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# Knowledge, attitudes, and practices toward Covid-19 among the Mongolian general population during the period of the Covid-19 pandemic: a nationwide, population-based, randomised, cross-sectional study

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Abstract: Improving knowledge, attitudes, and practices toward COVID-19 is critical to control the infection rate of the pandemic successfully. Mongolia declared a state of emergency in January 2020 but no study was performed on public adherence to centralised measures and awareness of the pandemic in Mongolia. This study aimed to determine knowledge, attitudes, and practices (KAP) toward COVID-19 in the general population, especially regarding the extent to which KAP has contributed to the control measures before local COVID-19 outbreaks. The study was conducted between July and October 2020, when the pandemic was limited to internationally imported cases. We adapted a structured KAP questionnaire that was used to survey residents of Wuhan, China, during the initial outbreak of the pandemic. Participants aged between 13 and 65 years (n=1324, mean age=39.79±14.8), 73.2% were women, and 27.2% held a bachelor's degree or above. The results suggested that 81.9% of the participants had sufficient knowledge about the transmission, symptoms, treatment, and prevention of the disease. In the multiple linear regression, an increase in age and education contributed positively to a high knowledge score (p<0.05, p<0.001, respectively). The majority of the participants (96.2% - 96.5%) had compliance with the measures to control COVID-19 spread with good practices (82.4% - 93.1%) toward COVID-19 prevention. In the binary logistic regression analyses, the COVID-19 knowledge score was associated with a higher likelihood of optimistic attitudes and preventive practices (OR: 0.617 - 0.845). In conclusion, despite the sufficient knowledge toward the COVID-19 pandemic among the general population of Mongolia, a relatively low level of optimistic attitudes and appropriate practices

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compared to other populations may negatively impact preventing the outbreak in the society. Health education programs aimed at improving COVID-19 knowledge will be helpful to minimise local epidemic growth and the current government measures such as lockdowns, quarantines, and travel restrictions.

Keywords: COVID-19; KAP; nationwide population-based; cross-sectional; Mongolia;

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#### 1.0 INTRODUCTION

COVID-19, also known as the coronavirus pandemic, is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and was first detected in December 2019 in Wuhan, China. This highly contagious pandemic is ongoing, with an overall infection fatality rate of 0.6-1.1% (Ngwewondo et al., 2020). Earlier studies have shown that the overall case fatality rate of COVID-19 is 2.3% in China, lower than those of SARS (9.5%), MERS (34.4%), and H7N9 (39.0%) (Munster et al., 2020). By October 2020, the COVID- 19 pandemic had spread to 215 countries, while there were only 338 laboratory-confirmed imported cases without local infections and mortality in Mongolia (Ministry of Health Mongolia, 2020), (WHO, 2020a). In Mongolia, the Government declared a state of emergency in January 2020 with an array of measures to curb the infections, much earlier than the WHO's decision to announce a pandemic in March 2020 (WHO, 2020b). Those centralised measures included personal protection, curfew, international travel restrictions, quarantines of international travellers, closures of educational institutions accompanied by infection surveillance that lasted until September 2020 (Erkhembayar et al., 2020). These public health measures delayed the first confirmed infection case until March and prevented the first local infection outbreak in society until November 2020.

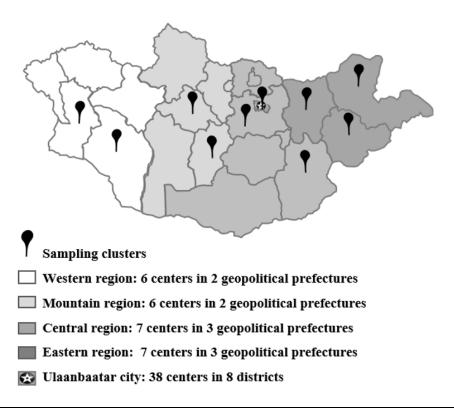
People's adherence to these control measures is essential, primarily affected by their knowledge, attitudes, and practices (KAP) toward COVID-19 (<u>Tachfouti et al., 2012</u>). Previous studies suggest that public awareness of the epidemic nature and adherence to the control measures play an important role in

preventing the spread of the pandemic (Bener & Al-Khal, 2004). So far, there has been no KAP study on COVID-19 in Mongolia, which determines public awareness concerning a range of knowledge about the causes, infection routes, symptoms, complications, treatment modalities, and prognosis of the disease. Low awareness may result in a potential risk of an infection outbreak. Since November, it has been reported by the Ministry of Health that there are 1692 confirmed cases and 2 deaths as of January 28<sup>th</sup>, 2021.

