to 0.94 (*M*=0.86). The level of subjective happiness and the score range in which it is defined are explained in Table 2.

Table 2. Mean score and description of students' subjective happiness level

Mean score	Description
>5.6	Happier than the average person
<5.6	Less happy than the average person

b. Attitude towards mathematics inventory

This brief instrument is a 40-question, 4-factor survey intended to measure the attitudes toward mathematics of high school and college students. This instrument captures multiple factors contributing to students' attitudes about mathematics [49]. The scale shows excellent internal consistency with Cronbach's Alpha value of 0.963. The level of attitude toward math and the score range in which it is defined are explained in Table 3.

Table 3. Mean score and description of students' attitude towards mathematics

Mean score	Description
4.21-5.00	Very high
3.41-4.20	High
2.61-3.40	Average
1.81-2.60	Low
1.00-1.80	Very low

2.5. Research procedures

The researchers sought the approval of the school principal and teachers of VSUIHS to conduct this study on students. After securing the approval and endorsement, the researchers secured voluntary participation from the respondents, specifying their willingness to be a part of the research. The survey questionnaire was then administered. Students involved were instructed to respond as honestly as possible.

Data gathered was analyzed using SPSS 21. In determining the subjective level of happiness of the students, the sum of the mean was utilized, while the mean and standard deviation were used for their attitudes toward mathematics. Pearson coefficient correlation (*r*) was employed to determine the significant relationship between the two variables involved in the study.

2.6. Ethical consideration

Before the study, students were informed that the research was voluntary and that all data gathered would be utilized for research purposes only, per the data privacy act of 2012. Those who indicated their willingness participated in the administered survey. The survey was administered for at most 30 minutes.

3. RESULTS AND DISCUSSION

3.1. The demographic profile of secondary school students in detail

Table 1 shows that 58.7% are female. In the year level, grades 7 and 11 got the most number, accounting for 19%. Most of the students' daily allowance ranges from 51-150 pesos, while 31 students received at least 200 pesos daily allowance. The majority of the students belong to the lower to middle classes. About 77% of the students only studied for at most five hours per week, indicating less than an hour of studying the subject matter. As for the facilitative ability of the math teacher during the discussion, 97% indicated that their math teacher facilitated whenever they got questions on the topic or needed help. Finally, 86% of the students shared that their classrooms were conducive to learning mathematics.

Results indicate that most of the students rarely study their lessons. These results imply a need to revisit teachers' planning that would enable more students to scan their notes for at least 30 minutes a day. One of the reasons could be that Filipinos spend 10 hours a day online, the highest in the world [50]. This setup could lead students to focus on social networking activities rather than studying their lessons. Magulod [51] further stated that students still need to develop highly positive attitudes toward studying to become better learners.

Results further imply that teachers may have utilized different activities that facilitate learning, like differentiated learning activities and other student-centered activities, from the student's perspective. These are necessary for becoming a facilitative teacher since successful teachers teach well-prepared and well-paced,

catering to students' abilities and interests [52]. In terms of learning environment, results imply that an appropriate classroom setting suitable for learning to take place has been placed by the school for the students. This could indicate well-ventilated classrooms, spacious cities, and manageable learning activities. This is like studying at a state university in the Philippines, showing their classroom conducive to learning [53]. Also, Afalla and Fabelico [54] shared that their physical classroom is clean, spacious, and adequately ventilated. There is indeed a need to put it up this way since a conducive classroom atmosphere minimizes misbehavior and produces better instruction [55].

3.2. Subjective happiness of secondary school students

In the study, the participants' subjective happiness score averages were calculated according to variables such as sex, year level, daily allowance, family monthly income, time spent students' study per week, having facilitative teachers, and conducive classroom environment. The results are presented in Table 4. Results show that 93% of the students were less than happy than the average person, with *a mean*<5.6. Comparing the means of the different groups, the females, grade 7 students, students with allowance ranging from Php 101-150, lowest family income earners, time studying for 7.6-10 hours per week, having a facilitative and not conducive classroom environment, got the smallest means in their cohorts. Among the 300 respondents, only 21 students were happier than the average person, with a *mean* of greater than 5.6.

