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Improved knowledge, attitude, and practice during COVID-19 pandemic among Chinese in Mainland China compared to Malaysian

Shucheng Li, Bin-Seng Low
School of Medicine, Faculty of Health and Medical Sciences, Taylor's University, Subang Jaya, Malaysia

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ABSTRACT

COVID-19 is currently inconspicuous yet to be eradicated. Since knowledge, attitude and practice (KAP) are important elements in containing the outbreak, it is worth ascertaining the KAP in preventing COVID-19. Present study compared the KAP of the respondents from the two countries China and Malaysia on COVID-19 outbreak. A cross-sectional questionnaire-based study was conducted. Descriptive statistics, Chi-square test, t-test and one-way ANOVA on the data were performed. A total of 390 respondents from Malaysia and 395 respondents from China were participated in the study. Results showed gender, education level, and age were associated with overall better knowledge ($p<0.05$) in China. In Malaysia, positive attitudes towards COVID-19 were more prevalent among degree holders and within the age range of 18 to 30 years. However, differences by gender, education level, age and monthly income between Chinese and Malaysian respondents on attitude were found significant ($p<0.05$). During the pandemic, the preventive practices were associated with education and age ($p<0.05$) for both Chinese and Malaysian respondents. In conclusion, Chinese respondents demonstrated better knowledge and more positive attitudes compared to Malaysians, highlighting the need for comprehensive educational programs in Malaysia to enhance public KAP regarding COVID-19 prevention, particularly among less educated and older populations.

Corresponding Author:

Bin-Seng Low
School of Medicine, Faculty of Health and Medical Sciences, Taylor's University
Lakeside Campus, Subang Jaya, Selangor, Malaysia
Email: binseng.low@taylors.edu.my

1. INTRODUCTION

In December 2019, an atypical severe acute respiratory syndrome caused by a novel coronavirus was reported epidemically [1]. The virus spread promptly from Huanan seafood wholesale market in Wuhan City, Hubei Province, China to other provinces in China, then swamped across different countries including Japan, South Korea, Iran and Italy in dreadfully rate [2]. Later, the disease was named 'coronavirus disease 2019' or COVID-19, and within 3 months the disease was declared a 'pandemic' by World Health Organization (WHO) on March 12, 2020 [3]. As of 24 September 2020, there were more than 32 million COVID-19 positive infected cases have been reported causing more than one million deaths globally [2].

COVID-19 is an enveloped β-coronavirus, consists of positive-sense single-stranded RNA, ranging from 60-140 nm in diameter [4]. Chinese scientists reported that the virus has more than 95% homology with bat origin coronavirus [5]. However, the current COVID-19 pandemic is propagated by human-to-human transmission and it was presumed that the virus was initially transmitted from animals to humans following the

consumption of infected meat [6], [7]. COVID-19 virus was spread through fluid droplets via coughing or sneezing [8], [9]. Elderly with chronic non-communicable diseases such as diabetes, hypertension, heart problems, liver diseases including pregnant women and smokers have increased risk of the COVID-19 infections [10].

Indeed, limited knowledge, negative attitudes and bad practice have contributed to the higher risk for spreading caused by COVID-19. In 2020, the religious event that took place at Sri Petaling, Kuala Lumpur, Malaysia, triggered an exponential increase in COVID-19 cases [11]. After a few weeks of the gathering, the number of COVID-19 positive cases throughout the whole country in Malaysia was reported the highest among Southeast Asia countries [11], [12]. Thus, standard operating procedures are important to prevent and to control the disease more efficiently. In fact, most countries have implemented movement control orders (MCOs) and social distancing to avert the growth of the number of cases and to contain the spread of the pandemic [11], [13].

By September 2022, a cumulative total of 5.8 million and 4.8 million COVID-19 cases were reported in China and Malaysia, respectively [3]. Despite a densely populated developing country like China with nearly 50 times more populated compared to that of Malaysia, it can be undoubtedly concluded that the pandemic was well controlled in China. Besides, numerous studies have been reported on the knowledge, attitudes, and practices (KAP) in preventing and controlling the outbreak of COVID-19 in the populations of China and Malaysia [10], [14]. However, a study comparing the KAP of China's and Malaysia's population regarding the pandemic remains obscure.

Since KAP are important elements in containing the outbreak, it is worth to investigate the KAP in preventing COVID-19 disease [15], to assess the correlation between demographic factors and to compare the KAP among Chinese and Malaysian population during the outbreak. While existing research has provided valuable insights, several issues remain unresolved. For example, the impact of cultural differences on KAP is not well understood, and there is a need for more comprehensive comparative studies. Additionally, the long-term effectiveness of public health interventions and the role of demographic factors in shaping KAP are areas that require further investigation.

