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A systematic review of the knowledge, attitudes, and practices of physicians, health workers, and the general population about Coronavirus disease 2019 (COVID-19)

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1 **A systematic review of the knowledge, attitudes, and practices of physicians, health**
2 **workers, and the general population about Coronavirus disease 2019 (COVID-19)**

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27 **workers, and the general population about Coronavirus disease 2019 (COVID-19)**

28 **Abstract**

29 **Background:** Understanding people, physicians, and healthcare workers' knowledge, attitude,
30 and practices (KAPs) can help to achieve the outcomes of planned behavior. The aim of this
31 study was to investigate and synthesize the current evidence on KAPs regarding COVID-19.

32 **Methods:** We conducted a systematic search on PubMed/LitCovid, Scopus, and Web of
33 Sciences databases for papers in the English language only, up to 1 Jul 2020. We used the Joanna
34 Briggs Institute (JBI) checklist developed for cross-sectional studies to appraise the quality of the
35 included studies. All stages of the review conducted by two independent reviewers and potential
36 discrepancies solved with a consultation with a third reviewer. We reported the result as number
37 and percentage. PROSPERO registration code: (CRD42020186755).

38 **Results:** Fifty-two studies encompassing 49786 participants were included in this review.
39 45.76% of the participants were male. The mean age of the participants was 32.6 years. 44.2% of
40 the included studies were scored as good quality, 46.2% as fair quality, and remaining (9.6%) as
41 low quality. 30.76% examined all three components of the KAPs model. The knowledge
42 component was reported as good, fair, and poor in 59%, 34%, and 7%, respectively. Of the
43 studies that examined the attitude component, 82% reported a positive attitude, 11% a fairly
44 positive attitude, and 7% a negative attitude. For the practice component, 52% reported good
45 practice, 44% fair practice, and 4% poor practice.

46 **Conclusion:** This systematic review showed that the overall KAP components in the included
47 studies were at an acceptable level. In general, knowledge was at a good level, the attitude was

48 positive and practice was at a fairly good level. Using an integrated international system can help
49 better evaluate these components and compare them between countries.

50 **Keywords**

51 COVID-19; Knowledge; Attitude; Practice; Systematic review

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66 **Introduction**

67 Coronavirus disease 2019 (COVID-19) was reported on 31st December 2019 from Wuhan,
68 China, and announced by the World Health Organization (WHO) as a pandemic on 11th March
69 2020 [1, 2]. To date, it was estimated that about 30 million people were infected with COVID-19
70 worldwide, of which about one million have died [3].

71 COVID-19 is characterized by a number of flu-like symptoms including fever, respiratory
72 problems (dry cough, shortness of breath or difficulty breathing, sore throat), chills, headache,
73 and loss of taste. Also, this disease is much more severe with men, higher age groups, and
74 patients with other pre-existing conditions, such as cardiovascular disease, chronic respiratory
75 disease, diabetes, and hypertension [4, 5]. Based on existing evidence, about 81% of COVID-19
76 cases is mild, 14% are severe and 5 % is critical. The median time from symptoms onset to
77 clinical recovery is approximately two weeks for mild cases and three to six weeks for severe or
78 critical cases [6]. The incubation period for this disease was reported as 2-14 days based on
79 WHO reports. The mortality rate for this disease is different among countries and was reported
80 between two% and 5% [7, 8]. The most important ways to prevent this disease are to use a mask
81 and maintain social distance [9-11]. So far, there have been several cases of infection in the
82 general public, especially doctors and medical staff, some of which have led to death [12-14].

83 Considering the extent and progress of COVID-19 disease and its major effects on economic,
84 social, political, and cultural dimensions of all countries [15, 16], it is essential that people with
85 COVID-19 are provoked, informed, and engaged in all aspect of the disease. From the onset of
86 the disease until now, various studies conducted worldwide have investigated on this disease and
87 some of these studies have examined the knowledge, attitudes, and practices (KAPs) of people

88 with COVID-19. Having enough knowledge about a disease can always affect people's attitudes
89 and practices, and on the other hand, improper attitudes and practices can increase the risk of
90 disease and death. Therefore, understanding people, physicians, and healthcare workers' KAPs
91 and knowing potential risk factors can help to achieve the outcomes of planned behavior [17,
92 18].

93 Given the importance of the issue, conducting a review of studies that have examined the KAPs
94 of individuals and summarizing the results can provide solid evidence for decision-makers in all
95 countries to better manage the disease. Thus, this study aimed at conducting a systematic review
96 to synthesize current evidence on KAPs of people with COVID-19 worldwide.

