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Global epidemiology of COVID-19 knowledge, attitude and practice: a systematic review and meta-analysis

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ABSTRACT

Objective To assess the knowledge, attitude and practice (KAP) of the global general population regarding COVID-19.

Design Systematic review and meta-analysis.

Methods MEDLINE, Embase, CINAHL and PsycINFO were used to identify articles published between 1 January and 30 June 2021 assessing KAP regarding COVID-19 in the global general population. The quality of eligible studies was assessed. Random effects model was used to obtain the pooled proportion of each component of KAP of COVID-19. Heterogeneity (I^2) was tested, and subgroup and correlation analyses were performed.

Results Out of 3099 records, 84 studies from 45 countries across all continents assessing 215 731 participants' COVID-19 KAP were included in this study. The estimated overall correct answers for knowledge, good attitude and good practice in this review were 75% (95% CI 72% to 77%), 74% (95% CI 71% to 77%) and 70% (95% CI 66% to 74%), respectively. Low-income countries, men, people aged below 30 years and people with 12 years of education or less had the lowest practice scores. Practice scores were below 60% in Africa and Europe/Oceania. Overall heterogeneity was high ($I^2 \geq 98\%$), and publication bias was present (Egger's regression test, p<0.01). A positive significant correlation between knowledge and practice (r=0.314, p=0.006), and attitude and practice (r=0.348, p=0.004) was observed.

Conclusions This study's findings call for community-based awareness programmes to provide a simple, clear and understandable message to reinforce knowledge especially regarding efficacy of the preventive measures in low and lower middle-income countries, and in Africa and Europe/Oceania, which will translate into good practice. Targeted intervention for men, people with low education, unemployed people and people aged below 30 years should be recommended. As most of the included studies were online surveys, underprivileged and remote rural people may have been missed out. Additional studies are needed to cover heterogeneous populations.

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INTRODUCTION

Emerging infectious diseases (defined as diseases that have 'newly appeared in a population or have existed previously but are rapidly increasing in incidence or geographic range'[1]) have always been a public health

Strengths and limitations of this study

► This is the first systematic review and meta-analysis that summarises existing knowledge, attitude and practice pertaining to COVID-19 in the global general population.

► The study identified a large number of studies and participants, covering all continents of the world.

► Articles published in non-English were excluded, and substantial heterogeneity was present in the evaluated outcomes.

► As most of the included studies were cross-sectional online surveys, underprivileged and remote rural people who do not have internet access may have been missed out.

threat worldwide. Since late December 2019, the world has been facing COVID-19, which is caused by SARS-CoV-2. On 30 January 2020, the WHO declared a state of public health emergency. Since then, this emerging and highly infectious disease has spread to 223 countries and territories, leading quickly to a global pandemic, with nearly 181.3 million cases and 3.9 million deaths reported as of 30 June 2021. At time of writing, COVID-19 is still challenging to contain for most countries around the world[2] and it mainly affects the respiratory system and can lead to acute hypoxaemic respiratory failure, and 0.9%–14% of these patients require admission to intensive care units (ICU) for advanced respiratory support.[3 4] The consequent increase in critically ill patients with COVID-19 with respiratory failure has overwhelmed ICUs as well as the invasive mechanical ventilation capacity of healthcare systems in many countries across the globe.

Currently, vaccines are authorised and recommended to prevent COVID-19. Assuming two vaccine doses per person, according to a study published on 3 December 2020,[5] an estimated 15.6 billion doses of COVID-19 vaccines are needed for the 194

WHO member states to achieve a universal COVID-19 vaccination programme. Furthermore, 10.3 billion doses are required for targeted and high-risk groups. According to 12 COVID-19 vaccine manufacturers across the world, about 10 billion doses will be available by the end of 2021. Vaccine production, however, is only the first step in a long delivery process that may face immense challenges such as logistics, cold chains and the actual administering of the vaccine.[5] Furthermore, according to WHO, about 50% of the vaccine will be wasted because of temperature control in the supply chains.[6] Therefore, distribution of vaccines, especially in rural and remote communities in many low to lower middle-income countries, requires strong international and national supply chains.[5] In addition, the literature shows that vaccine hesitancy may affect the benefits of vaccination campaigns,[7] and a recent global systematic review on COVID-19 vaccine hesitancy among general people showed that in many countries vaccine acceptance is below 60%.[8]

