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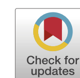
Original Research

Knowledge and awareness of COVID-19 among Indonesian migrant workers in the Greater China Region



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ABSTRACT

Objectives: Migrant workers are one of the most vulnerable population groups during the coronavirus disease 2019 (COVID-19) pandemic. This study investigated knowledge and awareness of COVID-19 among Indonesian migrant workers (IMWs) in Macao (SAR), Hong Kong (SAR), and Taiwan.
Study design: This was a cross-sectional study.
Methods: Data were collected through an online survey in February and March 2020 to gain information on (1) participants' sociodemographic characteristics, (2) experience and awareness regarding COVID-19 information, and (3) knowledge and understanding of COVID-19. A series of Chi-squared, *t*-test, and logistic regression analyses were conducted.
Results: The survey was completed by 491 participants (92.1% female). Knowledge of COVID-19 was obtained from multiple sources, including a large proportion from online social media. However, participants who obtained information from their employer, local social networks, and migrant organisations answered a greater number of questions correctly. One-third of participants reported receiving hoax, fake news, and incorrect information and obtained information from unverified sources. Participants were most interested in information about how to cure COVID-19, and 57.8% knew that no specific drug or vaccine was currently available. Almost all participants correctly identified fever and wearing a facemask as the main COVID-19 symptom and prevention strategy, respectively. Participants with senior high school or higher education and who worked as domestic or care workers had a greater knowledge of COVID-19 than their counterparts.
Conclusions: Public health communication strategies using multiple channels, including employers and community organisations, would help to minimise COVID-19 knowledge gaps. In addition, it is recommended that digital literacy content is added to public health campaigns.
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Introduction

The World Health Organisation (WHO) declared the novel coronavirus disease 2019 (COVID-19) outbreak as a public health emergency of international concern on 30 January 2020. At this time, 7818 cases had been confirmed globally, and approximately 98.9% of the cases were in the Greater China Region, including Macao (SAR), Hong Kong (SAR), and Taiwan.[1] The status was escalated to a pandemic on 11 March 2020, when the total number of confirmed cases was 118,319 globally, and 31.6% were outside of China.[2,3] A critical public health communication strategy during an epidemic is to raise public awareness about the disease and provide information on how to prevent infection. It has been shown that limited public knowledge and awareness of COVID-19 can increase the risk of transmission.[2,4]

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Consistent with these guidelines, public health authorities in the Greater China Region engaged in campaigns to improve epidemic prevention and control strategies through multiple channels.[5,6] For example, in Macao (SAR), China, the government provided daily press briefings, and this information was also shared on social media platforms in English.[7] Furthermore, the governments in these regions provided useful information related to COVID-19, such as prevention strategies in several formats (e.g. videos and posters). However, the uptake of these messages by the general public is not known.

As noted in previous epidemics,[8] migrant workers are not specifically targeted in health promotion campaigns and may not receive timely information that can protect their health. It is unclear whether knowledge related to COVID-19 was received by migrant workers, thus increasing their vulnerability to infection during the COVID-19 pandemic.[9] In the absence of COVID-19 information provided by official government public health sources in their native language, migrant workers are likely to have relied on informal sources of information, including peer networks and online social media. Because of the lack of social media regulation, the quality of health information messages is known to vary considerably from official channels and may spread misinformation,[10–12] further increasing migrant workers' vulnerability.

International migration to Greater China has increased in recent years, and one of the largest communities of migrant workers in the region is from Indonesia, numbering >500,000.[13] This population is primarily engaged in domestic work, security, and other non-technical labour. Previous studies have demonstrated that migrant domestic workers, in particular, experience substantial health challenges and barriers to access to health care.[14] This study investigated the knowledge and awareness of COVID-19 among Indonesian migrant workers (IMWs) in Macao (SAR), Hong Kong (SAR), and Taiwan and assessed the various channels they used to receive COVID-19 information during the pandemic. In addition to the concentrated number of IMWs in Macao (SAR), Hong Kong (SAR) and Taiwan, these regions were also chosen because mainstream social media (i.e. Facebook) and search engines (i.e. Google) can be accessed in these locations. Findings from this study are important in strengthening the preventive strategy through public awareness of COVID-19 among migrant workers. Because of the nature of this explorative study, no hypothesis was tested in the analysis.