97 **Materials and Methods**

98 **Protocol and registration**

99 We conducted a systematic review of the existing evidence related to KAPs of COVID-19
100 patients worldwide following Preferred Reporting Items for Systematic Reviews and Meta-
101 analyses (PRISMA) statements (Appendix Supplementary file 1) [19]. We also registered a
102 protocol for this systematic review in the International Prospective Register of Systematic
103 Reviews [20] (CRD42020186755).

104 **Eligibility criteria**

105 We included all studies which met the following inclusion criteria: 1) cross-sectional survey; 2)
106 investigate at least one component of the KAPs model regarding COVID-19 patients worldwide;
107 3) published, in-press or preprint original paper; 4) in English; 5) with a sample of the general
108 population, physicians or other healthcare workers. No restrictions were applied to the setting,
109 time, or quality of the study.

110 **Information sources, search and study selection**

111 We search the PubMed/LitCovid, Scopus, and Web of Sciences for papers in the English
112 language only, up to 1 Jul 2020 (MA-Z). We also conducted a search in Google Scholar for
113 retrieving studies that were not cited in the above-mentioned databases. In addition, the reference
114 lists to final articles were hand-searched. The keywords used in the search were: attitude,
115 knowledge, practice, awareness, perception, action, COVID-19, coronavirus disease, SARS-
116 CoV-2, and severe acute respiratory syndrome coronavirus 2. The full search strategy for the
117 Scopus database is provided in Appendix Supplementary file 2. When the search was complete,
118 all records were transferred to the Endnote software (V. X8; Clarivate Analytics, Philadelphia,
119 PA) and duplicates were removed. Then, studies based on the title, abstract, and full text were
120 screened by two researchers independently by considering the pre-specified eligibility criteria
121 (MM and SS). Disagreements were solved through consultation with a third researcher (MA-Z).

122 **Data collection process and data item**

123 Two researchers independently engaged in the data collection process and extracted data
124 including author, year, journal name, location, study design, data collection tools, sample size,
125 focusing group, mean age or range, gender percent, and result related to KAPs model
126 components (MM and SS). Potential disagreements were solved through consultation with a
127 third researcher (MA-Z).

128 **Quality appraisal**

129 Included studies were critically appraised by two researchers independently (MM and SS). We
130 used the Joanna Briggs Institute (JBI) checklist developed for cross-sectional studies to appraise
131 the quality of the included studies [21]. This checklist contains eight simple and clear questions

132 that cover topics such as inclusion criteria for sample; details about study subjects and setting;
133 validity and reliability; criteria for measurement of the condition; confounding variables; and
134 statistical analysis [22]. The answer to each questions is yes, no, unclear, and not applicable.
135 Potential discrepancies were resolved by consultation with a third researcher (SH).

136 **Synthesis of results**

137 Due to potential heterogeneity between included studies the meta-analysis was not conducted.
138 Therefore we carried out the descriptive analysis in most sections and report the pooled data as
139 number or percentage for similar data items. We used Microsoft Excel software to design the
140 charts. Also, we report the result of the included studies in a narrative manner.

141 **Results**

142 **Study selection**

143 A total of 4829 records were retrieved from our database search. After removing duplicate, 3085
144 records were screened by title, abstract, and full-text based on eligibility criteria, of which fifty-
145 two studies were included in the final review [23-74]. The PRISMA flow diagram for the
146 complete study selection process is presented in Fig 1.

147 Figure 1: PRISMA flow diagram

148 **Study characteristics**

149 Fifty-two studies encompassing 49786 participants were included. Also, 45.76% of the
150 participants were male. The mean age of the participants was 32.6 years. Most studies were from
151 Asia, Africa, South America, Europe, and multinational, respectively (Fig 2A). The most
152 important method of data collection was online questionnaires (Fig 2B). Focusing groups were

153 diverse between the studies and included health care workers, students, general population, adult
 154 population, patients groups, residents, and pregnant women (Fig 2C). Most studies examined all
 155 three components of the KAPs model, but some studies examined two components or one
 156 component. More details about the characteristics of included studies are presented in Table 1.
 157 Figure 2: The percentage of the included studies based on location (A), data collection methods
 158 (B), and focusing group (C).