To facilitate outbreak management of COVID-19 in Mongolia, there is an urgent need to understand the public's awareness of COVID-19 at this critical moment. In this study, we aimed to investigate KAP toward COVID-19 among the Mongolian population during the controlled period of the COVID-19 pandemic.

#### 2.0 MATERIALS AND METHODS

Brain Science Institute at the Mongolian National University conducts a nationwide multicentred, interdisciplinary, prospective, population-based cohort study to investigate brain-related disorders in the general population of Mongolia (MonTimeLine). The current population of Mongolia is 3,305,576 based on the latest United Nations data, of which half of them live in Ulaanbaatar, the capital city, and the remaining half of them live in 4 rural regions. The cohort consists of 64 sampling centres, including 30 primary health centres of 8 districts in Ulaanbaatar and 34 primary health centres of 4 rural regions in Mongolia. Primary health centres provide health care services to all individuals within certain geopolitical units where the entire population is registered by name, age, gender, education, employment, and household income (Figure 1).



**Figure 1: MonTimeLine Cohort centres across Mongolia.** The cohort consists of 64 sampling centres, including 38 primary health centres of 8 districts in Ulaanbaatar and 26 primary health centres of 4 rural regions in Mongolia.

In this cross-sectional study, we randomly selected 40 individuals aged 13 or older from each centre. Only Mongolian citizens who lived in the units for at least 6 months were considered to meet inclusion criteria. If selected participants were not available at the centre for the paper-based study, they were replaced by the following available participants regardless of age and sex category.

A total of 1,976 participants were approached to complete the survey. Five hundred seventeen of those approached either did not complete or refused to take the KAP survey. One hundred thirty-five participants were excluded due to missing dependent variables in the KAP survey. One thousand three hundred twenty-four participants were included in the final analysis. The survey started on the 24 July and the preliminary dataset was extracted on the 18 October 2020. The KAP survey was administered in the official language, Mongolian.

We adapted a structured KAP questionnaire to survey residents of Wuhan, China, during the initial outbreak of the pandemic. The questionnaire was translated into Mongolian then translated back to English by two independent reviewers, followed by an expert committee review. Demographic variables included age,

gender, marital status, education level, occupation, income, and place of current residency. Briefly, the questionnaire was divided into three subsections and contained a total of 16 questions. There are 12 questions on the knowledge about COVID-19, 2 questions on the adherence of centralised measures, and 2 questions on the regular practice to prevent the infection. These questions have three answers with a true/false basis and an additional "I don't know" option. A correct answer was assigned 1 point, whereas incorrect and "I do not know" answers were assigned 0 points. The total knowledge score ranged from 0 to 12, with a higher score referring to a better knowledge of COVID-19. The overall Cronbach's alpha coefficient of the knowledge questions was 0.65, indicating an acceptable internal consistency (Table 1) (Taber, 2018).

Data were analysed using SPSS for Windows, v26. Data were not normally distributed by the Kolmogorov–Smirnov test (df: 1324, statistic: 0.321, P<0.001). Differences in knowledge scores between demographic variables were tested using the independent samples Mann-Whitney U test or one-way analysis of variance (Woods et al. 2020) as appropriate. Differences in attitudes and practices between demographic variables were tested by the Mann-Whitney U test or the Kruskal-Wallis H test as appropriate. To identify the causal

relationship of demographic variables with overall knowledge score, we used the multivariate linear regression, whereas with attitudes or practices, the binary logistic regression or the multinomial logistic regression analyses as appropriate. Factors were selected with a stepwise forward method. Statistical significance was set at P<0.05, and all tests were two-tailed. Data were presented as means ± standard deviations (SD) with 95% confidence intervals (CI).