Methods

Procedures

A cross-sectional study using an online survey was conducted between 28 February and 31 March 2020. As the study was conducted online with survey links, it was not feasible to target a certain sample size before data collection. In addition, the number of migrant workers during the early phase of the pandemic was fluctuating as a result of layoffs and immigration policies in these three areas. However, to increase the sample diversity, the study was conducted in collaboration with several Indonesian migrant community groups (e.g. the Indonesian Migrant Workers Union and religious-based groups). The survey link was widely distributed through Indonesian migrant's online social networks for a convenience sample. The survey link was posted on their Facebook groups/pages and sent to their group members through WhatsApp/WeChat/Telegram groups. To reach broader potential participants, the survey link was also promoted offline by advertising it on leaflets and posters that were distributed in restaurants and shops frequently visited by Indonesian migrants. The survey link directed participants to complete the online survey in Qualtrics.

Instruments

The survey consisted of several sections. The first section included questions to obtain sociodemographic information. The second section included multiple-choice questions to assess (1) primary sources of information related to COVID-19, (2) experiences in obtaining information on COVID-19, and (3) essential information they wanted relating to COVID-19. The final section assessed participants' knowledge and awareness of COVID-19 in five domains, including (1) symptoms of COVID-19, (2) COVID-19 transmission routes, (3) availability of specific drugs or vaccines for COVID-19, (4) quarantine period, and (5) prevention strategies.

The questions in this survey were adapted from studies on COVID-19 knowledge among local residents and international migrants in China[15,16] that applied the Theory of Planned Behaviour, similar to an Ebola prevention education programme in Nigeria.[17] The preventive strategies applied in the three regions of this study were relatively similar because of their proximity to the pandemic epicentrum and similar COVID-19 first-case confirmation dates (January 21st, 22nd, and 23rd in Taiwan, Macao, and Hong Kong, respectively).[18–20] Information and instructions given to the public related to COVID-19 were also relatively similar in these regions (e.g. it was compulsory to wear facemasks in public areas and 14 days of quarantine for incoming passengers).[21] In addition, these three regions had similar experiences of the severe acute respiratory syndrome outbreak in 2003.

The questionnaire was adapted into the Indonesian language. This adaption was in collaboration with executive members of the Indonesian Migrant Workers Union in Macao (SAR), who also communicated extensively with their colleagues in Hong Kong and Taiwan through focus-group discussions between January and February 2020. For example, the 10 sources of COVID-19 information were gathered from migrant workers' experiences during the beginning of the outbreak. Before data collection, a draft of the online survey was piloted to check language comprehension and estimate the completion time needed. The questionnaire was deemed comprehensible, as no major problems were raised during the pilot study. The questionnaire could be completed in approximately 20–30 min depending on participants' responses, particularly to questions with open-ended answers.

Analyses

Descriptive statistics were used in presenting the participants' sources of information, experiences in obtaining information related to COVID-19, and their knowledge and awareness of COVID-19. The data are presented for each region to provide detailed information. However, because of the risk of sampling bias and uneven sampling from the three regions, inferential statistics were not conducted to compare results across regions. Continuous sociodemographic- and knowledge-related variables were dichotomised to enable Chi-squared tests. For example, age was divided into two groups at the mean sample age ($\leq$36 years vs >36 years). Symptom knowledge was dichotomised (correct vs incorrect) by categorising participants who chose three key symptoms (fever, cough, and sore throat) into the correct group. These three key symptoms had been included in public health information about COVID-19 across the Greater China Region since January 2020 and were more commonly advertised than other symptoms that were included in the list. Transmission route knowledge was dichotomised by categorising participants who chose 'droplets' and 'contact' into the correct group. Treatment knowledge was dichotomised by categorising participants who chose 'no drug, no vaccine' into the correct group. Quarantine period knowledge was dichotomised by categorising participants who chose '14 days' into the correct group. Finally, knowledge of prevention strategies was

dichotomised by categorising participants who chose all strategies in the list into the correct group.

A series of Chi-squared tests were conducted to examine associations between five COVID-19 knowledge and awareness domains (i.e. symptoms, transmission route, drug and vaccine, quarantine period, and prevention strategies) and participants' sociodemographic characteristics (i.e. sex, age, education level, length of stay in the host country, type of job, and accommodation). A series of independent *t*-tests were used to examine the difference in the number of information sources accessed by participants between correct and incorrect groups of five COVID-19 knowledge and awareness responses. A series of logistic regression analyses were conducted to examine the odds of correct answers from five COVID-19 knowledge and awareness domains with 11 primary sources of COVID-19 information (10 sources and 1 'other' option) listed in the survey. The regression models were adjusted for sociodemographic variables, including sex, age, education level, length of stay in the host country, type of job, and accommodation. All statistical tests were performed with two-sided *P*-values and a predetermined significance level of 0.05.