159 Table 1: Summary characteristics of the included studies

Reference (Author, Year)	Journal	Location	Study Design	Data Collection tool	Sample Size	Focusing Group	Male (%)	Mean Age or range
Abdelhafiz et al, 2020 [23]	Journal of community health	Egypt	Cross-Sectional	Online questionnaire/Google Form	384	Egyptian Adults	37.7	18-60+
Al Nsour et al, 2020 [24]	JMIR Medical Education/preprints	Jordan, Sudan, and Yemen	Cross-Sectional	Online Questionnaire/Email	57	Epidemiology Training Program graduates	70	39.2
Alhaj et al, 2020 [25]	World neurosurgery	Multinational	Cross-Sectional	Questionnaire/on site	52	Neurosurgery Residents	73.1	NR*
Khan et al, 2020 [46]	Ophthalmology retina	USA	Cross-Sectional	Online questionnaire/SurveyMonkey	87	Ophthalmology Trainees	NR	NR
Alzoubi et al, 2020 [26]	Journal of pure and applied microbiology	Jordan	Cross-Sectional	Online self-administered questionnaire/Facebook	592	Undergraduate Students	34.5	NR
Escalera-Antezana et al, 2020 [36]	Travel medicine and infectious disease	Bolivia and Colombia	Cross-Sectional	Questionnaire/On site, before lockdowns; and online, thereafter	1165	Healthcare workers and students	61.9	33.5
Apajitt and Wiwanitkit 2020 [27]	Infection control & hospital epidemiology	Thailand	NR	Questionnaire/on site	124	Medical Personnel	33.87	36.7
Azlan et al, 2020 [28]	PLOS one	Malaysia	Cross-Sectional	Online questionnaire/Survey Monkey	4850	General population	42.1	34
Basheti et al, 2020 [29]	Research in social and administrative pharmacy	Jordan	Cross-Sectional	Online questionnaire / Facebook and WhatsApp	726	Pharmacists and Pharmacy Students	28.1	26.9
Bhagavathula et al, 2020 [30]	JIMIR public health and surveillance	Multinational	Cross-Sectional	Web-Based questionnaire/Telegram	529	Health Care Workers	51.6	25-34

Bragazzi et al, 2020 [31]	Dermatologic therapy	Italy	Cross-Sectional	Questionnaire/on site	98	Dermatological Patients	52	44.36
Cai et al, 2020 [32]	Laryngoscope	USA	Cross-Sectional Survey	Online questionnaire/Qualtrics survey platform	82	Otolaryngology Residents	NR	NR
Chesser et al, 2020 [33]	Health education & behavior	USA	Survey	Questionnaire/E mail	1136	University Students	30	27
Clements, 2020 [34]	JMIR public health and surveillance	USA	Cross-Sectional	Online questionnaire/MTurk platform	1034	U.S. Residents	58.2	37.11
Galle et al, 2020 [37]	International journal of environmental research and public health	Italy	Survey	Web-based questionnaire	2125	Undergraduate Students	37.2	22.5
Geldsetzer et al, 2020 [38]	Journal of medical internet research	USA and UK	Cross-Sectional	Online questionnaire / Prolific platform	5974	Adults	US=49.1 UK=48.8	18-58+
Giao et al, 2020 [39]	Asian pacific journal of tropical medicine	Vietnam	Cross-Sectional	Self-Administered Questionnaire/on site	327	Health Care Workers	26	30.1
Liu et al, 2020 [50]	Brain, behavior, and immunity	China	Cross-Sectional	Self-Administered Questionnaire/on site	118	Patients with COVID-19	52	41
Kamate et al, 2020 [42]	Dental and medical problems	Multinational	Survey	Online Questionnaire/Google forms	860	Dental Practitioners	NR	NR
Karasneh et al, 2020 [43]	Research in social and administrative pharmacy	Jordan	Cross-Sectional	Web-Based self-reported questionnaire/social media	486	Pharmacists	21.4	28.1
Kebede et al, 2020 [44]	Plos one	Ethiopia	Cross-Sectional	Questionnaire/on site	247	Medical Center Visitors	76.5	30.5
Erbas et al, 2020 [35]	Sao Paulo medical journal	Turkey	Cross-Sectional	Online questionnaire/Survey Monkey	248	Intensive care physicians	49.1	37.2
Lau et al, 2020 [49]	Journal of global health	Philippines	Cross-Sectional	Online questionnaire/SurveyCTO platform	2224	Income-poor households	7.3	41.3
Abdel Wahed et al, 2020 [70]	Journal of Community Health	Egypt	Cross-Sectional	Online questionnaire/Google Forms /Facebook and WhatsApp	407	Health Care Workers	50.6	34.9
Sari et al, 2020 [65]	Journal of Community Health	Indonesia	Cross-Sectional	Online questionnaire/Google Forms /WhatsApp	201	General population	46.3	35.5
Khasawneh et	Frontiers in	Jordan	Cross-	Online	1404	Medical	40.5	NR