#### **Ethical considerations**

Our study was conducted in accordance with the ethical standards outlined in the 1964 World Medical Association Declaration of Helsinki. The institutional review board and Ethics committee of the Mongolian National University of Medical Sciences approved the study protocol and procedures for informed consent on 12 June 2020 (Ethics Nr. 20/03-05).

#### 3.0 RESULTS

A total of 1,324 participants completed the survey questionnaire. The average age was 39.79 years (SD: 14.8, range: 16-65), 969 (73.2%) were women, 359 (27.2%) held a bachelor's degree or above, 876 (66.2%) married in a national registering agency and 605 (45.7%) were residents of Ulaanbaatar city. Other demographic characteristics are shown in **(Table 2).** 

**Table 1:** Questionnaire of knowledge, attitudes, and practices toward COVID-19.

Knowledge (n=1324, correct rate: 81.9%)	True	False	I don't know
• K1. The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, and myalgia. (correct rate: 90.7)	1201	44	79
<ul> <li>K2. Unlike the common cold, stuffy nose, runny nose, and sneezing are less common in persons infected with the COVID-19 virus. (correct rate: 85.2)</li> </ul>	1128	69	127
<ul> <li>K3. There currently is no effective cure for COVID-2019, but early symptomatic and supportive treatment can help most patients recover from the infection. (correct rate: 92.1)</li> </ul>	1220	31	73
• K4. Not all persons with COVID-2019 will develop to severe cases. Only those who are elderly, have chronic illnesses, and are obese are more likely to be severe cases. (correct rate: 84.2)	1115	105	104
• K5.Eating or contacting wild animals would result in the infection by the COVID-19 virus. (correct rate: 25.5)	337	844	143
• K6. Persons with COVID-2019 cannot infect the virus to others when a fever is not present. (correct rate: 73.8)	978	228	118
• K7.The COVID-19 virus spreads via respiratory droplets of infected individuals. (94.6)	1252	22	50
<ul> <li>K8.Ordinary residents can wear general medical masks to prevent the infection by the COVID-19 virus. (correct rate: 96.7)</li> </ul>	1280	23	21
<ul> <li>K9.It is not necessary for children and young adults to take measures to prevent the infection by the COVID-19 virus. (correct rate: 50.9)</li> </ul>	674	572	78
• K10. To prevent the infection by COVID-19, individuals should avoid going to crowded places such as train stations and avoid taking public transportations. (correct rate: 96.1)	1272	26	26
• K11. Isolation and treatment of people who are infected with the COVID-19 virus are effective ways to reduce the spread of the virus. (correct rate: 96.9)	1283	12	29
<ul> <li>K12. People who have contact with someone infected with the COVID-19 virus should be immediately isolated in a proper place. In general, the observation period is 14 days. (correct rate: 96.6)</li> </ul>	1279	18	27
Overall knowledge (correct rate: 81.9)	1084.92	166.17	72.91

Attitudes	Agree	Disagree	I don't know
A1. Do you agree that COVID-19 will finally be successfully controlled?	1277	7	40
	Yes		No
• A2. Are you confident that Mongolia can win the battle against the COVID-19	1274		50
Practices	Yes		No
P1. In recent days, have you gone to any crowded place?	233		1091
<ul><li>P2. In recent days, have you worn a mask when leaving home?</li></ul>	1233		91