This study addresses the gap in the literature by comparing the KAP of adults in Mainland China and Malaysia during the COVID-19 pandemic. Our research provides new insights into how different populations from different countries in respond to pandemics and identified the best practices for public health communication. This comparative analysis has not been reported and would contribute to the global understanding of the responses on the pandemic.

The following sections of this manuscript demonstrated our research methodology, results of our comparative analysis, and discussed the implications of our findings. We showed how our study contributed to the existing body of knowledge and why it is relevant for public health policymakers and researchers. The subsequent sections were structured as: i) Study design, participant recruitment, data collection, and analysis techniques were presented in the Method section; ii) Findings and interpretation of findings, contextualize them within the existing literature, and discuss their implications on the KAP of the Chinese and Malaysian populations were presented in Results and Discussion section; iii) Key contributions and suggest directions for future research were summarized in Conclusion. Our study found that participants in Malaysia and China demonstrated a good understanding of COVID-19. Chinese respondents demonstrated better knowledge and more positive attitudes compared to Malaysians.

2. METHOD

2.1. Study design

A cross-sectional study was conducted to compare the knowledge, attitudes, and practices (KAP) related to COVID-19 among adults in Mainland China and Malaysia. The study was conducted between December 1st, 2021, and February 1st, 2022, to capture data during a period of active pandemic management and public health measures. The chosen methodology, including the cross-sectional design and convenience sampling, was selected to capture a snapshot of KAP during a critical phase of the pandemic. The use of an online questionnaire allowed for a wide reach and adherence to social distancing measures. The pilot testing ensured the reliability and validity of the questionnaire. The statistical methods were chosen to analyze and to interpret the data, providing a comprehensive understanding of the KAP related to COVID-19.

2.2. Data collection and ethics approval

The target population consisted of adults aged 18 years and above from both countries. A convenience sampling method was employed to recruit participants, ensuring a diverse representation across various demographic groups, including gender, age, education level, and income. An anonymous online questionnaire was developed using Google Forms and disseminated through social media platforms (WeChat®, Facebook®, and Twitter®) in China and Malaysia. The questionnaire was designed in English

and translated into Mandarin and Malay languages to ensure better comprehensiveness among respondents regardless of different ethnicities. Participation was voluntary, and confidentiality was assured. Informed consent was obtained implicitly through the completion of the questionnaire.

2.3. Questionnaire development

The questionnaire was divided into the following sections:

i) Sociodemographic information: Collected data on age, gender, nationality, education, and monthly income. The educational level group was divided into five subgroups, such as no proper schooling, secondary school or lower, diploma or certificate, degree, master's degree, and above. The age group was divided into five subgroups, such as 18-30, 31-40, 41-50, 51-60, and >60 years old. Monthly income group was divided into four categories, such as <RM 2,000 (<RMB 3,000), RM 2,000-5,000 (RMB 3,000-7,500), RM 5,000-10,000 (RMB 7,500-10,000), >RM 10,000 (RMB 15,000) with the exchange rate fixed at 1 RM: 1.5 RMB.

ii) Knowledge assessment: Included questions on COVID-19 symptoms, transmission, prevention, and control measures, adapted from previous studies [14]. The sections were on symptoms and transmission of COVID-19, with each question having the possibility to answer 'yes' (score 1), 'no' and 'I don't know' (score 0) by the respondents. The total scores ranged from 0 to 25. Scores above 18 were considered knowledgeable. In the second section, constipation and frequency of urination are not the actual symptoms of COVID-19, so the 'no' option was counted for one point. The rest are the 'correct' option for COVID-19 symptoms, counted for one point. In the third section, the following statement had different scoring for Malaysian and Chinese participants. For Chinese respondents, the statement of 'A COVID-19 suspected individual should be self-quarantined at home and all confirmed cases of COVID-19 should be quarantined in quarantined center' is considered 'yes' as correct answer. However, for Malaysian respondents, 'no' was the correct answer. The correct answer is worth one point, for a total score of 11 points.

iii) Attitude evaluation: Used a 5-point Likert scale to assess attitudes towards COVID-19 prevention and control measures, based on established scales [16]. The section regarding the attitude, consisted of nine questions that respondents were asked to fill out based on 5-point Likert scale as 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree). Those who answered 1, 2 being classified as having a 'negative' attitude; 3 classified as a 'neutral'; and those who answered 4 and 5 possessed 'positive' attitude. The total score ranged from 0 to 45 points. Respondents with higher total score would possess more positive attitude towards COVID-19.

iv) Practice survey: Enquired about participants' self-reported adherence to preventive practices during the pandemic. The section consisted of questions regarding what has been done and what will be done by participants in response to COVID-19, with each response being answered as 'yes', 'no' and 'I am not sure'. The total score ranged from 0 to 14, with a higher total score indicating better control measures been practiced during the pandemic.