Results

Participants in this study were migrant workers in Macao (SAR), Hong Kong (SAR), and Taiwan. The inclusion criteria were that participants were Indonesian who lived in the host country as migrant workers when they completed the online survey and were aged ≥18 years. At the end of the survey period, 568 people from the three regions had accessed the survey, with a completion rate of 86.4% (n = 491). Participants were predominantly from Macao (58.5%), female (92.1%), worked as a domestic worker or caregiver (71.3%), with an average age of 36 years. Participants' sociodemographic characteristics are presented in Table 1.

The average number of information sources accessed by participants was three (standard deviation = 2.10). In total, 74.3% and 44.8% of participants obtained information related to COVID-19 mainly from social media (Facebook) and electronic/online mass media, respectively (Table 2). Some less frequently accessed sources were local social/migrant organisations (17.5%), printed mass media (14.7%), and non-IMW friends (13.2%). More than one-third of participants received hoax/fake news/incorrect information (38.7%), obtained information from unknown/unverified sources (38.1%), and found it difficult to obtain information in the Bahasa Indonesia language (35.0%). In general, participants were interested in information about how to cure COVID-19 (72.1%) and less interested in psychological support or counselling (22.6%). Some topics under the 'other' option that were not listed in the survey but were mentioned by participants included insurance coverage for treatment related to COVID-19, information on free facemask distribution, changes in immigration regulation and flight schedules, and policies to protect migrant workers.

Table 3 summarises the five domains of knowledge and awareness related to COVID-19 that were assessed in the survey. In general, almost all participants (96.1%) recognised fever as the key symptom of COVID-19, whereas diarrhoea and stomach ache were the least endorsed symptoms (4.89% and 1.63%, respectively). Most participants (94.1%) identified the correct transmission routes of COVID-19 through droplets and contact with infected people; however, a few participants thought that it is transmitted through spoiled food (5.70%). Participants' knowledge of drugs and vaccines for COVID-19 varied; 57.8% correctly answered that no specific drug or vaccine was currently available. In total, 12.4% of participants chose the incorrect options for the quarantine period. Most participants knew that wearing a mask (96.1%) and washing hands frequently (89.6%) were recommended prevention strategies; however, only two-thirds of participants correctly identified physical distancing as an important strategy, including 'do not go to crowded places' (68.0%) and 'stay indoors and avoid going out' (62.9%).

The level of symptom knowledge between different sociodemographic groups did not differ significantly. In terms of transmission route knowledge, 'droplets' and 'contact with infected persons' were correctly identified by 94.1% of participants, particularly among participants with senior high school or higher education level (x^2 = 12.09, P = 0.001). Regarding no current drug and vaccine for COVID-19, only approximately half of the participants (57.8%) were aware of this, and they were more likely to be participants with senior high school or higher education (x^2 = 4.16, P = 0.041), had stayed ≥6 years in their host country (x^2 = 16.50, P < 0.001), and work as domestic or care workers (x^2 = 4.45, P = 0.035). In total, 87.6% of participants correctly identified the quarantine period to be 14 days, and these individuals were more likely to be aged >36 years (x^2 = 7.40, P = 0.007) and have a senior high school or higher education (x^2 = 4.52, P = 0.034). Finally, all six prevention strategies were only recognised by one-quarter of participants (25.3%) who were more likely to be women (x^2 = 9.80, P = 0.002) and work as domestic or care workers (x^2 = 4.65,

Table 1
Sociodemographic characteristics of study participants.

Characteristic	Region			Total (n = 491), n (%)
	Macao (n = 287), n (%)	Hong Kong (n = 146), n (%)	Taiwan (n = 58), n (%)	
Sex				
Female	256 (89.2)	143 (97.9)	53 (91.4)	452 (92.1)
Male	31 (10.8)	3 (2.05)	5 (8.62)	39 (7.90)
Age group				
≤36 years	142 (49.5)	75 (51.4)	33 (56.9)	250 (50.9)
>36 years	145 (50.5)	71 (48.6)	25 (43.1)	241 (49.1)
Educational level				
Elementary or junior high school	112 (39.0)	69 (47.3)	23 (39.7)	204 (41.5)
Senior high school or higher education	175 (61.0)	77 (52.7)	35 (60.3)	287 (58.5)
Length of stay in host country				
<6 years	182 (63.4)	50 (34.2)	43 (74.1)	275 (56.0)
≥6 years	105 (36.6)	96 (65.8)	15 (25.9)	216 (44.0)
Type of job				
Domestic or care workers	176 (61.3)	136 (93.2)	38 (65.5)	350 (71.3)
Non-domestic or care workers	111 (38.7)	10 (6.85)	20 (34.5)	141 (28.7)
Accommodation				
With employer (live-in)	88 (30.7)	138 (94.5)	37 (63.8)	263 (53.6)
Not with employer (live-out)	199 (69.3)	8 (5.48)	21 (36.2)	228 (46.4)

Note: Percentages are calculated by comparing the category frequency with total sample in the region.