Thus, until the distribution of vaccine produces herd immunity, perceived risk-induced behaviours and preventive measures work best to stop the further spread of the disease. This includes behaviours like avoidance of crowded places, washing hands regularly or using hand sanitisers, avoiding frequent touching of the eyes, nose and mouth, cleaning touched surfaces frequently, wearing a mask, social distancing and seeking medical advice on noticing symptoms like sore throat, fever or shortness of breath.[9 10] People need to follow these measures voluntarily for the safety of themselves and other people in general. The level to which they follow them voluntarily will depend on their accurate knowledge about the pandemic and their attitude towards it.[11] However, since voluntary action is not enough, most governments across the world have been forced to come up with strict laws and measures that aim to stop the further spread of the disease. Still many countries across the world have not been successful in enforcing these laws. The biggest challenge with people's devotion to these control measures is determined by what they know about the disease, what their attitude is and what practices they undertake to follow their local measures.

Since the emergence of the virus, through the combined efforts of healthcare professionals and government bodies, several measures have been developed to raise awareness, improve knowledge and strengthen preventive practices to control the spread of infection.[12] However, lack of knowledge about mode of transmission and vulnerable populations, as well as lack of attention to preventive measures, may still be widespread; consequently, many countries are facing localised spikes or the localised return of a large number of cases and deaths.

The constant evolving nature of the COVID-19 pandemic necessitates the need for regular update of scientific literature and research techniques. While reviews have been published in the past on knowledge, attitude and practice (KAP), they are not comprehensive and need timely update. One review article (that included
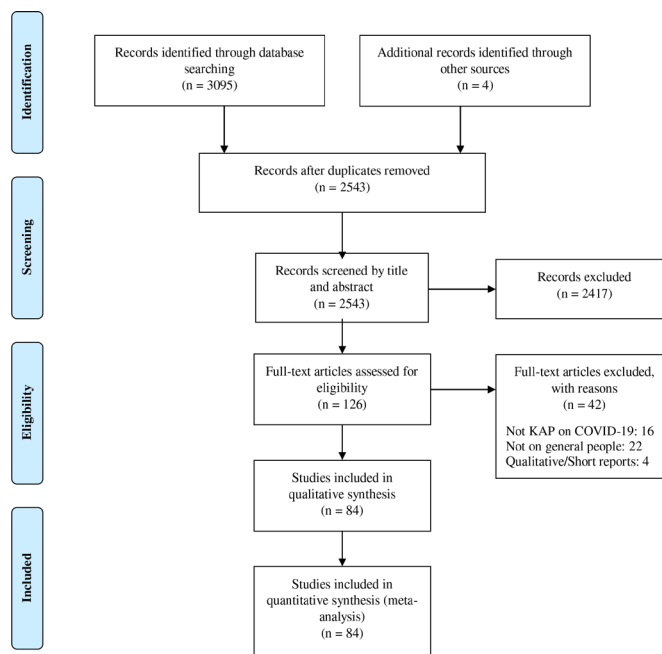
Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) 2009 flow diagram. KAP, knowledge, attitude and practice.

articles published from December 2019 to September 2020) assessed predominantly the American subcontinent, and did not perform any definite or accurate quantitative analysis.[13] Another review article that included articles from March to July 2020 also did not perform any meta-analysis and included studies conducted on healthcare workers as well as on the general population.[14] Thus, the aim of the current study was to perform a systematic review and meta-analysis in order to provide the current global epidemiology of COVID-19 KAP in the general population. In comparison with the above published review studies, the present study was conducted over a more comprehensive time period (1 January 2020 to 30 June 2021) and performed a thorough meta-analysis with various in-depth subgroup analysis. To the best of our knowledge, the present study is the first global meta-analysis to have overall pooled prevalence of each component of KAP of COVID-19 among the global general population.