2.4. Sampling size

The sample size was calculated using Cochran's formula to ensure adequate representation with a confidence interval of 95% and a margin of error of 5%. $n = Z^2pq/e^2$ (n: sample size; Z: 95% confident interval; p: estimated proportion of the population; q = 1–p; e: margin of error). The calculated minimum sample size was 385 per country, which was increased to 405 to account for a 5% dropout rate. The questionnaire was piloted with a small sample size (n = 40) to assess clarity and comprehensiveness. Feedback was used to refine the instrument, achieving a Cronbach's α of 0.82 for internal reliability.

2.5. Statistical analysis

Data were analyzed using SPSS version 25. Descriptive statistics were used to summarize the demographic characteristics and KAP scores. Chi-square tests and t-tests were conducted to compare differences in KAP between demographic groups and countries. A one-way ANOVA was used to explore differences in KAP scores across multiple demographic categories. A binary logistic regression analysis was performed to identify factors associated with KAP. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS AND DISCUSSION

To the best of our knowledge, the present study is the only comparative study done to assess the knowledge, attitudes, and preventive of the population regarding COVID-19 between the two countries, China and Malaysia. A total of 810 questionnaires were distributed to Malaysian and Chinese residents using a convenience sampling method, and the actual returned questionnaires were 390 from the Malaysian and 395 from the Chinese group with total response rate of 96.9%. Majority of participants in Malaysia and China

were female at 51.0% and 62.5%, respectively. Majority of participants in Malaysia were Diploma degree or certificate holder, while majority of participants in China were Degree holders. Majority of participants in Malaysia were aged 18-30 years old and had a monthly income of RM 5,000-10,000. Majority of participants in China were also aged 18-30 with a monthly income of RM 7,500-10,000 as shown in Table 1.

3.1. Knowledge towards COVID-19

In general, most participants in both countries answered all the questions correctly. However, there were differences in knowledge regarding the signs and symptoms of COVID-19 infection between participants from the two countries, including fever, dry cough, difficulty in breathing, body pain, headache, constipation, frequent urination, skin rashes, and loss of taste. Table 2 shows Chinese and Malaysian knowledge scores were lower for rash and conjunctivitis, indicating that respondents were not very familiar with this symptom. In China, the average knowledge score for COVID-19 was 19.71±2.98, while in Malaysia, it was 18.59±2.47 as shown in Table 2. There was a significant difference in the knowledge of COVID-19 between Malaysia and China ($p<0.05$). In COVID-19 only affect humans, Proper care can help most of COVID-19 patients to recover, a COVID-19 suspected individual should be self-quarantined at home, all confirmed cases of COVID-19 Should be quarantined in a quarantine center, there are significant differences between Malaysia and China ($p<0.05$). Respondents from China and Malaysia with degree holder, gender female, age ranged from 18-30 years and monthly income>RM 5,000 or>RMB 7,500 have significant differences in the knowledge of COVID-19 as shown in Figure 1.

Table 1. Sociodemographic characteristics of the Chinese and Malaysian respondents

Variable		Malaysia (N = 390)		China (N = 395)	
		Frequency(n)	Percentage (%)	Frequency(n)	Percentage (%)
Gender	Female	199	51%	247	62.5%
	Male	191	49%	148	37.5%
Education level	No proper schooling	52	13.3%	40	10.1%
	Secondary or lower	71	18.2%	47	11.9%
	Diploma or Certificate	105	26.9%	91	23%
	Degree	89	22.8%	144	36.5%
	Master Degree and above	73	18.7%	73	18.5%
Age	18-30 year-old	114	29.2%	169	42.8%
	31-40 year-old	86	22%	51	12.9%
	41-50 year-old	85	21.8%	89	22.5%
	51-60 year-old	56	14.4%	48	12.2%
	>60 year-old	49	12.6%	38	9.6%
Monthly income	<RM 2,000 (<RMB 3,000)	66	16.9%	69	17.5%
	RM2,001-5,000 (RMB 3,001-7,500)	101	25.9%	103	26.1%
	RM 5,001-RM10,000 (RMB 7,500-15,000)	121	31%	114	28.9%
	>RM 10,001 (>RMB 15,000)	102	26.2%	109	27.6%