al, 2020 [47]	public health		Sectional	questionnaire/ Google Forms		students		
Khader et al, 2020 [45]	JMIR public health and surveillance	Jordan	Cross-Sectional	Online questionnaire/ Google Forms	368	Dentists	33.4	32.9
Kumar et al, 2020 [48]	Cureus	Pakistan	Cross-Sectional	Semi-structured questionnaire/ on site	392	Health Care Workers	86.98	42.37
McFadde et al, 2020 [51]	PLOS ONE	US	Survey	Online questionnaire/ Qualtrics	718	Adult population	49	18-55+
Modi et al, 2020 [52]	Cureus	India	Survey	Online questionnaire	1562	Health and Students, Allied Health Professionals	24.1	18-45+
Moro et al, 2020 [53]	Acta Biomedica	Italy	Survey	Online questionnaire/ SurveyMonkey	2046	Hospital staff	NR	NR
Olapegba et al, 2020 [55]	Data in brief	Nigeria	Survey	Online questionnaire	1357	General population	58	26.85
Olum et al, 2020 [56]	Frontiers in Public Health	Uganda	Cross sectional	Online questionnaire/ Google Forms	581	Health Care Workers	87	34
Parikh et al, 2020 [57]	Cureus	India	Cross-sectional	Online questionnaire/ social media platforms	1246	General public, healthcare professionals	52.40	30.60
Ricco et al, 2020 [60]	Acta Biomedica	Italy	cross-sectional	Online questionnaire/ Google Forms	561	Medical workforce	42.6	NR
Roy et al, 2020 [61]	Asian Journal of Psychiatry	India	Cross-sectional	Online questionnaire/ Google Forms	662	General population	48.6	29.9
Sahraian et al, 2020 [62]	Multiple Sclerosis and Related Disorders	Iran	Cross-sectional	Online questionnaire/ Google Forms	233	Multiple Sclerosis patients	22.7	34.2
Salman et al, 2020 [63]	Drugs & Therapy Perspectives	Pakistan	Cross-sectional	Self-administered questionnaire/ on site	417	Students and employees at two higher educational institutions	41.2	22.6
Saqlain et al, 2020 [64]	The journal of Hospital Infection	Pakistan	Cross-sectional	Online questionnaire/ Google Forms	414	Healthcare professionals	50.5	NR
Shi et al, 2020 [66]	Brain, Behavior and Immunity	China	Cross-sectional	Online questionnaire	311	Medical staff in psychiatric hospitals	48.2	33.7
Singh et al, 2020 [67]	Journal of Community Health	Nepal	cross-sectional	Online questionnaire	871	Nepalese adults	40.4	26.4
Siniscalchi et al, 2020 [68]	Digestive and Liver Disease	Italy	cross-sectional	E-mail	276	Celiac adult patients	24.3	39
Taghrir et al, 2020 [69]	IRANIAN MEDICINE	Iran	cross-sectional	Online	240	Medical Students	40.8	23.6

				questionnaire				
Nwafor et al, 2020 [54]	Gynecology Obstetrics	Nigeria	cross-sectional	Self-administered questionnaire	284	Pregnant women	NR	<30->40
Wolf et al, 2020 [71]	Annals of Internal Medicine	USA	Cross-sectional	Telephone	630	Adults aged	40.3	23 - 88
Yassa et al, 2020 [72]	Maternal-fetal & neonatal medicine	Turkey	cross-sectional	Telephone	172	Pregnant women	NR	27.5
Zhang et al, 2020 [73]	Journal of Hospital Infection	China	cross-sectional	NR	1357	Healthcare workers	53.4	NR
Zhong et al, 2020 [74]	International Journal of Biological Sciences	China	cross-sectional	Online questionnaire	6910	Residents	34.3	16-50≤
Reuben et al, 2020 [59]	Journal of Community Health	Nigeria	Cross-sectional	Online questionnaire	589	Residents	59.6	18-50
Jemal et al, 2020 [40]	Research Square	Ethiopia	Cross-sectional	Structured questionnaire/on site	422	Healthcare workers	56.7	29.28
Raza et al, 2020 [58]	International Journal of Homeopathy Complementary and Alternative Medicine	Pakistan	Cross-sectional	Questionnaire/on site	150	Patients	36	12-75
Kakemam et al, 2020 [41]	Pre-print MedRxiv	Iran	Cross-sectional	Online questionnaire/Portline/Social media	1480	General population	42.8	31.2