**Table 2:** Demographic characteristics and knowledge score.

Chara	acteristics (n=1324)	n (%)	Knowledge score (mean ± SD)	T (df)/F	P-value*
Gender	Male	355 (26.8)	9.1 ± 1.49	-1.35/1322	0.108
	Female	969 (73.2)	9.22 ± 1.46	-1.55/1522	0.108
	13-19	173 (13.1)	9.06 ± 1.43		
	20-29	188 (14.2)	9.31 ± 1.68		
Age groups	30-39	260 (19.6)	8.99 ± 1.66	5/2.421	0.034
(years)	40-49	304 (23.0)	9.22 ± 1.53	5/2.421	0.054
	50-59	273 (20.6)	9.22 ± 1.21		
	60<	126 (9.5)	9.47 ± 1.04		
	Married	876 (66.2)	9.21 ± 1.46		
Marital status	Never-married	290 (21.9)	9.1 ± 1.49	2/0.821	0.440
	Others#	158 (11.9)	9.26 ± 1.52		
	Middle school or below	640 (48.3)	9.04± 1.53		<0.001
Education	Associate's degree	325 (24.5)	9.19 ± 1.41	2/9743	
	Bachelor's degree or above	359 (27.2)	9.46 ± 1.39		
	Student	174 (13.1)	9.01 ± 1.32		
Employment	Pensioner	283 (21.4)	9.27 ± 1.02	2/2 062	0.026
Employment	Unemployed	164 (12.4)	8.94 ± 1.25	3/2.862	0.036
	Employed	703 (53.1)	9.25 ± 1.57		
Current	Ulaanbaatar	605 (45.7)	9.22 ± 1.93	0.61/840.35	<0.001
residency	Other parts of Mongolia	719 (54.3)	9.17 ± 0.93	0.01/640.55	<0.001
	< 175\$	841 (63.5)	9.13 ± 1.42		0.094
Income	175\$-525\$	462 (34.9)	9.28 ± 1.58	2/2370	
	> 525\$	21 (1.6)	9.57 ± 0.92		

<sup>\*</sup> P-values were calculated using the independent samples Mann-Whitney test or ANOVA as appropriate.

The correct answer rates of the 12 questions on the COVID-19 knowledge questionnaire were between 25.5% and 96.9% (Table 1). The mean COVID-19 knowledge score was 9.19 (SD: 1.47, range: 0-12), indicating an 81.9% correct rate overall. Knowledge scores significantly differed across age groups, education levels, employment, and current residency (Table 2). Multiple linear regression analyses showed that older age and higher education contributed positively to higher knowledge scores (P=0.034, P<0.001, respectively) (Table 3).

Most of the participants agreed that COVID-19 would be successfully controlled (96.5%). The rates of reporting "disagree" and "I don't know" were 0.5% and 3.0%, respectively. The attitude toward the final success in controlling COVID-19 differed across age groups, current residency, and income. In addition, participants reporting "disagree" and "I don't know" had significantly lower knowledge scores than those reporting "agree" (P<0.001).

**Table 3:** Results of multiple linear regression on factors associated with COVID-19 knowledge.

Variables	Coefficient	95% CI		Standard		P-value*
variables	(Woods et al.)	Lower	Upper	error		P-value
Gender	0.077	-0.104	0.258	0.092	0.831	0.406
Age groups	0.059	0.005	0.113	0.028	2.127	0.034
Marital status	0.048	-0.072	0.168	0.061	0.788	0.431
Education	0.218	0.107	0.329	0.057	3.849	< 0.001
Employment	-0.038	-0.124	0.048	0.044	-0.862	0.389
Current residency	0.046	-0.119	0.211	0.084	0.548	0.584
Income	0.079	-0.106	0.264	0.094	0.837	0.403

<sup>\*</sup> P-values were calculated using the multiple linear regression model. OR, odds ratio; CI, confidence interval.

<sup># &</sup>quot;Others" included re-married, cohabiting, separated, divorced, and widowed.