3.2. Attitude towards COVID-19

The average attitude score of Chinese respondents towards the pandemic was 37.99 while the average attitude score of Malaysian respondents was 33.47, over the total score of 45.00 as shown in Table 3. Female in Malaysia and male in China have better attitude on COVID-19. Education level with degree in education level, 18-30 years old, and monthly income of >RM 10,000 of Chinese and Malaysian scored higher attitude. Malaysian and Chinese respondents differed in their attitudes towards COVID-19 significantly across all demographic groups. In China, the majority of respondents with good attitudes were male, with degree in education level, aged 18-30 years, with monthly income of RMB 3,001-7,500. The results showed that there are differences in all demographic factors between Chinese and Malaysian respondents as shown in Figure 2. In fact, Chinese attitude towards COVID-19 is better than Malaysian respondents in every demographic aspect ($p<0.05$).

3.3. Practice towards COVID-19

In Table 4, the results showed that the average practice score of Malaysian and Chinese respondents was 10.03 and 9.96 over total score of 14.00. There was no significant difference in the COVID-19 prevention scores between Chinese and Malaysian respondents. Results also showed that the number of Malaysian participating in social activities during the pandemic was slightly more than Chinese. Malaysian respondents preferred to take some medicine to prevent the disease. Chinese male took better prevention and control measures than female, but it was not the case for Malaysian respondents as shown in Table 4. Chinese respondents with Master Degree and above, 31-40 age groups, and incomes of more than RMB 15,000 (RM 10,000) have taken better prevention and control measures to contain COVID-19, while Malaysians with

Degree, 18-30 age group, income of RM 2,001-5,000 (RMB 3,001- 7,500) actively prevent the pandemic in Figure 2. There were differences between Chinese and Malaysian respondents with no proper schooling and Master Degree and above. Differences in practice were found between Chinese and Malaysian respondents aged 31-40 years as shown in Figure 3.

Table 2. Comparison of the Chinese and Malaysian respondents towards knowledge about COVID-19

Knowledge about COVID-19	Malaysia			China			$\chi 2$ (p-value)
	Yes (%)	No (%)	I don't know (%)	Yes (%)	No (%)	I don't know (%)	
High fever	315(80.8%)	37(9.5%)	38(9.7%)	354(89.6%)	15(3.80%)	26(6.6%)	12.208(<0.001)
Dry cough	315(80.8%)	45(11.5%)	30(7.7%)	376(95.2%)	10(2.53%)	9(2.3%)	38.716(<0.001)
Tiredness	272(69.8%)	63(16.2%)	55(14.1%)	295(74.7%)	50(12.7%)	50(12.7%)	2.387(0.705)
Difficulty in breathing	313(80.3%)	10(2.6%)	67(17.2%)	293(74.2%)	39(9.9%)	63(16.0%)	4.120(0.042)
Body aches and pains	266(68.2%)	38(9.7%)	86(22.1%)	300(76%)	41(10.4%)	54(13.7%)	5.851(0.016)
Sore throat	334(85.0%)	25(6.4%)	31(8.0%)	321(82.3%)	72(18.2%)	52(13.2%)	2.719(0.099)
Diarrhea	242(62.1%)	56(14.4%)	92(23.6%)	271(68.6%)	53(13.4%)	71(18.0%)	3.725(0.054)
Conjunctivitis	243(62.3%)	65(16.7%)	82(21.0%)	237(60.0%)	84(21.3%)	74(18.7%)	0.440(0.507)
Headache	202(51.8%)	106(27.2%)	82(21.0%)	297(75.2%)	29(7.3%)	69(17.5%)	46.378(<0.001)
Constipation	74(44.6%)	222(56.9%)	94(24.1%)	71(18.0%)	256(64.8%)	68(17.2%)	5.126(0.024)
Loss of taste	313(80.3%)	26(6.7%)	51(13.1%)	345(87.3%)	19(4.8%)	31(7.9%)	7.265(0.007)
Loss of smell	321(82.3%)	21(5.4%)	48(12.3%)	334((84.6%)	37(9.4%)	34(8.6%)	0.719(0.397)
Frequent urination	31(8.0%)	280(71.8%)	79(20.3%)	83(21.0%)	247(62.5%)	65(16.5%)	7.632(0.006)
Rashes on skin	203(52.1%)	80(20.5%)	107(27.4%)	236(59.8%)	86(21.8%)	73(18.5%)	4.407(0.036)
COVID-19 only affect humans.	45(11.5%)	250(64.1%)	95(24.4%)	35(8.86%)	300(75.95%)	60(15.19%)	13.131(<0.001)
There is no effective treatment for COVID-19 infection	271(69.5%)	36(9.2%)	83(21.3%)	297(75.2%)	35(8.9%)	63(15.9%)	3.490(0.062)
Proper care can help most of COVID-19 patients to recover.	295(75.6%)	48(12.3%)	47(12.1%)	354(89.6%)	18(4.6%)	23(5.8%)	26.744(<0.001)
All COVID-19 infected patients show the disease signs and symptoms	42(10.8%)	251(64.3%)	97(24.9%)	107(27.1%)	238(60.2%)	50(12.7%)	1.408(0.235)
Individuals with COVID-19 may infect others even though there is no symptoms.	390(100%)	0(0.0%)	0(0.0%)	395(100%)	0(0.0%)	0(0.0%)	
Preventive measures are not required for children against COVID-19 infection.	56(14.4%)	277(71%)	57(14.6%)	63(16%)	266(67.3%)	66(16.7%)	1.249(0.264)
After vaccination, one will not be infected with COVID-19.	49(12.6%)	304(77.9%)	37(9.5%)	13(3.3%)	362(91.6%)	20(5.1%)	28.625(0.026)
The COVID-19 virus will continue to mutate to produce new viral strains.	316(81%)	38(9.7%)	36(9.2%)	294(74.4%)	40(10.1%)	61(15.4%)	4.928(0.705)
A COVID-19 suspected individual should be self-quarantined at home. #	6(1.5%)	368(94.4%)	16(4.1%)	381(96.5%)	6(1.5%)	8(2%)	647.851(<0.001)
All confirmed cases of COVID-19 should be quarantined in a quarantine center.#	17(4.4%)	359(92%)	14(3.6%)	390(98.7%)	0(0.0%)	5(1.3%)	650.400(<0.001)
Elderly are most susceptible to COVID-19 infection.	327(83.8%)	50(12.8%)	13(3.4%)	348(88.1%)	12(3%)	35(8.9%)	2.949(0.086)
Overall Mean Knowledge score		18.59±2.47			19.71±2.98		<0.001