160 *NR: not reported

161 Quality appraisal

162 The overall mean quality score of the included studies was 4.90. Of the included studies, 23
 163 studies (44.2%) were scored as good quality (score ≥ 6), 24 (46.2%) as fair quality (score 3-5),
 164 and remaining (9.6%) as low quality (score < 3) (Fig 3). The lowest and highest quality scores in
 165 the studies were two and six, respectively. None of the studies scored on questions 5 and 6,
 166 which were related to identification and deal with confounding variables in the studies (for more
 167 details about items see Appendix Supplementary file 3.

168 Figure 3: The percentage of included studies based on quality score

169 **Synthesis of results**

170 Among the included studies, 30.76% examined all three components of the KAPs model
 171 simultaneously. The most studied component in the studies was the knowledge component with
 172 about 84.61%, followed by attitude and practice with 53.84% and 44.23%, respectively. Also,
 173 34.61% and 17.3% of the articles have examined other components including perception and
 174 awareness, respectively (Table 2, Fig 4).

175 Figure 4: The number of investigated components in the included studies

176 Of the studies that examined the knowledge component, 59% reported good knowledge, 34%
 177 fair knowledge, and 7% poor knowledge. As well as, of the studies that examined the attitude
 178 component, 82% reported a positive attitude, 11% a fairly positive attitude, and 7% a negative
 179 attitude. For the practice component, 44% reported good practice, 52% fair practice, and 4%
 180 poor practice. Also, 39% of the perception component reported a high level of perception and for
 181 the awareness component, 44% reported good awareness (Table 2, Fig 5).

182 Figure 5: The percentage of studies based on the knowledge (K), attitudes (A), and practices (P)

183 Table 2: Results related to Coronavirus- related KAPs components of the included studies

Reference (Author, Year)	KAPs components			Other components	
	Level of Knowledge	Level of Attitudes	Level of Practices	Level of Perception	Level of Awareness
Abdelhafiz et al, 2020 [23]	Good	Positive	NA*	Moderate	NA
Al Nsour et al, 2020 [24]	NA	NA	NA	NA	Good
Alhaj et al, 2020 [25]	Good	NA	NA	NA	NA
Khan et al, 2020 [46]	NA	NA	NA	High	NA
Alzoubi et al, 2020 [26]	Good	Positive	Good	NA	NA
Escalera-Antezana et al, 2020 [36]	Good	NA	NA	NA	NA
Apaijitt and Wiwanitkit 2020 [27]	Fair	NA	NA	NA	NA
Azlan et al, 2020 [28]	Good	Positive	Fair	NA	NA
Basheti et al, 2020 [29]	NA	NA	NA	Moderate	Fair
Bhagavathula et al, 2020 [30]	Poor	NA	NA	High	NA
Bragazzi et al, 2020 [31]	Fair	Fairly positive	NA	NA	NA