Table 2
Sources of information and experiences in getting information related to COVID-19.

Variables	Region			Total, *n* (%)
	Macao, *n* (%)	Hong Kong, *n* (%)	Taiwan, *n* (%)	
Primary sources of information related to COVID-19[a]				
Social media (Facebook)	210 (73.2)	108 (74.0)	47 (81.0)	365 (74.3)
Electronic/online mass media	128 (44.6)	63 (43.2)	29 (50.0)	220 (44.8)
Employer	91 (31.7)	45 (30.8)	30 (51.7)	166 (33.8)
Online group (e.g. WeChat/WhatsApp group)	80 (27.9)	61 (41.8)	22 (37.9)	163 (33.2)
YouTube	71 (24.7)	34 (23.3)	17 (29.3)	122 (24.8)
Indonesian Consulate/Representative	46 (16.0)	53 (36.3)	13 (22.4)	112 (22.8)
Local Labour Department, Health Department, or other local official departments	52 (18.1)	29 (19.9)	21 (36.2)	102 (20.8)
Local social/migrant organisation	43 (15.0)	30 (20.5)	13 (22.4)	86 (17.5)
Printed mass media	31 (10.8)	34 (23.3)	7 (12.1)	72 (14.7)
Non-Indonesian migrant worker friends	31 (10.8)	24 (16.4)	10 (17.2)	65 (13.2)
Other	15 (5.23)	6 (4.11)	3 (5.17)	24 (4.90)
Experiences in getting information on COVID-19[a]				
Received hoax/fake news/incorrect information	111 (38.7)	50 (34.2)	29 (50.0)	190 (38.7)
Received information from unknown/unverified sources	106 (36.9)	57 (39.0)	24 (41.4)	187 (38.1)
Difficult to find information in the Bahasa Indonesia language	100 (34.8)	44 (30.1)	28 (48.3)	172 (35.0)
Difficult to find information from official sources	76 (26.5)	54 (37.0)	16 (27.6)	146 (29.7)
Difficult to find information that could be easily understood	45 (15.7)	21 (14.4)	16 (27.6)	82 (16.7)
Most wanted information related to COVID-19[a]				
How to cure the disease	198 (69.0)	103 (70.5)	53 (91.4)	354 (72.1)
Status and trend of epidemic	166 (57.8)	96 (65.8)	54 (93.1)	316 (64.4)
How to prevent the disease	154 (53.7)	62 (42.5)	46 (79.3)	262 (53.4)
The symptoms of the disease	134 (46.7)	59 (40.4)	51 (87.9)	244 (49.7)
How the disease is transmitted	122 (42.5)	51 (34.9)	42 (72.4)	215 (43.8)
Where the virus came from	109 (38.0)	46 (31.5)	41 (70.7)	196 (39.9)
Other	91 (31.7)	50 (34.2)	23 (39.7)	164 (33.4)
Psychological support or counselling	51 (17.8)	26 (17.8)	34 (58.6)	111 (22.6)

[a] Participants may choose more than one option. Percentages are calculated by comparing the category frequency with total sample in the region.

Table 3
The five domains of knowledge and awareness related to COVID-19 of the study participants.