**Table 4:** Attitudes toward COVID-19 by demographic variables.

				Attit	udes, n (%)						
Characteristics (n=1324)		Final suc	cess in contr	olling		Confidence of winning					
		<b>Agree</b> 1277 (96.5)	Disagree 7 (0.5)	I don't know 40 (3.0)	P-value*	Yes 1274 (96.2)	<b>No</b> 50 (3.8)	P-value*			
Gender	Male	343 (96.6)	0 (0)	12 (3.4)	0.250	347 (97.7)	8 (2.3)	0.079			
	Female	934 (96.4)	7 (0.7)	28 (2.9)	0.230	927 (95.7)	42 (4.3)	0.075			
	13-19	161 (93.0)	0 (0)	12 (7)		168 (97.1)	5 (2.9)				
	20-29	179 (95.2)	2 (1.1)	7 (3.7)		173 (92.0)	15 (8.0)	0.003			
Age groups	30-39	248 (95.4)	3 (1.2)	9 (3.5)	0.006	248 (95.4)	12 (4.6)				
(years)	40-49	298 (98.0)	2 (0.7)	4 (1.3)	0.000	290 (95.4)	14 (4.6)				
	50-59	268 (98.2)	0 (0)	5 (1.8)		269 (98.5)	4 (1.5)				
	60<	123 (97.6)	0 (0)	3 (2.4)		126 (100)	0 (0)				
	Married	850 (97.0)	4 (0.5)	22 (2.5)	0.280	843 (96.2)	33 (3.8)	0.980			
Marital status	Never-married	276 (95.2)	0 (0)	14 (4.8)		279 (96.2)	11 (3.8)				
	Others#	151 (95.6)	3 (1.9)	4 (2.5)		152 (96.2)	6 (3.8)				
	Middle school and below	615 (96.1)	2 (0.3)	23 (3.6)		620 (96.9)	20 (3.1)	0.016			
Education	Associate's degree	317 (97.5)	3 (0.9)	5 (1.5)	0.623	320 (98.5)	5 (1.5)				
	Bachelor's degree and above	345 (96.1)	2 (0.6)	12 (3.3)	0.623	334 (93.0)	25 (7.0)				
	Student	161 (92.5)	0 (0)	13 (7.5)		167 (96.0)	7 (4.0)				
Employment	Pensioner	279 (98.6)	0 (0)	4 (1.4)	0.144	280 (98.9)	3 (1.1)	0.050			
Employment	Unemployed	159 (97.0)	2 (1.2)	3 (1.8)	0.144	158 (96.3)	6 (3.7)	0.050			
	Employed	678 (96.4)	5 (0.7)	20 (2.8)		669 (95.2)	34 (4.8)				
Current	Ulaanbaatar	570 (94.2)	3 (0.5)	32 (5.3)		559 (92.5)	45 (7.5)				
Current residency	Other parts of Mongolia	707 (98.3)	4 (0.6)	8 (1.1)	<0.001	714 (99.3)	5 (0.7)	<0.001			
	< 175\$	812 (96.6)	1 (0.1)	28 (3.3)		819 (97.4)	22 (2.6)				
Income	175\$-525\$	445 (96.3)	6 (1.3)	11 (2.4)	0.024	436 (94.4)	26 (5.6)	0.003			
	> 525\$	20 (95.2)	0 (0)	1 (4.8)		19 (90.5)	2 (9.5)				
COVID-19 know	ledge score, mean (SD)	9.3 (1.3)	7.6 (2.8)	7 (3.7)	<0.001	9.2 (1.4)	8.2 (3.1)	0.119			

<sup>\*</sup> P-values were calculated using the Mann-Whitney test, Kruskal-Wallis test, or ANOVA as appropriate.

Most participants (96.2%) believed that Mongolia could win the battle against COVID-19, while 3.8% had no such confidence. The attitude toward the confidence of winning differed across age groups, education levels, employment, current residency, and income. The COVID-19 knowledge scores were significantly lower in persons without than with confidence of winning (P<0.001) (Table 4).