Cai et al, 2020 [32]	NA	NA	Good	High	NA
Chesser et al, 2020 [33]	Fair	NA	NA	NA	NA
Clements, 2020 [34]	Good	NA	Fair	NA	NA
Galle et al, 2020 [37]	Good	NA	Fair	NA	Good
Geldsetzer et al, 2020 [38]	Good	NA	NA	Low	NA
Giao et al, 2020 [39]	Good	Positive	NA	NA	NA
Liu et al, 2020 [50]	Poor	NA	NA	Low	NA
Kamate et al, 2020 [42]	Good	Positive	Good	NA	NA
Karasneh et al, 2020 [43]	Fair	NA	NA	High	Fair
Kebede et al, 2020 [44]	Fair	NA	Fair	Moderate	NA
Erbas et al, 2020 [35]	Fair	Fairly positive	NA	NA	NA
Lau et al, 2020 [49]	Good	Positive	Good	NA	NA
Abdel Wahed et al, 2020 [70]	Good	Positive	NA	High	NA
Sari et al, 2020 [65]	Good	Positive	NA	NA	NA
Khasawneh et al, 2020 [47]	Good	Positive	Good	NA	NA
Khader et al, 2020 [45]	NA	Good	NA	Moderate	Good
Kumar et al, 2020 [48]	Poor	Positive	Fair	NA	NA
McFadde et al, 2020 [51]	NA	NA	NA	Low	NA
Modi et al, 2020 [52]	NA	NA	NA	NA	Fair
Moro et al, 2020 [53]	Fair	Positive	NA	NA	NA
Olapegba et al, 2020 [55]	Fair	NA	Fair	Moderate	NA
Olum et al, 2020 [56]	Fair	Negative	Good	NA	NA
Parikh et al, 2020 [57]	Good	NA	NA	High	NA
Ricco et al, 2020 [60]	Fair	Negative	NA	NA	Fair
Roy et al, 2020 [61]	Fair	Positive	NA	NA	Good
Sahraian et al, 2020 [62]	Good	NA	NA	NA	NA
Salman et al, 2020 [63]	Fair	Positive	Fair	NA	NA
Saqlain et al, 2020 [64]	Good	Positive	Good	Moderate	NA
Shi et al, 2020 [66]	Good	Positive	NA	NA	NA
Singh et al, 2020 [67]	Good	NA	NA	High	NA
Siniscalchi et al, 2020 [68]	NA	NA	NA	Moderate	NA
Taghrir et al, 2020 [69]	Good	NA	Good	Moderate	NA
Nwafor et al, 2020 [54]	Fair	NA	Poor	NA	NA
Wolf et al, 2020 [71]	Fair	Fairly positive	Fair	NA	Fair
Yassa et al, 2020 [72]	Fair	Positive	NA	NA	NA
Zhang et al, 2020 [73]	Good	Positive	Fair	NA	NA
Zhong et al, 2020 [74]	Good	Positive	Good	NA	NA
Reuben et al, 2020 [59]	Good	Positive	Good	NA	NA
Jemal et al, 2020 [40]	Good	Positive	Fair	NA	NA
Raza et al, 2020 [58]	Good	Positive	Fair	NA	NA
Kakemam et al, 2020 [41]	Good	Positive	Fair	NA	NA

184 *NA: not assessed

185 Discussion

186 COVID-19 has had serious, long-term, and sometimes irreparable effects on all aspects of the
 187 daily lives of individuals and society [75, 76]. Getting informed from the knowledge, attitude,

188 and practice of different people can play a vital role in preventing diseases [77, 78], so the study
189 of these components in different communities and between different groups seems necessary.

190 **Strength and weakness**

191 Meta-analysis was not possible due to the different questionnaires and their dimensions, the
192 target group, and study setting, so we reported the results descriptively in the form of tables and
193 figures. Also, a large number of the included studies did not report the validity and reliability of
194 the questionnaires, and therefore, the overall quality of the included studies was moderate. The
195 main reason for this is the rush to publish articles related to coronavirus disease. Also, due to the
196 high volume of articles published in this field, some new articles that may not have been
197 included in this article may have been published during the writing and reviewing process. One
198 of the most important strengths of this study was that all stages of the study were conducted with
199 two researchers and in all stages, in cases of disagreement, the third person and consensus were
200 used. Also, registering the protocol of this study and reviewing and modifying it in the
201 PROSPERO platform is the strength of this study.

202 **Summary of study findings**

203 We found that about 60% of the samples had good knowledge of COVID-19. Also, 82% of the
204 samples were reported positive attitudes regarding COVID-19 and slightly more than 50% of
205 samples performed good practices. About 80% of the studies used an online questionnaire to
206 collect data, and the most used platforms included Google form, SurveyMonkey, and Qualtrics.
207 The most important social media through which the questionnaires were distributed were
208 Facebook, WhatsApp, and Telegram. The most important sources for learning and staying up to

209 date about COVID-19 mentioned in the studies were television, social media, internet, radio, and
210 friend and relatives.

211 The finding of our systematic review demonstrated fairly good knowledge about COVID-19. In
212 most studies, more than 70% of the participants had a good knowledge of issues such as causes,
213 symptoms, ways of transmission, and ways of prevention. Also, the majority of participants had
214 a high level of knowledge about symptoms such as high fever and dry cough, breathing difficulty
215 and a small number had sufficient knowledge about other symptoms such as chills, headache,
216 muscle pain, sore throat, and loss of taste or smell [23, 25, 26, 34, 36-38, 41, 42, 64, 66]. More
217 than 90% of the participants considered air droplets as a way to spread. This good level of
218 knowledge can be due to widespread information through various means such as public media
219 (television and radio), social media, and government announcements. In addition, preparing
220 several guidelines and reports by WHO, CDC and local government in times of outbreak and
221 easy access to them have increased the level of information and knowledge of individuals
222 regarding COVID-19 [79, 80]. On the other hand, factors such as low literacy level, older age,
223 and the presence of the rural population in the samples were among the factors that have reduced
224 the level of knowledge in the studies [23, 27, 31, 33, 71].