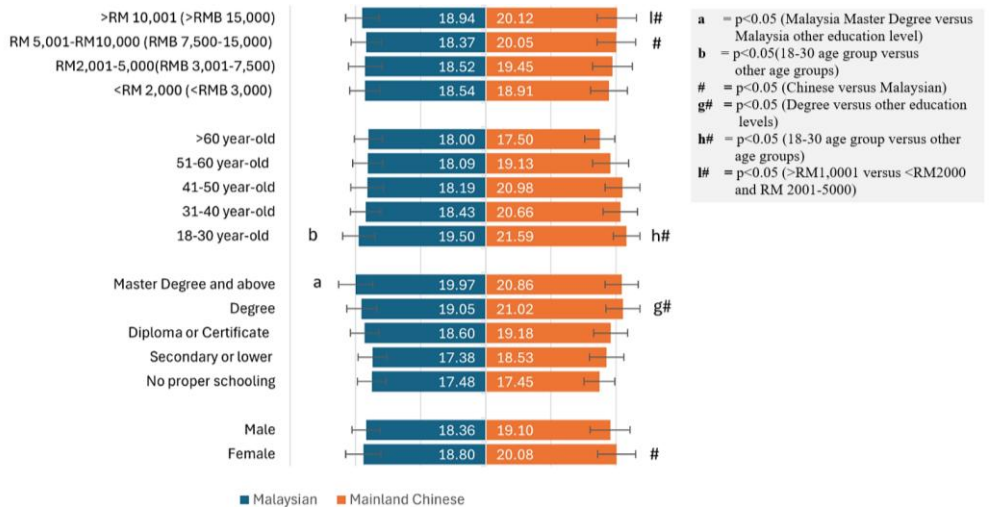

Figure 1. Comparison of knowledge mean score between Chinese in Mainland China and Malaysian respondents according to the breakdown of demographic. (Error bars represent standard deviation)

Table 3. Mean score of the respondents towards attitude about COVID-19

Attitude on COVID-19	Malaysia (mean±SD)	China (mean±SD)
Reporting suspected cases to the health authority is crucial	4.03±0.72	4.48±0.50
Health education plays an important role in COVID-19 prevention	3.92±0.82	4.40±0.57
Everyone must comply with government-issued policies related to COVID-19	4.31±0.55	4.51±0.50
COVID-19 pandemic will be eradicated by the year 2022	3.12±0.80	2.84±1.18
Refraining from visiting public places will prevent the spread of COVID-19 disease	3.84±0.74	4.38±0.49
Refraining from visiting recreational facilities will prevent the spread of COVID-19 disease	3.75±0.79	4.37±0.48
Vaccination helps to curb the spread of the virus	4.29±0.65	4.45±0.50
Closing schools to home online classes can slow the spread of the virus	3.77±1.00	4.28±0.46
Someone nearby who has been diagnosed or sees a significant increase in daily growth will be particularly concerned	3.98±0.76	4.30±0.46
Overall mean attitude score	33.47±4.58	37.99±2.50