METHODS

This systematic review and meta-analysis was conducted in accordance with 'Preferred Reporting Items for Systematic Reviews and Meta-analyses' (PRISMA).[15] It also complies with the Meta-analysis and Systematic Reviews of Observational Studies (MOOSE) guidelines.[16] The study has been registered on PROSPERO. The review process is shown in the flow diagram in figure 1 and the PRISMA and MOOSE checklists are included as online supplemental tables 1 and 2.

Eligibility criteria
Inclusion criteria
The review included studies that reported any form of quantitative assessment/measurement/evaluation of KAP regarding COVID-19 in the general population in any country or region across the world. There were no restrictions on the age, gender, ethnicity or health status of the participants, the duration for which the study was conducted or the geographic location of the study. Only published articles that had full text available (in English) were included.

Exclusion criteria
Studies were excluded if they were conducted only on some specific group of people, such as healthcare workers, medical students, pregnant women or people with comorbidities. Short reports, case reports, briefs, letters, editorials and study duplicates were also excluded.

Search strategy, information sources and study selection
With the help of a senior medical librarian, two authors (BNS and AS) independently searched the publicly available KAP in COVID-19-related published articles using databases of MEDLINE, Embase, CINAHL and PsycINFO following the PRISMA and MOOSE checklists (online supplemental tables 1 and 2).[15 16] This review also included preprints, which provide a dynamic update of research papers related to COVID-19. The main keywords for the search strategy included 'knowledge', 'attitude', 'practice' and 'COVID-19'. Only English-language articles were considered, as a search restriction. EndNote was used to store, organise and manage all the citations.

The same authors (BNS and AS) then independently conducted the initial screening of the title and abstract for each article obtained from the literature search. When a title or abstract was not sufficient grounds to reject an article, the full text was obtained and assessed. After the independent review, they had a disagreement with the consideration of four papers (5%). Three papers were resolved by mutual consensus and one was resolved by consulting with the senior author (BB). Reference lists of the articles selected in this meta-analysis were also screened manually for any additional studies.

The preliminary search, which was carried out on 4 September 2020 and updated on 30 June 2021, covered published articles between 1 January 2020 (as the first novel case of COVID-19 was discovered on 31 December 2019) and 30 June 2021. The detailed search strategy is given in the online supplemental table 3.

Study outcomes
This meta-analysis addressed three main outcomes of overall KAP pertaining to COVID-19 in the general population across the world.

Knowledge: level of knowledge or awareness regarding symptoms, mode of transmission, people at risk, incubation and isolation periods, virus fatality, treatments and prevention of COVID-19 infection.

Attitude: attitude towards controlling or managing of COVID-19.

Practice: practices such as hand hygiene, wearing face masks, social distancing, avoidance of crowded places/social events and isolation/quarantine to prevent the spread of COVID-19.

The secondary outcomes included the estimated effect by age (under 30 years of age vs 30 or older), gender (male vs female), employment status (unemployed vs employed vs retired/student), income level of the country where the study was conducted (low income vs lower middle income vs upper middle income vs high income), educational level (up to 12 years vs over 12 years), continent and study period (January to March 2020 vs April to June 2020 vs July to October 2020).

Data extraction
Using a data extraction template (Excel spreadsheet), two reviewers (BNS and AS) independently extracted key information regarding identification of the study (authors, publication month, country where the studies were conducted), methodology (study setting, study design, study population, sample size, data collection tool, recruitment method, recruitment period), participants' demographics (gender, age, education, current employment status, income, area of residence) and main study findings (prevalence of correct knowledge/mean knowledge score of participants regarding symptoms, mode of transmission and prevention of COVID-19, prevalence of positive attitudes of participants towards controlling or managing of COVID-19 and prevalence of good practices such as social distancing, hand hygiene, wearing face masks and (where relevant) quarantine of participants to prevent COVID-19. The two data files were then cross-checked by a third reviewer (OB). Any disagreements were resolved by a consensus meeting under the supervision of a senior author (BB). Missing data, where required, were sought from the study authors.