225 In this review, participants showed a positive attitude regarding COVID-19. Almost all
226 participants believed in the importance of handwashing, disinfecting surfaces, using masks to
227 prevent the spread of infection, resting at home in the event of symptoms, and maintaining social
228 distance and limited contact. Of course, in some cases, there was a negative belief that it could be
229 due to differences in instructions and guidelines by different institutions, such as what was about
230 wearing a face mask at the beginning of the pandemic, and then it was recommended that the
231 whole population should use a mask [56, 60]. Such cases show the importance of integrated

232 guidelines and the focus of decision-making in times of crisis [81, 82]. Although having a
233 responsible organization can help make better and faster decisions, in such cases, political
234 pressure is exerted by governments that such organizations should put the health of the people at
235 the top and not refuse to make the right decisions due to political pressures [11, 83, 84].

236 In general, the level of practice of the participants in the studies was fair. However, despite the
237 high knowledge and positive attitude of the participants, the level of practices was still
238 sometimes lower than expected. Numerous reasons for a low level of practice have been cited in
239 studies. Lack of availability (for example, masks and disinfectants), imposing financial costs on
240 participants, ambiguity in instructions, not getting used to new conditions such as staying home
241 and wearing a mask, exhaustion from existing conditions, and anxiety and stress of disease were
242 among the causes mentioned in the studies [28, 34, 40, 44, 54, 58, 71]. In this regard, some
243 countries have imposed strict laws and penalties on people who do not follow the guidelines to
244 improve their performance, but in many countries under study, such laws do not exist and have
245 not been applied [85, 86]. Another factor that affects the performance of individuals was the
246 presence of decision-makers in public and social media. Seeing a person without a mask at the
247 height of a pandemic can have a negative impact on a person's good practices.

248 Given the diversity of settings and questionnaires, the authors of this paper recommend that there
249 be a need to design an integrated online system to assess the knowledge, attitudes, and practices
250 of the population about health-related crises. Designing such an integrated system can help better
251 compare countries because integrated items are used for comparison. On the other hand,
252 designing such a system and disseminating its results can accelerate integrated decision-making
253 and improve crisis management. On the other hand, the existence of such an integrated system

254 can lead to an increase in solidarity, which was emphasized by the World Health Organization
255 during the corona pandemic [87, 88].

256 **Limitations**

257 The included studies were from both high and low-income countries and therefore generalization
258 of results to all countries should be done with caution. Also, many of the questionnaires in the
259 studies did not have sufficient validity and reliability or did not report it. Our review study also
260 had some limitations. Due to differences in studies and the use of different questionnaires,
261 conducting a meta-analysis was not possible in this study. We have only reviewed studies
262 published in English. On the other hand, due to the high speed of publication of articles in this
263 field, some other studies may be published at the time of writing the article and the review
264 process, which has been missed. Of course, due to the high speed of publishing articles, this
265 limitation is inevitable.

266 **Conclusion**

267 This systematic review showed that the KAP components in the participants are at an acceptable
268 level. In general, knowledge was at a good level, the attitude was positive and practice was at a
269 fairly good level. Providing accurate and up-to-date information in times of crises and
270 disseminating them through responsible institutions and through the mass media and holding
271 online training courses can help increase people's knowledge, attitudes, and practices.

272 **Supporting Information**

273 Supplementary file 1; PubMed search strategy

274 Supplementary file 2; quality appraisal of the included studies

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279 **Author Contributions**

280 Conception and design: MA-Z. Screen the records, data extraction, and quality appraisal: MM,
281 SS and SH. Data analysis: MA-Z and HA. Draft manuscript: MA-Z. Critical review: SH and HA.
282 All authors approved the final version of the manuscript for publication.