Multinomial logistic regression analysis found that the agreement of final success in controlling the pandemic was positively associated with the marital status of "married" compared to "others" ("agree" vs "disagree", OR: 0.157, P=0.039), and with the current residency of "other parts of Mongolia" compared to "Ulaanbaatar" ("agree" vs "I do not know", OR: 6.05, p<0.001). Binary logistic regression analysis showed that the agreement

of confidence in winning the battle against the pandemic was positively associated with the education level of "associated degree" compared to "bachelor's degree or above" (OR: 0.315, P=0.030), and the current residency of "other parts of Mongolia" compared to "Ulaanbaatar" (OR: 10.33, P<0.001). Similarly, both attitudes were positively associated with higher COVID-19 knowledge scores (OR: 0.618, P=0.023; OR: 0.617, P<0.001, respectively) (Table 5).

The majority of the participants had not visited any crowded place (82.4%), and at the same time wore masks when going out (93.1%) in recent days. The participants who visited a crowded place (17.6%) were mostly employed men living in Ulaanbaatar. The participants who did not wear masks when going out

<sup># &</sup>quot;Others" included re-married, cohabiting, separated, divorced, and widowed.

(6.9%) were mainly young, never-married, employed people with less income (Table 6).

Binary logistic regression analysis showed that the agreement on the practice of not going to a crowded

place was positively associated with a higher education level, employment, and residing out of Ulaanbaatar. In contrast, the agreement on the practice of wearing a mask when going out was positively associated with older age, higher education, and employment (Table 7).

**Table 5:** Results of multiple binary logistic regression analysis on factors associated with attitudes toward COVID-19.

Variables	OR (95%CI)	P-value*
Final success in controlling the pandemic		
Marital status (married vs. others)	0.157 (0.027, 0.911)	0.039
Current residency (other parts of Mongolia vs. Ulaanbaatar)	6.053 (2.689, 13.624)	< 0.001
COVID-19 knowledge score	0.618 (0.407, 0.935)	0.023
Confidence of winning battle the pandemic		
Education (associate's degree vs. bachelor's degree and above)	0.315 (0.112, 0.892)	0.030
Current residency (other parts of Mongolia vs. Ulaanbaatar)	10.25 (3.963, 26.51)	<0.001
COVID-19 knowledge score	0.617 (0.535, 0.712)	<0.001

<sup>\*</sup> P-values were calculated using the multinomial logistic regression or binary logistic regression as appropriate. OR, odds ratio; CI, confidence interval.

**Table 6:** Practices toward COVID-19 by demographic variables.

			Practices, n	(%) or mea	n (standard de	eviation)	iation)			
Characteristics (n=1324)		Going to a crowded place V			Wearing a r	nask when g	oing out			
		Yes	No	D al a*	Yes	No	D.volue*			
		233 (17.6)	1091 (82.4)	P-value*	1233 (93.1)	91 (6.9)	P-value*			
Condon	Male	49 (13.8)	306 (86.2)	0.028	324 (91.3)	31 (8.7)	0.100			
Gender	Female	184 (19.0)	785 (81.0)	0.028	909 (93.8)	60 (6.2)	0.106			
	13-19	32 (18.5)	141 (81.5)		151 (87.3)	22 (12.7)				
	20-29	35 (18.6)	153 (81.4)		169 (89.9)	19 (10.1)	<0.001			
Age groups	30-39	39 (15.0)	221 (85.0)	0.837	240 (92.3)	20 (7.7)				
(years)	40-49	62 (20.4)	242 (79.6)		291 (95.7)	13 (4.3)				
	50-59	40 (14.7)	233 (85.3)		258 (94.5)	15 (5.5)				
	60<	25 (19.2)	101 (80.2)		124 (98.4)	2 (1.6)				
	Married	143 (16.3)	733 (83.7)	0.083	830 (94.7)	46 (5.3)	0.004			
Marital status	Never-married	57 (19.7)	233 (80.3)		257 (88.6)	33 (11.4)				
	Others#	33 (20.9)	125 (79.1)		146 (92.4)	12 (7.6)				
	Middle school and below	114 (17.8)	526 (82.2)		586 (91.6)	54 (8.4)	0.178			
Education	Associate's degree	53 (16.3)	272 (83.7)	0.951	314 (96.6)	11 (3.4)				
Education	Bachelor's degree and above	66 (18.4)	293 (81.6)	0.931	333 (92.8)	26 (7.2)				
	Student	21 (12.1)	153 (87.9)		165 (94.8)	9 (5.2)				
Fueral er use e set	Pensioner	42 (14.8)	241 (85.2)	0.011	280 (98.9)	3 (1.1)	0.004			
Employment	Unemployed	32 (19.5)	132 (80.5)	0.011	158 (96.3)	6 (3.7)	<0.001			
	Employed	138 (19.6)	565 (80.4)		630 (89.6)	73 (10.4)				
Current	Ulaanbaatar	177 (7.4)	428 (92.6)	40.001	561 (92.7)	44 (7.3)	0.500			
residency	Other parts of Mongolia	56 (0.7)	663 (99.3)	<0.001	672 (93.5)	47 (6.5)	0.598			
	< 175\$	139 (16.5)	702 (83.5)		793 (94.3)	48 (5.7)				
Income	175\$-525\$	93 (20.1)	369 (79.9)	0.240	419 (90.7)	43 (9.3)	0.041			
	> 525\$	1 (4.8)	20 (95.2)		21 (100.0)	0 (0)				
COVID-19 knd	owledge score, mean (SD)	9.25 (1.1)	8.88 (2.57)	0.034	9.23 (1.37)	8.67 (2.45)	0.501			