Quality assessment and risk of bias in individual studies
The quality of the included studies was assessed by two independent reviewers (BNS and AS) using the National Heart, Lung, and Blood Institute (NHLBI) quality assessment tool for observational cohort and cross-sectional studies.[17] The tool uses 14 criteria to assess internal validity and risk of bias. Each criterion was rated as 'yes', 'no', 'cannot determine', 'not applicable' or 'not reported' (online supplemental table 4). An overall quality of the study was then rated as good, fair or poor. Any discrepancies in the rating between the two reviewers were resolved by a third author (OB).

Data analysis
Quantitative data (eg, percentage of KAP regarding COVID-19, and by age, gender, educational level, current employment status of the participants) extracted from each study were analysed by the author (AA) and were then cross-checked by the senior author (BB); any

discrepancies were resolved. Statistical software package Stata V.16 (StataCorp, USA) was used for statistical analyses.

Means (SDs) or medians (25th and 75th percentiles), where appropriate, were extracted and then reported for numerical data. Percentage was extracted and then reported for each category of KAP, age group, gender, educational level and employment status of the study participants. The pooled proportion of COVID-19 KAP was calculated as a data synthesis of primary outcomes and was presented in forest plots. This analysis was performed using the random effects model, as this method demonstrates better properties in the presence of heterogeneity (if any), accounting for both within-study and between-study variances.[18] Heterogeneity among the included studies was tested using the χ^2 test on Cochran's Q statistic, which was calculated by means of H and I^2 indices. The I^2 index represents the percentage of total heterogeneity across studies based on true between-study differences rather than on chance. I^2 values over 75% might represent substantial/considerable heterogeneity.[19] In order to identify the possible sources of substantial heterogeneity, subgroup analysis was conducted for each of the components of KAP by age group, gender, educational level, employment status, income level of the country, continent and study period.[20] The income level of each country was classified as low income, lower middle income, upper middle income or high income, according to the World Bank.[21] A comparison of China versus other countries was done because China was the epicentre of COVID-19, and was the first country to introduce the preventive measures and strict laws. Hence, we wanted to analyse if this difference in timeline would have an effect on its people's KAP in comparison with other countries. Egger's regression test was used to examine for publication bias, and the symmetry of the funnel plots was evaluated.[22] Sensitivity analyses were performed using quality score categories of the included studies. Furthermore, correlation analysis among the components of KAP was also performed to evaluate the strength and direction of correlation (denoted by r) between knowledge and attitude, attitude and practice, and knowledge and practice.