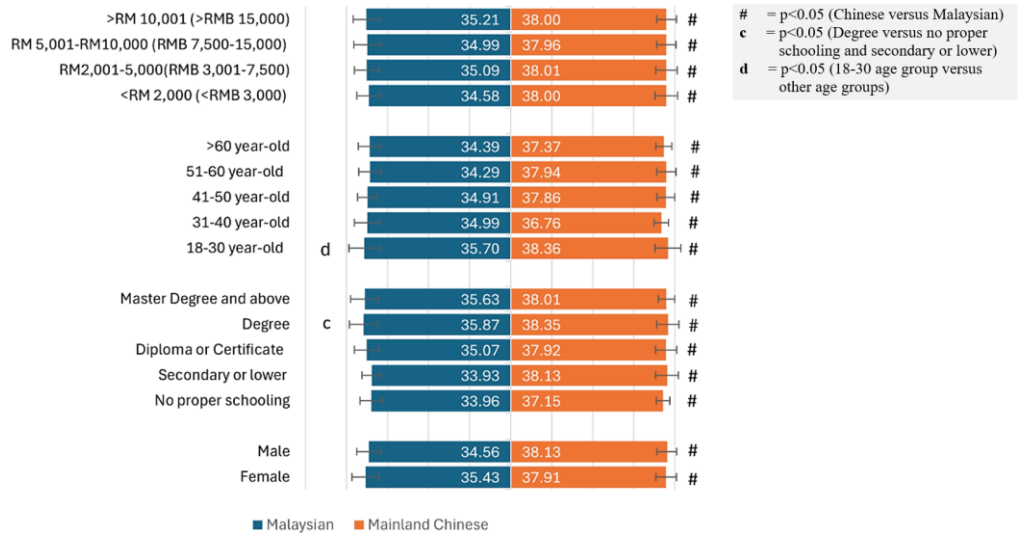

Figure 2. Comparison of attitude mean score between Chinese in Mainland China and Malaysia according to the breakdown of demographic. (Error bars represent standard deviation)

Table 4. Perceptions of the respondents towards Practice about COVID-19

Practice on COVID-19	Malaysia			China			$\chi 2$ (p-value)
	Yes	No	I am not sure	Yes	No	I am not sure	
I will go to the hospital for a clinical examination if I have symptoms of COVID-19	331(84.9%)	24(6.2%)	35(9%)	341(86.3%)	25(6.3%)	29(7.3%)	0.700(0.705)
I maintain social distancing during this pandemic period	387(99.2%)	2(0.5%)	1(0.3%)	391(99%)	4(1%)	0(0.0%)	1.655(0.437)
I maintain home isolation during this pandemic period	316(81.%)	42(10.8%)	32(8.2%)	333(84.%)	49(12.4%)	13(3.3%)	8.975(0.01)
Recently, I have been to a social event involving a large number of people	145(37.2%)	149(38.2%)	96(24.6%)	212(53.7%)	124(31.4%)	59(14.9%)	21.435(<0.001)
I always use mask in crowded places	387(99.2%)	0(0.0%)	3(0.8%)	388(98.2%)	4(1%)	3(0.8%)	3.970(0.137)
I disinfect myself with sanitizer after coming home from an outing	196(50.3%)	97(25%)	97(24.9%)	252(63.8%)	72(18.2%)	71(18%)	14.691(<0.001)
I use tissues or handkerchief when coughing or sneezing	367(94.1%)	12(3.1%)	11(2.8%)	362(91.6%)	30(7.6%)	3(0.8%)	12.289(<0.001)
I wash my hands regularly with soap and water	386(99%)	1(0.3%)	3(0.8%)	386(97.7%)	9(2.3%)	0(0.0%)	9.369(<0.001)
I apply hand sanitizer regularly	275(70.5%)	57(14.6%)	58(14.9%)	307(77.7%)	50(12.7%)	38(9.6%)	6.352(0.042)
I exercise regularly during the lockdown	195(50%)	107(27.4%)	88(22.6%)	166(42%)	172(43.5%)	57(14.4%)	4.070(<0.001)
I have a balanced diet every day, during this pandemic	190(48.7%)	107(27.4%)	93(23.9%)	213(53.9%)	119(30.1%)	63(16%)	7.688(0.021)
I take medication to prevent the infection of COVID-19	181(46.4%)	123(31.5%)	86(22.1%)	138(34.9%)	198(50.1%)	59(14.9%)	8.316(<0.001)
I take traditional medicine to prevent the infection of COVID-19	167(42.8%)	134(34.4%)	89(22.8%)	142(36%)	188(47.6%)	65(16.5%)	14.788(<0.001)
I been vaccinated	390(100%)	0(0.0%)	0 (0.0%)	395(100%)	0(0.0%)	(0.0%)	2.973(0.085)
Overall mean practice score		10.03±1.90			9.96±1.75		0.149