<sup>\*</sup> P-values were calculated using the Mann-Whitney test, Kruskal-Wallis test, or ANOVA as appropriate.

<sup># &</sup>quot;Others" included re-married, cohabiting, separated, divorced, and widowed.

**Table 7.** Results of multiple binary logistic regression analysis on factors associated with practices toward COVID-19.

Variables	OR (95%CI)	P-value*
Going to a crowded place		
Education (bachelor's degree and above vs middle school and below)	2.058 (1.348, 3.143)	0.001
Employment (employed vs student)	0.227 (0.110, 0.466)	< 0.001
Employment (employed vs pensioner)	0.564 (0.338, 0.940)	0.028
Current residency (other parts of Mongolia vs. Ulaanbaatar)	5.774 (4.071, 8.191)	< 0.001
COVID-19 knowledge score	0.882 (0.810, 0.960)	0.004
Wearing a mask when going out		
Age groups	0.733 (0.569, 0.945)	0.016
Education (bachelor's degree and above vs middle school and below)	2.349 (1.296, 4.256)	0.005
Employment (employed vs student)	0.075 (0.030, 0.189)	< 0.001
Employment (employed vs pensioner)	0.134 (0.038, 0.471)	0.002
Employment (employed vs unemployed)	0.259 (0.104, 0.647)	0.004
COVID-19 knowledge score	0.845 (0.754, 0.947)	0.004

<sup>\*</sup> P-values were calculated using the multiple binary logistic regression. OR, odds ratio; CI, confidence interval

#### 4.0 DISCUSSION

This study determined the knowledge, attitude, and practices toward COVID-19 among the Mongolian general population. The results suggest that the participants have sufficient knowledge about the transmission, symptoms, treatment, and prevention of the disease. Mongolians held an optimistic attitude to disease control measures. Most participants complied with the recommended practices such as wearing masks and social distancing to prevent COVID-19 infections.

The first KAP study towards COVID-19 conducted in Hubei province revealed that the correct answer rate of the knowledge questionnaire was excellent, whereas Palestinian and Bangladesh studies showed a marginal correct answer rate (Zhong et al., 2020; Qutob & Awartani, 2021; Ferdous et al., 2020). Compared to previous studies, our findings demonstrate that the Mongolian general population has moderate knowledge of COVID-19. Our results were similar to the Malaysian KAP study (Azlan et al., 2020). This may be associated with the early onset of centralised measures that have been accompanied by daily news reports on new cases in the country and abroad by the Ministry of Health. In addition to this, there has been widespread information about the disease's nature and facts in the media and on social networking platforms. The significant positive association between levels of education and COVID-19 knowledge scores supports this speculation. The South Koreans discussed the "infodemic", which had been a tremendous and ongoing challenge during the COVID-19 pandemic in their study. In agreement with their results, we found a high prevalence of misunderstanding of the source of

infection from eating or contacting wild animals (Lee et al., 2021). This also means that policymakers and health professionals should recognise target populations for COVID-19 prevention and health education programs and prioritise providing information to certain demographic groups, particularly the youth and those with a low level of education. Furthermore, children and young adults did not wear a mask when going out. This is contrary to previous studies that reported older age affects risk-taking behaviours (Cobey et al., 2013).