Patient and public involvement

There was no patient or public involvement in this systematic review of published literature.
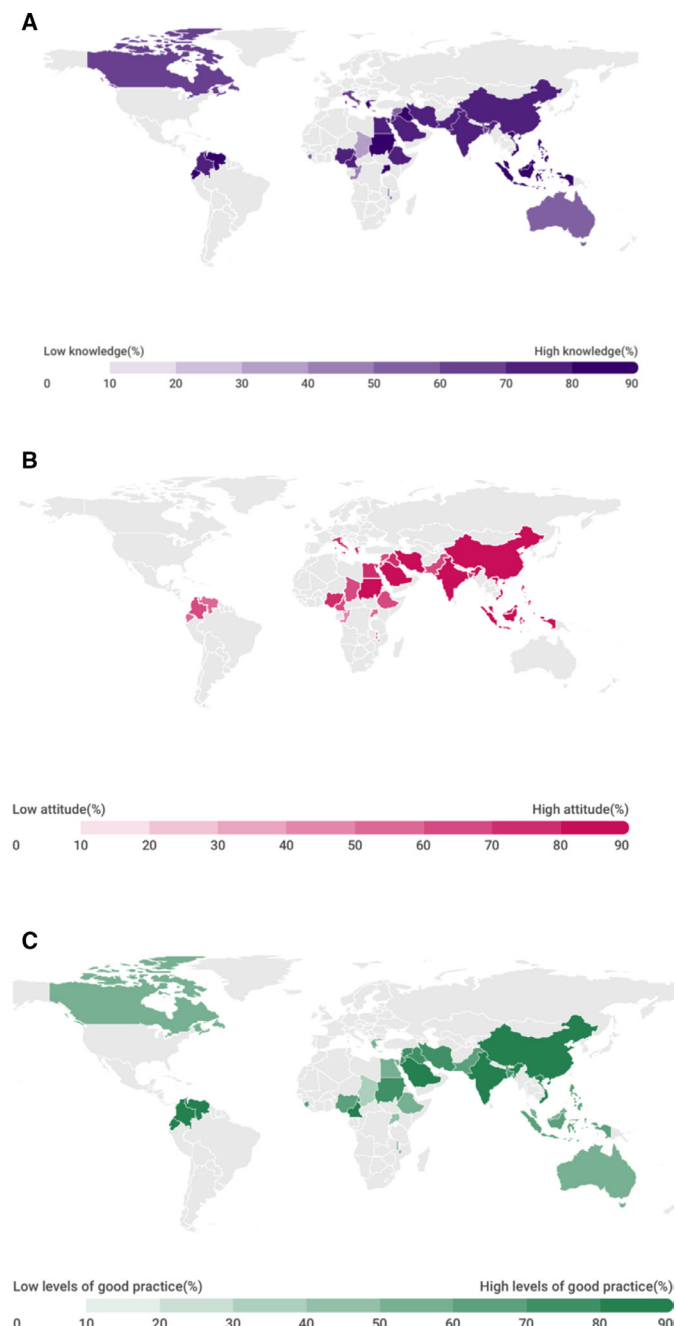
RESULTS

A total of 3099 articles, published between 1 January 2020 and 30 June 2021, were retrieved from the four databases and manual searches. After removing duplicate records and screening by titles and abstracts, 126 articles were included for full-text reading. Of these, 42 articles were excluded by the exclusion criteria. Finally, 84 studies from 45 countries or territories, reporting 215 731 participants' KAP towards COVID-19, were included in the qualitative and quantitative analyses.[11 23–105] Of them, 66 were

cross-sectional online surveys, 12 were community-based surveys, 5 were both community-based and online surveys and 1 was a hospital-based cross-sectional study. Based on the NHLBI quality assessment tool, 17 studies were of good quality, 44 were of fair quality and the remaining 23 were of poor quality. Online supplemental table 5 summarises the study features and the characteristics of the participants. The age of the study participants ranged from 16 to 75 years, and 41.7% were male. In the context of participants' education, 23.8% had up to secondary-level education and 74.3% had university-level education. About 48.7% of participants were employed, 15.2% were unemployed, 14.3% were students and 3.5% were retired. In terms of country income level, 18% of the studies (n=32 617) were from high-income countries, 30% (n=63 545) were from upper middle-income countries, 32% (n=33 360) were from lower middle-income countries and 20% (n=13 293) were from low-income countries.

Figure 2 represents the pooled proportion of people who had answered correctly in their knowledge questions, had positive attitude and good practice techniques. The findings demonstrated that 75% of the present study population answered the knowledge question correctly (95% CI 72% to 77%, p<0.001, I^2=99.55%), 74% had positive attitude towards COVID-19 (95% CI 71% to 77%, p<0.001, I^2=99.58%) and 70% followed good COVID-19 practice techniques (95% CI 66% to 74%, p<0.001, I^2=99.69%). High heterogeneity was observed (I^2 >99%), with the presence of publication bias (Egger's regression test, p<0.01). Correlation analysis among the components of KAP was also performed and is presented in online supplemental figure 1. Very weak and insignificant correlation of knowledge with attitude was observed. However, practice had a significant positive correlation with both knowledge (r=0.314, p=0.006) and attitude (r=0.348, p=0.004). Furthermore, practice measures pertaining to COVID-19 did not correlate with time since the emergence of this pandemic. Prevalence of each component of KAP by countries has been presented in figure 3.