Variables	Region			Total, *n* (%)
	Macao, *n* (%)	Hong Kong, *n* (%)	Taiwan, *n* (%)	
Symptoms of COVID-19[a,b]				
Fever	276 (96.2)	143 (97.9)	57 (98.3)	476 (96.1)
Cough	148 (51.6)	70 (47.9)	40 (69.0)	258 (52.5)
Sore throat	118 (41.1)	59 (40.4)	44 (75.9)	221 (45.0)
Runny nose	74 (25.8)	52 (35.6)	36 (62.1)	162 (33.0)
Headache	65 (22.6)	39 (26.7)	25 (43.1)	129 (26.3)
Weakness	55 (19.2)	37 (25.3)	20 (34.5)	112 (22.8)
Diarrhoea	11 (3.83)	13 (8.90)	0 (0)	24 (4.89)
Stomach ache	5 (1.74)	3 (2.05)	0 (0)	8 (1.63)
Transmission routes of COVID-19				
Droplets (e.g. from a sneeze) and contact with infected persons[d]	268 (93.4)	137 (93.8)	57 (98.3)	462 (94.1)
Spoiled food	18 (6.27)	9 (6.16)	1 (1.72)	28 (5.70)
Mosquito bites	1 (0.35)	0 (0)	0 (0)	1 (0.20)
From the Soil	0 (0)	0 (0)	0 (0)	0 (0)
Specific drug or vaccine for COVID-19				
No drug, no vaccine[d]	153 (53.3)	90 (61.6)	41 (70.7)	284 (57.8)
There is a drug but no vaccine	68 (23.7)	24 (16.4)	3 (5.17)	95 (19.3)
There is both a drug and a vaccine	36 (12.5)	17 (11.6)	6 (10.3)	59 (12.0)
No drug but there is a vaccine	30 (10.5)	15 (10.3)	8 (13.8)	53 (10.8)
Quarantine period				
14 days[d]	254 (88.5)	126 (86.3)	50 (86.2)	430 (87.6)
1 month	23 (8.01)	17 (11.6)	7 (12.1)	47 (9.60)
7 days	8 (2.79)	2 (1.37)	1 (1.72)	11 (2.20)
5 days	2 (0.70)	1 (0.68)	0 (0)	3 (0.60)
Prevention strategies[a,c]				
Wear mask	274 (95.5)	141 (96.6)	57 (98.3)	472 (96.1)
Wash hands frequently	255 (88.9)	130 (89.0)	55 (94.8)	440 (89.6)
Do not go to crowded places	194 (67.6)	97 (66.4)	43 (74.1)	334 (68.0)
Stay indoors and avoid going out	169 (58.9)	95 (65.1)	45 (77.6)	309 (62.9)
Keep room well ventilated	112 (39.0)	60 (41.1)	37 (63.8)	209 (42.6)
Do not contact wild animals	85 (29.6)	46 (31.5)	30 (51.7)	161 (32.8)

[a] Participants may choose more than one option. Percentage is calculated by comparing the category frequency with total sample in the region.
[b] All these six options were correct. However, fever, cough, and sore throat were three key symptoms that participants were categorised into a correct group if answered these three options.
[c] These six options were correct. Only participants who chose all strategies together were categorized as correct.
[d] Correct answer.

$P = 0.031$). In general, the number of information sources accessed by participants was not significantly different between correct and incorrect groups across the five knowledge domains (see Table 4).

The detailed logistic regression results on the odds of correct answers from five dimensions of COVID-19 knowledge and awareness with 11 primary sources of COVID-19 information are presented in Table 5. The odds ratio (OR) for correct symptoms knowledge indicated that when sociodemographic variables were controlled, participants who (1) obtained information from their employer were 2.11 times more likely to have correct knowledge than participants who did not (95% confidence interval [CI] 1.41–3.17; $P < 0.001$), (2) obtained information from local social/migrant organisations were 1.67 times more likely to have correct knowledge than participants who did not (95% CI 1.03–2.72; $P = 0.038$), (3) obtained information from other sources outside the list were 2.42 times more likely to have correct knowledge than participants who did not (95% CI 1.05–5.60; $P = 0.038$), and (4) obtained information from WeChat/WhatsApp groups were 0.56 times less likely to have correct knowledge than participants who did not (95% CI 0.36–0.86; $P = 0.009$).

The OR for correct transmission route knowledge indicated that when sociodemographic variables were controlled, participants who obtained information from WeChat/WhatsApp groups were 0.45 times less likely to have correct knowledge than participants who did not (95% CI 0.21–0.99; $P = 0.047$). The OR for correct drug and vaccine knowledge indicated that when sociodemographic variables were controlled, participants who (1) obtained information from electronic/online mass media were 1.49 times more likely to have correct knowledge than participants who did not (95% CI 1.01–2.21; $P = 0.043$) and (2) obtained information from local social/migrant organisations were 1.79 times more likely to have correct knowledge than participants who did not (95% CI 1.07–2.98; $P = 0.025$).

The OR for correct quarantine period knowledge indicated that when sociodemographic variables were controlled, participants who (1) obtained information from their employer were 2.38 times more likely to have correct knowledge than participants who did not (95% CI 1.22–4.67; $P = 0.011$), (2) obtained information from the Indonesian Consulate/Representative were 2.99 times more likely to have correct knowledge than participants who did not (95% CI 1.24–7.23; $P = 0.015$), (3) obtained information from an online WeChat/WhatsApp groups were 0.48 times less likely to have correct knowledge than participants who did not (95% CI 0.28–0.85; $P = 0.011$), and (4) obtained information from YouTube were 0.36 times less likely to have correct knowledge than participants who did not (95% CI 0.20–0.63; $P < 0.001$).

The OR for correct prevention strategies knowledge indicated that when sociodemographic variables were controlled, participants who (1) obtained information from the local Labour Department, Health Department, or other local official departments were 1.65 times more likely to have correct knowledge than participants who did not (95% CI 1.01–2.69; $P = 0.044$); and (2) obtained information from local social/migrant organisations were 1.84 times more likely to have correct knowledge than participants who did not (95% CI 1.10–3.07; $P = 0.020$).