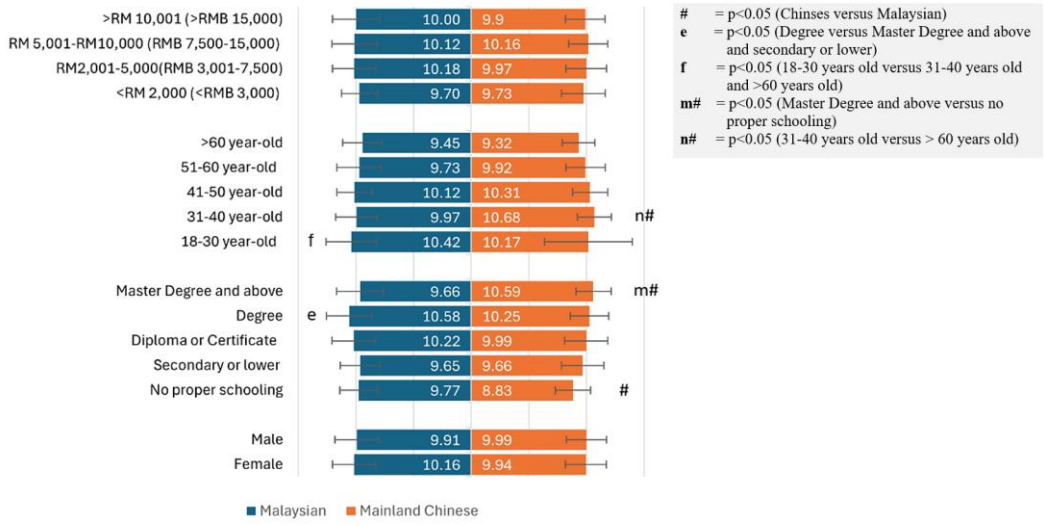

Figure 3. Comparison of practice mean score between Chinese in Mainland China and Malaysian respondents according to the breakdown of demographic. (Error bars represent standard deviation)

3.4. Implication of research fields

Present study found that respondents in Malaysia and China had good knowledge of COVID-19. They took appropriate measures to prevent COVID-19 and showed positive attitudes during the pandemic, consistent with the previous study [17]. The evidence for asymptomatic transmission remains controversial as some studies have shown low transmission rates in asymptomatic patients [18], [19]. This has led to difficulties in obtaining accurate information from respondents.

Regarding the response to the statement on reducing visits to public places and entertainment venues, Malaysian respondents had lower scores compared to Chinese respondents, probably due to the authority in China and Malaysia have taken different measures to contain the outbreak. China has adopted a "zero" policy and a lockdown approach to slow the spread of the virus, while Malaysia has adopted a relaxed pandemic prevention policy during the study period. Chinese respondents were less likely to believe that the coronavirus will be eradicated by 2022 than Malaysian respondents did, and Chinese respondents did not have a positive attitude in this regard [8]. In terms of proper precautionary measures on COVID-19, Malaysians scored slightly better than Chinese respondents on average, as a lot of new cases were reported every day in Malaysia, leading the respondents to be more vigilant and taken more measures to prevent the outbreak.

In Malaysia, respondents who were asked to take some medication or traditional medication for COVID-19, which is significantly higher than Chinese respondents. It is worth mentioning that higher COVID-19 knowledge scores were found to be significantly associated with lower likelihood of negative attitudes and potential dangers of COVID-19 prevalence in a previous study [10]. These findings also indicate the importance of improving health education knowledge for COVID-19. A significant difference in knowledge of COVID-19 at the age of 18-30 years between China and Malaysia indicates a significant education gap, likely reflecting suboptimal public health information and dissemination regarding COVID-19.

Several studies conducted in some Asian countries showed high knowledge levels of COVID-19 among general population and health care professionals [12], [20]. The present study found that most participants had positive attitudes toward COVID-19 consistence with a study done in China [10]. It was generally believed that the COVID-19 pandemic could be eliminated dependent on the use of adequate personal protective equipment, adhere to appropriate social distancing and the application of disinfectant as according to Roy *et al.* [21] and Saqlain *et al.* [22]. Public knowledge, positive attitudes [21] and good practice by taking the general measures advised by the CDC or WHO may prevent the spread of COVID-19 [22] and other outbreaks [23].