Online supplemental table 6 presents the subgroup analysis results by age group, gender, educational level, employment status, country income level, study period and continents. Respondents aged 30 years and above had relatively higher knowledge (80%, 95% CI 75% to 85% vs 78%, 95% CI 74% to 83%), attitude (73%, 95% CI 65% to 81% vs 68%, 95% CI 59% to 78%) and practice (82%, 95% CI 74% to 90% vs 80%, 95% CI 72% to 88%) compared with those aged below 30. However, the difference was not significant as the respective CIs overlapped. There were no significant differences between male and female participants regarding KAP; however, practice scores were slightly lower among male participants (75%, 95% CI 69% to 80%) than females (77%, 95% CI 72% to 82%). Participants with 12 years of education or less had non-significant lower knowledge and practice than, but similar attitudes to, those with above 12 years of education. There was no significant difference between

Figure 2 Pooled proportion of (A) knowledge, (B) attitude and (C) practice of COVID-19. REML-Restricted Maximum Likelihood

employed and unemployed participants when compared by each component of KAP. Knowledge score ranged from 72% (95% CI 63% to 80%) for low-income countries to 79% (95% CI 75% to 83%) for upper middle-income countries. There was no progressive increase or decrease in attitude and practice scores by income level. However, low-income countries had the lowest attitude score (69%, 95% CI 62% to 76%) and that was the highest for upper middle-income countries (78%, 95% CI 72% to 84%). In the context of practising scores, low-income countries had the lowest (55%, 95% CI 46% to 64%), and the highest came from the upper middle-income countries (77%, 95% CI 70% to 84%) and the difference was statistically significant. Analysis by continent showed non-significant differences. However, Americas had the highest knowledge score (79%, 95% CI 74% to 83%) and that was the lowest in Europe/Oceania (67%, 95% CI 54% to 80%). Attitude scores were highest in Middle East (79%, 95% CI 72% to 85%) and lowest in Americas (66%, 95% CI 56% to 77%). Asia had the non-significant highest practice score (76%, 95% CI 71% to 81%) as compared with other continents. Further subgroup analysis was done by time of data collection (study period) into 3 months' interval (January to March 2020, April to June 2020, July to October 2020). There was no significant increase or decrease in knowledge and practice over time. However, positive attitude towards COVID-19 had been decreased significantly over the time (January to March 2020: 80%, 95% CI 74% to 86%; April to June 2020: 73%, 95% CI 68% to 77%; July to October 2020: 65%, 95% CI 57% to 73%). Heterogeneity was high (I^2 >98%) across all

subgroup analyses (except for Europe/Oceania for attitude and practice where the heterogeneity was 0.29% and 0.28%, respectively), and publication bias was present in most of the studies.

The analyses comparing KAP between studies from China versus other counties are illustrated in online supplemental figure 2. The KAP scores across five studies from China (n=10 482) reported an overall higher prevalence of each component of KAP of 79% (95% CI 67% to 92%), 92% (95% CI 86% to 97%) and 85% (95% CI 74% to 96%) as compared with studies from other countries of 74% (95% CI 71% to 77%), 72% (95% CI 69% to 76%) and 69% (95% CI 65% to 73%), respectively, which showed statistical significance for attitude and practice. Sensitivity analyses were performed by quality of the studies, as presented in online supplemental figure 3; however, high heterogeneity and presence of publication bias still existed.

Further analysis was also done on some important individual questions regarding KAP towards COVID-19, as illustrated in online supplemental table 7. Of all participants, 85% and 81% had correct knowledge on 'main symptoms' (reported by 61 studies) and 'population at risk' (reported by 46 studies) of COVID-19, respectively, while 83% (reported by 58 studies) and 75% (reported by 39 studies) of respondents were aware of 'route of transmission' and spread of infection by asymptomatic patients, respectively. Knowledge regarding avoidance of crowded places as a preventive measure was reported by 27 studies, with overall correct knowledge of 95%. Correct knowledge about 'isolation and treatment of

Figure 3 Geographical representation of (A) knowledge, (B) attitude and (C) practice during the COVID-19 pandemic.

patients' (reported by 32 studies) and 'quarantine or incubation period' (reported by 44 studies) of COVID-19 was observed among 91% and 87% of the study participants, respectively. However, only 70% of the participants, reported in 35 studies, had correct knowledge about 'wearing a face mask' as a preventive measure.