As seen in Table 4, results indicate an alarming picture of the happiness state of the students. A result showing 93% to be less happy than the average could indicate problems that students may have faced at school, home, or even personal struggles like difficulty learning the topics discussed or being less or more sociable. This further implies that students may have performed academically at school but are unhappy with their current state. Several factors may explain why these students were less happy and could indicate possible school interventions.

Table 4. Subjective happiness of the secondary school students in terms of sex, year level, daily allowance, family monthly income, time spent studying in mathematics, teacher facilitating support, and conducive learning environment

Variable	Category	Mean	N	Description
Sex	Male	4.44	123	Less happy than the average person
	Female	4.36	176	Less happy than the average person
	Total	4.40	299	Less happy than the average person
Year level	7	4.29	58	Less happy than the average person
	8	4.33	49	Less happy than the average person
	9	4.66	44	Less happy than the average person
	10	4.45	47	Less happy than the average person
	11	4.27	57	Less happy than the average person
	12	4.42	45	Less happy than the average person
	Total	4.40	300	Less happy than the average person
Daily allowance	0–50	4.49	32	Less happy than the average person
	51-100	4.42	99	Less happy than the average person
	101–150	4.22	94	Less happy than the average person
	151–200	4.47	37	Less happy than the average person
	200–Above	4.55	30	Less happy than the average person
	Total	4.43	292	Less happy than the average person
Family monthly income	12,082.00-48,328.00	4.39	157	Less happy than the average person
	48,328.00-144,984.00	4.41	110	Less happy than the average person
	144,984.00 and above)	4.50	19	Less happy than the average person
	Total	4.43	286	Less happy than the average person
Time spent studying in hours per week	0–2.5	4.49	120	Less happy than the average person
	2.5–5.0	4.38	110	Less happy than the average person
	5.1–7.5	4.37	31	Less happy than the average person
	7.6–10	4.11	22	Less happy than the average person
	10.1 up	4.17	15	Less happy than the average person
	Total	3.21	298	Less happy than the average person
Facilitative	No	4.54	6	Less happy than the average person
	Yes	4.39	291	Less happy than the average person
	Total	3.08	297	Less happy than the average person
Conduciveness	No	4.36	40	Less happy than the average person
	Yes	4.40	257	Less happy than the average person
	Total	2.99	297	Less happy than the average person
Overall total		>5.60	21	More happy than the average person
		<5.60	279	Less happy than the average person

The data above supports Phuong and Yasri [27], emphasizing high school students have the lowest level of happiness. They further concluded that students need to be supported by alternative methods. However, in terms of gender, studies revealed otherwise, stating that females are generally happier than males [56]. Alemdag *et al.* [57] disagree with the claim, stating that subjective happiness is dependent on how physically active they are, particularly in males. Family income, gender, subjective health, and school influenced subjective health [58]. This entails an environment that motivates learners more towards learning. However, this negated data presented by Yoo and Kim [59] shows demographic profiles as non-predictors of happiness and did not differ according to the groups [60].

3.3. Attitudes towards mathematics of secondary school students

The participants' attitudes towards mathematics score averages were calculated according to variables such as sex, year level, daily allowance, family monthly income, time spent students' study per week, having facilitative teachers, and conducive classroom environment. The results are presented in Table 5. Results show a closely related level of attitude towards the subject matter grouped according to sex, which is a moderate level. On year level, results show that whether students are new in the school or graduating, they still have the same attitude level, with a mean ranging from 3.00 to 3.19. Further, it shows that the students with the biggest allowance of at least Php200 got the lowest mean *M*=2.90, and students who got the smallest allowance of at most Php50 got a higher mean of *M*=3.28. This is the opposite of the hypothesis that students with the biggest allowance have better attitudes towards a subject matter. When grouped according to family income, the student's attitude towards mathematics showed that rich students got the lowest mean of *M*=2.91. However, the overall mean still falls to a moderate level of attitude towards mathematics. Also, the table shows that those students studying the least got the lowest mean, *M*, ranging from 0-2.5 hours.