Discussion

The present study investigated IMWs' knowledge and awareness of COVID-19 in the Greater China Region, including Macao (SAR), Hong Kong (SAR), and Taiwan. To our knowledge, there are no other similar reports for this population; however, our findings could be compared with other COVID-19 knowledge studies among international migrants in other countries, such as international migrants in China[15] and Latinx in the United States.[22] Participants obtained information related to COVID-19 from various sources, mostly from social media (Facebook), as this online social networking platform is also used to connect with family and friends.[23] Furthermore, Indonesia was ranked as the third-largest Facebook user in the world.[24] This finding was different from previous studies among international migrants in mainland China, where WeChat was the most common channel to obtain information related to COVID-19,[15] and television was the most common information source for local urban and rural residents in China.[25] However, a survey among Indonesian people in Indonesia[26] found that participants obtained COVID-19 information mainly from television news (79.1%), followed by social media (57.7%), which could indicate that IMWs may have difficulty in understanding the television programmes in their host country.

Approximately one-third of participants (38.7%) experienced obtaining hoax/fake news/incorrect information and received information from unverified sources. A previous study on social media literacy among university students also found that the distribution of fake news on social media in Indonesia was severe, particularly from user-generated content.[24] These findings are consistent with the high level of misleading information (the so-called 'infodemic'), which may reduce beneficial health behaviours and increase psychological distress during the pandemic.[10,27,28] Social interventions could be used to fight this infodemic using crowdsourcing judgements where the audiences are requested to rate the accuracy of the news or information before sharing it with others.[29]

Table 4
Average number (mean) of information sources accessed by participants.

Five domains of knowledge and awareness related to COVID-19	n	Mean	SD	t	P-value
Symptoms of COVID-19					
Incorrect	338	2.94	1.99	−1.70	0.090
Correct	153	3.29	2.31		
Transmission routes of COVID-19					
Incorrect	29	3.17	2.62	0.33	0.744
Correct	462	3.04	2.07		
Specific drug or vaccine for COVID-19					
Incorrect	207	2.87	1.98	−1.57	0.116
Correct	284	3.18	2.18		
Quarantine period					
Incorrect	61	2.95	2.03	−0.39	0.697
Correct	430	3.06	2.11		
Prevention strategies					
Incorrect	367	2.95	2.03	−1.78	0.075
Correct	124	3.34	2.28		

SD, standard deviation.

Table 5
The odds ratio (OR) and 95% confidence interval (CI) for the correct five dimensions of COVID-19 knowledge and participants' sources of information

Sources of information		Symptoms			Transmission routes			Drug and vaccine			Quarantine period			Prevention strategies		
		OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Social media (Facebook)	No	1			1			1			1			1		
	Yes	0.77	0.50–1.18	0.230	0.30	0.09–1.04	0.057	0.69	0.45–1.06	0.087	0.82	0.43–1.59	0.563	0.65	0.41–1.03	0.066
Electronic/online mass media	No	1			1			1			1			1		
	Yes	1.45	0.97–2.18	0.069	1.75	0.73–4.21	0.214	1.49	1.01–2.21	**0.043**	1.52	0.83–2.78	0.175	1.15	0.75–1.78	0.524
Employer	No	1			1			1			1			1		
	Yes	2.11	1.41–3.17	**<0.001**	2.16	0.84–5.52	0.109	0.99	0.67–1.46	0.950	2.38	1.22–4.67	**0.011**	1.31	0.85–2.04	0.223
Online group (i.e. WeChat/WhatsApp)	No	1			1			1			1			1		
	Yes	0.56	0.36–0.86	**0.009**	0.45	0.21–0.99	**0.047**	1.18	0.79–1.76	0.410	0.48	0.28–0.85	**0.011**	0.94	0.61–1.47	0.801
YouTube	No	1			1			1			1			1		
	Yes	0.97	0.62–1.54	0.913	0.59	0.25–1.37	0.218	0.88	0.57–1.36	0.573	0.36	0.20–0.63	**<0.001**	1.32	0.81–2.13	0.266
Indonesian Consulate/Representative	No	1			1			1			1			1		
	Yes	1.27	0.81–1.99	0.299	1.43	0.52–3.93	0.488	1.28	0.81–2.00	0.286	2.99	1.24–7.23	**0.015**	1.35	0.83–2.19	0.223
Local Labour Department, Health Department, or other local official departments	No	1			1			1			1			1		
	Yes	1.47	0.93–2.33	0.099	0.98	0.38–2.53	0.970	1.12	0.71–1.78	0.627	1.75	0.79–3.84	0.166	1.65	1.01–2.68	**0.044**
Local social/migrant organisations	No	1			1			1			1			1		
	Yes	1.67	1.03–2.72	**0.038**	0.60	0.24–1.50	0.277	1.79	1.07–2.98	**0.025**	1.41	0.63–3.12	0.401	1.84	1.10–3.07	**0.020**
Printed mass media	No	1			1			1			1			1		
	Yes	1.00	0.57–1.73	0.994	1.20	0.32–4.24	0.774	1.20	0.70–2.07	0.508	0.71	0.33–1.53	0.381	1.34	0.76–2.36	0.314
Non-Indonesian migrant worker friends	No	1			1			1			1			1		
	Yes	1.24	0.71–2.16	0.440	0.75	0.27–2.07	0.573	1.28	0.74–2.23	0.376	1.17	0.50–2.72	0.723	1.40	0.78–2.52	0.254
Other	No	1			1			1			1			1		
	Yes	2.42	1.05–5.60	**0.038**	0.46	0.10–2.21	0.334	1.77	0.70–4.46	0.224	0.65	0.21–2.03	0.456	1.16	0.46–2.942	0.755