Positive attitude towards 'successful control of COVID-19' (reported by 22 studies) and 'social distance' (reported by 11 studies) was reported by 71% and 88% of the study participants, respectively.

Practising hand hygiene through 'proper hand washing or using hand sanitiser' was reported by 80% of the participants in 49 studies; 70% of the study participants

(reported by 32 studies) maintained social distance, and 75% (reported by 45 studies) avoided crowded places or social events to prevent the spread of infection. Unexpectedly, only 65% of the participants (reported by 56 studies) were practising the wearing of face masks while going out. High heterogeneity was observed in all these subgroup analyses, and presence of publication bias was observed in most.

DISCUSSION

This is a large international systematic review and meta-analysis that has examined the KAP of the general population on the novel COVID-19. Data were compiled from 215 731 participants from 84 studies of 45 countries, covering all continents. The study demonstrated a pooled score of ≥70% in each of the three components of KAP. The overall practice of preventive measures was low in the low-income countries, in Africa and Europe/Oceania, and among men, employed people and people aged 30 and above. There was a positive correlation between the components of KAP.

The estimated overall correct answers for knowledge, good attitude and good practice techniques in this review were 75%, 74% and 70%, respectively. A study from H1N1 influenza A reported a lower knowledge (60%) and similar attitude (74.5%), but higher practice (77.3%) scores, compared with current study.[106] Studies from SARS-CoV in 2003 reported a knowledge score of 52.4%–67.4% on symptoms among the general population compared with 85% in our study.[107] Furthermore, a study from Saudi Arabia on Middle East respiratory syndrome (MERS) reported study participants' fair knowledge on symptoms (79.8%) and transmissions (90.6%), and their practice on 'washing hands frequently' (94%) and 'using face masks' (74.9%),[108] which were higher than those in the current study. This could be due to high-risk perception and their longer experience with MERS (as the study was conducted 2 years after the first appearance of MERS-CoV).

Subgroup analysis showed that overall knowledge score was low in the low and high-income countries, in Europe/Oceania, among participants with 12 years or less education and unemployed people, and attitude score was low in Africa, Americas and low-income countries. Low practice score was observed in Africa, Americas, Europe/Oceania, the low-income countries, and among males, employed people, people aged below 30 years and participants with 12 years of education or less. A meta-analysis conducted among general population to see 'the association between gender and protective behaviours in response to respiratory epidemics and pandemics' revealed that females are about 50% more likely than males to adopt or practise preventive behaviours (eg, hand washing, face mask use, avoidance of public transport).[109] Educational attainment may also have a direct effect on knowledge and consequently on practices as people with less education are less likely to adopt preventive measures. Population density,

living conditions, livelihood and affordability could be the reasons behind low practices in the low-income countries. Moreover, due to existing health inequalities in low-income and lower middle-income countries and in socially disadvantaged groups, pandemics generally have their greatest effects on these populations.[5] During the 1918 'Spanish' influenza pandemic and in the 2009 H1N1 influenza pandemic, racial minority/minority groups were most affected.[110 111] However, literature supports that during COVID-19 pandemic, more cases and deaths have been reported from high-income and upper middle-income countries.[5] These differences may be related to timing of transmission, countries' response patterns, availability and accuracy of tests, sociodemographic condition, countries' environmental factors and connectivity and trade patterns.

Analysis by study period showed no progressive increase or decrease in knowledge over time; however, the positive attitude towards COVID-19 had been decreased significantly over time (January 2020 to October 2020). A major reason for this may be attributed to pandemic fatigue where the prolonging timeline of the pandemic makes it harder to follow the COVID-19 prevention guidelines. Besides, a decrease in perceived susceptibility and perceived severity may further deteriorate the positive attitude towards the pandemic.[112] The practice of COVID-19 prevention measures also did not increase since the emergence of this pandemic in early 2020, which may be partly reflected from the multiple spikes of COVID-19 spread in many countries across the world. This may be due to lack of understanding of the severity of the disease or true risk, low perceived risk of acquiring infection and perceived efficacy of the preventive measures.