Regarding the facilitative of the teacher, students who believed that their teacher was not facilitative during the discussion got a lower mean of *M*=3.01 compared to the 291 students with a mean of *M*=3.14. However, the two groups still had a moderate attitude towards the subject matter. Finally, students who believed their classroom was not conducive to learning mathematics got a lower mean of *M*=2.8, compared to the 257 students with a mean of *M*=3.19. However, the two groups still had a moderate attitude towards the subject matter.

Table 5. Attitude towards mathematics of the secondary school students in terms of sex, year level, daily allowance, family monthly income, time spent studying in mathematics, teacher facilitating support, and conducive learning environment

Variable	Category	Mean	N	Description
Sex	M	3.17	123	Moderate
	F	3.11	176	Moderate
	Total	3.14	299	Moderate
Year level	7	3.18	58	Moderate
	8	3.15	49	Moderate
	9	3.19	44	Moderate
	10	3.35	47	Moderate
	11	3.00	57	Moderate
	12	3.12	45	Moderate
	Total	3.17	300	Moderate
Daily allowance	0–50	3.28	32	Moderate
	51-100	3.20	99	Moderate
	101-150	3.07	94	Moderate
	151-200	3.19	37	Moderate
	200-above	2.90	30	Moderate
	Total	3.19	292	Moderate
Family monthly income	12,082.00-48,328.00	3.11	157	Moderate
	48,328.00-144, 984.00	3.21	110	Moderate
	144,984.00 and above)	2.91	19	Moderate
	Total	3.06	286	Moderate
Time spent studying per week	0-2.5	2.98	120	Moderate
	2.5-5.0	3.23	110	Moderate
	5.1-7.5	3.22	31	Moderate
	7.6-10	3.25	22	Moderate
	10.1 up	3.34	15	Moderate
	Total	3.21	298	Moderate
Facilitative	No	3.01	6	Moderate
	Yes	3.14	291	Moderate
	Total	3.08	297	Moderate
Conduciveness	No	2.80	40	Moderate
	Yes	3.19	257	Moderate
	Total	2.99	297	Moderate

Results indicate that most of the learners do not like nor hate the subject matter. They may not have been interested or found it meaningless. The student's ATM could be an indication that learners may have difficulty understanding mathematical concepts and did not find significance in the real world. Worth noting, the curriculum at VSUIHS adds additional mathematics and sciences for grades 7-10. These could be alarming results that could lead to curriculum revision or the deletion of some added subjects. This further implies that teachers should strive to utilize better strategies to integrate the affective domain of learning. This could then become the reason for changing the students' standpoint towards mathematics.

The data obtained corroborates that of Yaşar *et al.* [61], showing students' attitudes towards mathematics at a medium level. Furthermore, the results show no meaningful difference between the students' attitudes towards mathematics classes, high school types, gender, and their families' income level. Studies further supported statistically no significant differences in terms of gender. However, there is a significant difference in terms of grade levels [40], [62]–[64].

However, Mata *et al.* [41] found that high school students generally have a positive attitude towards the subject. Utsumi and Mendes [65] highlighted a significant statistical difference in the students' attitudes grouped according to the type of school, grade level, age, and self-perception of mathematical performance. Elçi [47] also showed differing math attitudes by gender, students' fields, and mathematics scores. Finally, Mazana *et al.* [5] highlighted several factors influencing the students' liking or disliking of mathematics, like their aptitude attributes and instructional, social, psychological, and environmental factors.