CI = Confidence Interval. OR = Odd Ratio. Models are adjusted for sociodemographic variables (sex, age, education level, length of stay in the host country, type of job, and accommodation).
The bold values are represents the p value < .05.

The governments of Macao (SAR), Hong Kong (SAR), and Taiwan are all using official and verified social media accounts to communicate with the public during the pandemic. For example, the Macao (SAR) government has two official verified Facebook accounts: one is its government information channel and the other is a newly created account specifically for pandemic communications. They have news feeds and occasionally provide infographics in English to inform knowledge on preventing COVID-19. However, as most of the information provided through these accounts are still in Chinese and its English version is always delayed, it is recommended that the migrant workers' country Consulate/Representative should provide timely translations of situational updates from the host country because not all migrant workers are fluent in the local language or in English. The WHO also partnered with Facebook to reduce the number of hoax/fake news/incorrect information being shared on the social media platform, as this misinformation increases the risk of being infected or other serious consequences.[12,30]

Participants were primarily interested in how to cure COVID-19, which is in line with results from international migrants in China,[15] but differs from individuals in Vietnam who were more interested in updated news about the pandemic.[12] Public health communication campaigns about the disease should include information about drugs and vaccines because only half of the participants were aware that no specific drug or vaccine was available for COVID-19 during the early period of this pandemic, which was comparable with Latinx migrant workers in the United States.[22] Similar to international migrants in China,[15] IMWs in this study had little interest in psychological support or counselling because it might not be a priority for them at the early stage of the pandemic. However, information on mental health services should be provided as early as possible to prevent the negative psychological impacts of the pandemic, including anxiety and depression, that could increase after several months.[31] In addition, support groups to assist the migrant workers in dealing with stress could also be established, without being labelled as a mental health service to avoid the stigma.

Regarding symptoms, almost all participants were aware that fever was the main symptom of COVID-19. However, many participants did not know that a cough and sore throat were also key symptoms associated with COVID-19. COVID-19 knowledge accuracy should be increased, including in the future outbreaks, because it was found that low COVID-19 knowledge had positive correlations with vaccine hesitancy and an unwillingness to be vaccinated among adults..[32] Despite a lack of awareness of symptoms, knowledge of prevention strategies was high, with most participants knowing that wearing a facemask and handwashing could prevent virus transmission, which was similar to results found for Latinx migrant workers in the United States.[22] However, awareness of physical distancing measures was relatively low, suggesting that increased education around prevention strategies is required in the future.

Educational level was a key factor associated with virus knowledge, which is similar to survey findings on COVID-19 knowledge among residents in mainland China during the early phase of the COVID-19 pandemic.[16,25,33] IMWs with elementary or junior high school education were less likely to correctly answer questions about virus transmission route, drug and vaccine availability, and quarantine periods compared with their peers with higher educational backgrounds. These results could be because of participants with higher educational levels having more comprehension skills compared with their counterparts. Therefore, the content of educational campaigns should use a language that

can be easily understood and be complemented with an illustration or simple infographic.[30] In this study, 16.7% of participants could not find information on COVID-19 that was easy for them to understand. In addition, approximately one-third of participants who work as domestic or care workers (e.g. cleaners, cooks, and servers) knew less about drug/vaccine and prevention strategies than their counterparts. Therefore, different strategies may be useful in disseminating information on COVID-19 for these population groups (e.g. through collaboration with their employers).