Similar to previous KAP studies, these findings suggest that higher COVID-19 knowledge scores were found to be significantly associated with a higher likelihood of positive attitudes and appropriate practices toward the COVID-19 pandemic, indicating the importance of improving knowledge to raise attitudes and appropriate practices toward COVID-19 (Zhong et al., 2020). Despite the higher knowledge score, residents of Ulaanbaatar showed less optimistic attitudes and less appropriate practice compared to the residents of other places than Ulaanbaatar.

Overall, most participants adhered to centralised measures to prevent infection, such as avoiding crowded places and wearing masks when going outside. This optimistic attitude of the Mongolian population could be related to the relatively long absence of local infections of the pandemic. However, 17.6% of the participants visited a crowded place, and 6.9% did not wear a mask when going out, representing a high risk of infection with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV2). These risky behaviours were related to age, gender, and marital status that resemble

the results of the Vietnamese KAP survey (Van Nhu et al., 2020). Yue et al. (2021) noticed a practice difference between residing sites of the participant. Similarly, we found that never-married, employed middle-aged women residing in Ulaanbaatar had better practices than others. It may indicate that those people might be the employees who have to work during the period, such as medical professionals and financial services workers. Second, the less adherence to preventive measures could be related to prolonged lockdown and curfew of the city. Compared to Chinese residents of whom 70.1-88.9% were adherent with the measures during the SARS epidemic, and 96.4-98.0% were during the COVID-19 pandemic, the adherence rates of the current study were relatively low, which indicate an urgent need to educate the target populations (Bener & Al-Khal, 2004). In accordance with the findings of the current results, most of the infections spread locally were registered in Ulaanbaatar since the pandemic surged in the society in November. Our results showed an inappropriate reaction of adolescents to wearing a mask when leaving home by comparison with other age groups. The main positive practice of adolescents in this study was maintaining adequate social distancing. It was in accordance with a report from a Jordanian study (Dardas et al., 2020). Therefore, the most vulnerable populations of Mongolian society during the COVID-19 pandemic are young and urban populations with less education, who are more likely to have poor knowledge, negative attitudes, and inappropriate preventive practices toward COVID-19. It is essential to increase the adherence to control measures since poor knowledge and attitudes toward infectious diseases are the risk factors to complications of outbreak management of the outbreak to prevent the infection.

The limitation of this study was the small size of the sample population that was predominantly consisted of women compared to other national populations. This may have been associated with the paper administration we used for the study due to limited access to the internet and the utilisation of online health care information among the rural population. Another

limitation of the study is the direct adoption of assessment for attitudes and practices toward COVID-19 from an external source without developing a standard questionnaire by in-depth interview, group discussion, and test-retest validation. Due to the limitations and the local outbreak of the infection since

November, more studies are required to investigate the KAP toward COVID-19 among the general population in Mongolia to facilitate the battle against the disease. It is essential to evaluate mental distress in the general population during this pandemic; thus, having good knowledge, a positive attitude, and practice toward COVID-19 is a preventive measure for mental distress (Rias et al., 2020).

#### **5.0 CONCLUSIONS**

In summary, our findings suggest that the Mongolian population of well-educated, employed, older people with a relatively high income had good knowledge, optimistic attitudes, and appropriate practices towards COVID-19 during the initial period of the COVID-19 pandemic. In addition, good knowledge is associated with optimistic attitudes and appropriate practices towards COVID-19, suggesting that health education programs should be aimed at improving COVID-19 knowledge essential to public adherence to centralised measures among young and urban populations.

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