3.4. Correlation between secondary school students' subjective happiness and attitude towards mathematics

A correlation analysis was conducted to determine the relationship between students' attitude and subjective happiness. Utilizing Pearson coefficient correlation (r) analysis, results show a very weak positive correlation. The results are presented in Table 6. Table 6 shows the correlation between students' subjective happiness and their attitude towards mathematics. The result shows a significant, very weak positive correlation: p=0.048, r=0.115. This shows that if students' happiness state is high, there is a tendency for their attitude toward the subject matter to be also high. Also, if students' attitude is low, a tendency of their happiness state is low.

The results imply that happiness and attitudes work in low level association. This is likely because when people have a positive mindset over things, they become motivated, determined, and happy in what they do. Results show that learners who are generally happy about their lives tend to have a positive attitude towards mathematics. Moreover, if the students tend to hate a subject matter like mathematics, there is a tendency for learners to be unhappy about their lives.

Results are similar to that of Tay [66], who showed a moderately significant positive relationship between students' attitudes and happiness. In one study in a math village, happy students benefited more in terms of the change in their mathematics attitudes [67], just like Alavi [68], who emphasized that a positive relationship between scientific, moral, and religious attitudes with the "happiness" of the university students. Also, [69], [70] found out that attitude towards school positively affects students' happiness.

Not only positive relationships between students' attitudes and happiness were relevant in the literature, but they included happiness and an appropriate educational environment [59] and forgiveness and subjective happiness [60]. Happiness and social factors [71], positive thinking and subjective happiness [72], self-kindness, common humanity, mindfulness, enjoyment, and attitude [5] were also presented in different studies. However, students' learning is connected to some important factors [73]–[76], other than their state of happiness.

Table 6. Pearson r correlation between students' subjective happiness and attitude towards mathematics

Variable	Subjective happiness	Attitude towards mathematics
Subjective happiness	1	
Attitude towards mathematics	0.115*	1

*p<.05; N=296.

4. CONCLUSION

This study gathered the subjective happiness and attitude towards mathematics of 300 students in an integrated high school in the central part of the Philippines via stratified random sampling. It can be concluded that almost all students in the school are less happy than the average person. On their attitude towards mathematics, the students were found to be at a moderate level. Results further show a very weak positive correlation between the two variables, indicating a tendency that as students become happier, their attitude towards mathematics may become higher.

The results on the happiness state and attitude towards the mathematics of the secondary school students contradict their perception of the teachers and the school setup. Most of the students emphasized that

teachers have facilitative skills and their classroom environment is conducive to learning. However, many students were still less happy than the average person and had a moderate attitude towards mathematics. The significant correlation between subjective happiness and attitude towards mathematics suggests that the student's level of happiness may be a potential factor that can influence his mathematics attitude.

These results call for an improvement of instructional strategies of the teachers to improve students' subjective happiness and ATM. Teachers may find ways to engage students in the teaching-learning process, such as utilizing Information and communications technologies (ICTs) in the classroom and other exciting delivery of mathematical concepts, where students can connect to the real world. Moreover, several interventions may be developed for students to help them appreciate the idea of being a student. School stakeholders should work to improve students' overall happiness state in school, at home, and in life. It is also recommended that qualitative data be gathered on why a conducive and facilitative environment did not even make students happier than the average person and have a high attitude towards mathematics.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

All authors declare that they have no conflicts of interest. The authors also declare that they have no known competing financial interests with private or local organizations. Further, no known personal relationships that could have appeared to influence the work reported in this paper.

INFORMED CONSENT

The authors have obtained informed consent from all individuals included in this study. The data-gathering processes strictly adhered to the Data Privacy Act of 2012. All respondents were knowledgeable about the survey.

DATA AVAILABILITY

Derived data supporting the findings of this study are available from the corresponding author, [LAM] on request. The data are not publicly available due to privacy or ethical restrictions. The data are archived in one computer folder.

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