The logistic regression analyses suggested that IMWs who received information related to COVID-19 symptoms, drugs and vaccines, quarantine periods, and prevention strategies from their employer and local social/migrant organisations (e.g. Migrant Workers Union) showed greater understanding than their counterpart peers. These findings are comparable with the international students who are supported by their university through the student union or the international office.[34] Hence, it is also important to empower local social migrant organisations in educating migrant workers about the disease. On the other hand, IMWs who accessed information related to COVID-19 symptoms and quarantine periods from WeChat/WhatsApp groups and YouTube tended to be more likely to exhibit an incorrect understanding compared with IMWs who did not receive information from these sources. Public health communication campaigns should encourage migrant workers to access only reliable information sources and recheck the information before sharing it.[29]

A digital literacy campaign might also be considered to increase migrant workers' skills in recognising reliable accounts or information related to COVID-19. Participants who accessed information on the quarantine period from the Indonesian Consulate/Representative tended to have a more accurate understanding than their peers who did not access this source. This might be a result of the quarantine period related to the immigration process and stay of permit that migrant workers must consider if they want to conduct international travel, which is similar to results from international migrants in China.[15] The Indonesian Consulate/Representative could also help in educating other domains of COVID-19 knowledge, such as its symptoms and prevention strategies.

The present study has several strengths, including the diverse and large sample of migrants in the three regions across Greater China and the cooperation with local migrant workers groups to design and carry out the study. The study also has some limitations. First, although online surveys may be the most effective method to reach migrant workers because the majority of them have smartphones and Internet connection,[35] and considering the physical distancing strategy during the pandemic,[16] it is worth considering that some IMWs might not have smartphones or be allowed to use them nor be allowed to go out, as found in a previous study among IMWs in Taiwan.[8] In addition, selection bias may be present, as IMWs who answered the survey might have had a particular interest in the pandemic. Those who were most vulnerable and not interested in the pandemic may have been excluded because of limitations in the sampling approach. To increase the sample diversity, posters and leaflets contained the survey information were also distributed in common places visited by IMWs, such as Indonesian restaurants.

Second, the male IMWs were underrepresented, and they might have different knowledge and awareness of COVID-19. The dominance of female IMWs in this study (92.1%) actually represents the proportion of women in the region; 99.8% of IMWs in Hong Kong in 2018 were female[36] and 75.4% in Taiwan in 2019.[37] This also reflects the gendered nature of migration and the caretaking jobs that are predominant in the region. Similar studies in other countries that are dominated by male IMWs (e.g. Malaysia) may complement findings from this study.

Third, as this was a cross-sectional study with a convenience sampling method and it was not possible to adjust for multiple sources of media use and other confounders, the casual association between particular sources of information and correct knowledge and understanding related to COVID-19 may be biased. For example, the survey link distribution was assisted by migrant communities, and the findings showed that participants who obtained information from social/migrant organisations were more likely to have correct knowledge than participants who did not. Finally, this study was conducted among IMWs only; their sociodemographic backgrounds may be different from other dominant migrant worker groups in the Greater China Region (e.g. migrant workers from The Philippines and Vietnam). Therefore, the findings from this study may not be applicable to other communities of migrant workers. Further studies among migrant workers from different nationalities should be conducted to provide a more complete picture about migrant workers' knowledge and awareness of COVID-19.

Conclusions

IMWs in the Greater China Region, including Macao (SAR), Hong Kong (SAR), and Taiwan, were knowledgeable and aware of COVID-19, and this information was received from multiple sources (mostly social media). However, their knowledge and awareness of COVID-19 could be improved by using easily understood content disseminated in their native language because more than one-third of participants reported difficulty in finding information in the Bahasa Indonesia language. Particular information related to COVID-19 that should be promoted more widely to IMWs includes other prevention strategies besides wearing a facemask, information about the cure (drug/vaccine), and other symptoms besides fever. The role of the employer and local social/migrant organisations should be maximised in disseminating COVID-19 information because these sources appear to have provided more accurate information. In contrast, IMWs should be encouraged to check the accuracy of the information they receive from online groups (e.g. WeChat/WhatsApp group) and YouTube because IMWs who obtained information from these sources reported more incorrect responses to knowledge questions than their counterparts. To overcome this issue, digital literacy should be promoted, including how to identify fake news and misinformation, to complement health promotion campaigns.

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Competing interests

The authors have no conflict of interest to declare.

Consent for publication

Not applicable.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author on reasonable request.

Authors' contributions

A.L. and B.J.H. drafted the study and article outlines. A.L., B.J.H., and C.W. developed the methods. A.L. wrote the draft of article. C.W., C.D., A.I.F.L., C.A.L., and B.J.H. provided critical feedback for the article, including data analysis and interpretation. All authors read and approved the final article.

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