Further subgroup analysis showed that overall KAP scores were higher (79%, 92% and 85%, respectively) in the studies from China, the early COVID-19 epicentre, compared with studies from other countries (74%, 72% and 69%, respectively). This could be due to highly educated study participants in the study from Wuhan (over 80% had associate degrees or higher), overwhelming news by the media and public health authorities, their experience with previous SARS outbreak and strict actions taken by the local government to control the infection immediately after the outbreak.

In this current study, the overall score of knowledge regarding individual questions about main symptoms, population at risk, route of transmission of COVID-19, isolation and treatment of infected people and quarantine time was higher than 80%; however, overall, 75% and 70% of respondents had knowledge of asymptomatic patients and the use of face masks as preventive measures, respectively. There were significant differences between knowledge and actual practices, and attitude and practices—specifically, avoidance of crowded places and maintaining social distance. Though 95% of participants had the knowledge of avoidance of crowded places to prevent the infection, only 75% of them were practising it. On the other hand, 88% of participants had a positive

attitude to maintain social distance, only 70% of them were practising it. This difference could be due to lack of understanding of the preventive measures, the rationales for their use and their impact on health, and due to population density and livelihood. Studies from H1N1 influenza A reported correct knowledge on symptoms (68.1%–76%), route of transmission (56.3%–75.6%), use of face mask (36.6%–70.4%), and practice of frequent hand washing (54.6%–56.9%) and avoidance of crowded places (42.9%–52.6%), which were lower than those in this current study.[113–115] This could be due to low educational level (nearly 50% of study participants had below primary/middle school education), lack of perceived risk of spread of the disease and lack of perceived efficacy of various preventive measures among the H1N1 study participants.

A correlation analysis conducted in this study showed a positive relationship between components of KAP. Literature supports correlation between KAP in relation to health issues, which supports this study findings.[116]

A wide heterogeneity was observed in the reported prevalence of each component of KAP, with ranges of 35%–95%, 42%–96% and 27%–97%, respectively. This was partly explained by the sociodemographic and cultural differences and political influence, and partly by the differences in the questionnaire contents, measurement and scoring systems. The majority of the studies were online surveys, and literature supports that gender, age and education influence online survey behaviour.[27] Internet and social media are today's important online health information resources, hence their users may have gained more information than underprivileged population. Differences in the time and actions taken by the government, trust in the governing institutions and experience in management of previous outbreaks may have influenced the attitude of the participants.[27 34 45 70] Mixed messages about the use of face masks in public places, scarcity and affordability of face masks, cultural norms to shake hands and going to social, family or religious gatherings, continuity of water supply and hand washing facilities and living conditions may have contributed to adopt the preventive practices against COVID-19 infection.[33 46 52 117]

This systematic review has several strengths and limitations. First, because of the challenges in conducting research during the pandemic, most of the studies were online surveys and covered major cities of the respected countries. Therefore, vulnerable population particularly income-poor people and urban slum dwellers, and people living in remote rural areas who did not have internet access may have missed out. Second, heterogeneity was high in the evaluated outcomes. Although a range of subgroup analyses have been performed, the sources of heterogeneity could not be identified. Third, articles published in other than English were excluded, which may have resulted in the exclusion of some studies. Despite these limitations, to our knowledge, this is the first systematic review and meta-analysis on KAP of COVID-19

among global general population. Furthermore, the study identified a large number of studies and participants, covering all continents of the world, and provided meaningful data on the KAP of COVID-19 in the general population.

CONCLUSION

The overall KAP pertaining to COVID-19 in the general population in this study was 75%, 74% and 70%, respectively. Low practice score was observed in Africa and Europe/Oceania, in low-income countries, and among men, employed, aged below 30 years, and participants with 12 years of education or less. These data suggest targeted group intervention to reinforce knowledge giving attention to efficacy of each of the preventive measures, which will translate into good practice. Additional studies covering heterogeneous population are also needed.

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