Since China and Malaysia are both multi-ethnic nations with disparate degrees of economic development, education, and cultural heritage, it is to be expected that the knowledge, attitudes, and levels of prevention of the populations will likewise differ greatly between the two nations. When standard-based unified education and communication initiatives are developed and implemented, populations without access to the internet and those living in remote areas are unlikely to escalate quickly and may also show a decrease in KAP. In fact, it is likely that many populations won't be fully aware of the COVID-19 preventative strategies such as reducing the spread of the virus and increasing their own protection [16]. Information dissemination, description of preventive practices and health education initiatives must all be easily

accessible by the community [24], [25]. The consensus is that populations with greater knowledge of a disease are better to be able to adhere to preventive and therapeutic measures [26]. The sample of participants in both countries showed a good level of knowledge and attitude, which may serve as a good baseline for any form of health education intervention to facilitate prevention, more vigilant in controlling the pandemic [27]. Hence, perhaps, the present findings are informative for public health policy makers and health workers to provide more conducive health education, awareness on vaccination for countering the next pandemic in view of the importance of knowledge [28] and vaccine [29], [30] to eradicate the disease.

3.5. Study limitations

Indeed, there are several limitations in conducting the present study. Firstly, convenience sampling was performed to select our respondents and we had to rely on self-reporting rather than direct observation. Thus, whether this measure was influenced by social desirability bias was unable to verify. Secondly, the number of questions to measure the level of knowledge, attitudes, and practices was limited as the survey was conducted online. Thirdly, the age of the respondents above 18 year old were not able to be ensured by investigators due to the web-based limitations on the survey done which may prone to sampling bias even though it had been consented.

3.6. Future research direction

The COVID-19 pandemic has underscored the importance of understanding public perceptions and behaviors. This study contributes to this understanding and offers a foundation for future research and practice. By continuing to explore the dynamics of KAP, we can better prepare for and respond to public health crises. For future research, this study suggests several directions. Longitudinal studies could track changes in KAP over time and assess the long-term impact of public health interventions. Additionally, research with systematic stratified sampling method could explore the role of social media and other communication channels in shaping public perceptions during pandemics. Furthermore, the impact of demographic factors on KAP should be examined in more depth to inform targeted health policies.

4. CONCLUSION

In conclusion, participants in Malaysia and China demonstrated a good understanding of COVID-19. Chinese respondents demonstrated better knowledge and more positive attitudes compared to Malaysians, highlighting the need for comprehensive educational programs in Malaysia to enhance public KAP regarding COVID-19 prevention, particularly among less educated and older populations. By enhancing public knowledge and fostering positive attitudes towards health practices, communities can improve compliance with preventive measures, ultimately reducing the outbreak perhaps for future pandemic.

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AUTHOR CONTRIBUTIONS STATEMENT

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Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Shucheng Li	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Bin-Seng Low	✓	✓				✓		✓		✓	✓	✓	✓	

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
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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

Authors state no conflict of interest.

INFORMED CONSENT

All participants in the study had been consented.

ETHICAL APPROVAL

The research complied with all the relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration and has been approved by the institutional Human Ethics Committee (Approval code: HEC 2021/160).

DATA AVAILABILITY

Derived data supporting the findings of this study are available from the corresponding author, [BSL], on request.

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BIOGRAPHIES OF AUTHORS

Shucheng Li completed her Master of Science in Medical Science postgraduate degree at Taylor's University and currently working as Anesthesiologist in Ningbo No.2 Hospital in China. Her current research focuses on epidemiology and mechanism studies on chronic diseases, including lung and liver cancer. She can be contacted at email: dengdengdeng103@gmail.com.

Bin-Seng Low has been appointed as an Associate Professor of Biochemistry at Taylor's University. He earned his Ph.D. from Universiti Sains Malaysia (USM), where his research focused on *Eurycoma longifolia* Jack, commonly known as Tongkat Ali. His work included developing bioactive fractions and conducting both in vitro and in vivo efficacy studies on animals as well as epidemiological study on tropical endemic and pandemic. Since 2017, he has secured three research grants as Principal Investigator and has published 20 articles in indexed journals, achieving a Scopus h-index of 10. He has also served as a judge for postgraduate seminars, as a reviewer for various scientific journals and conference proceedings. He can be contacted at email: binseng.low@taylors.edu.my.