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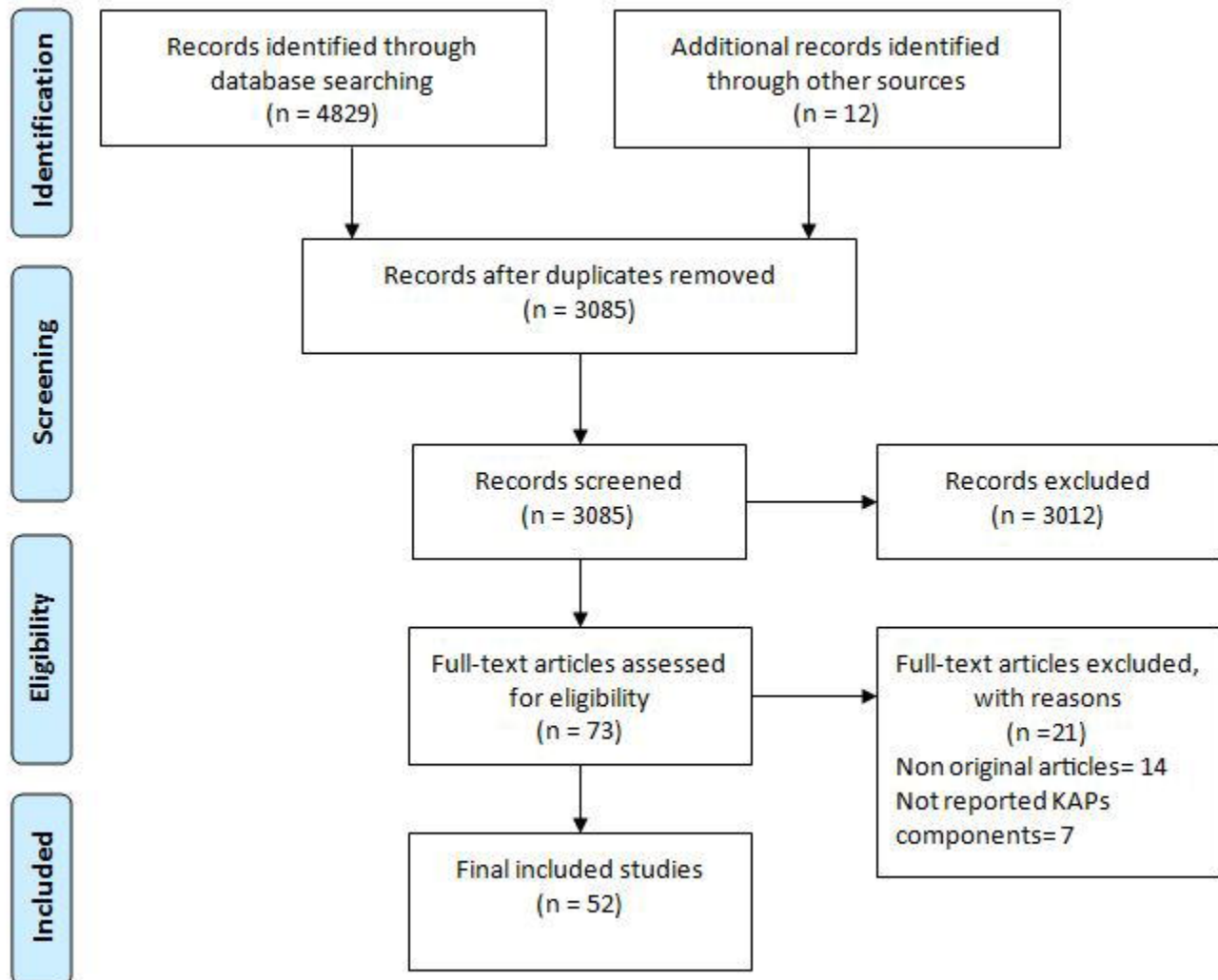
522

523 **Supporting information captions**

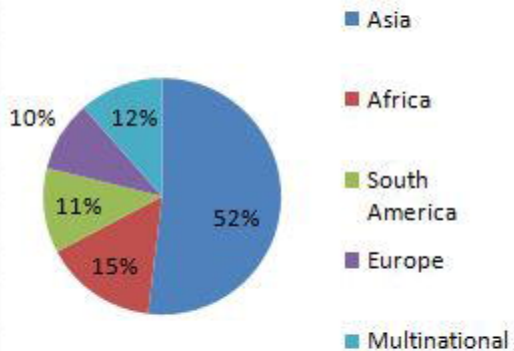
524 Supplementary file 1: PRISMA 2009 checklist

525 Supplementary file 2: Complete search strategy

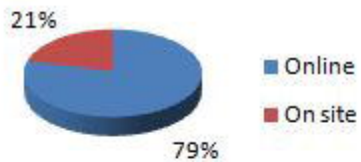
526 Supplementary file 3: Quality appraisal of the included studies



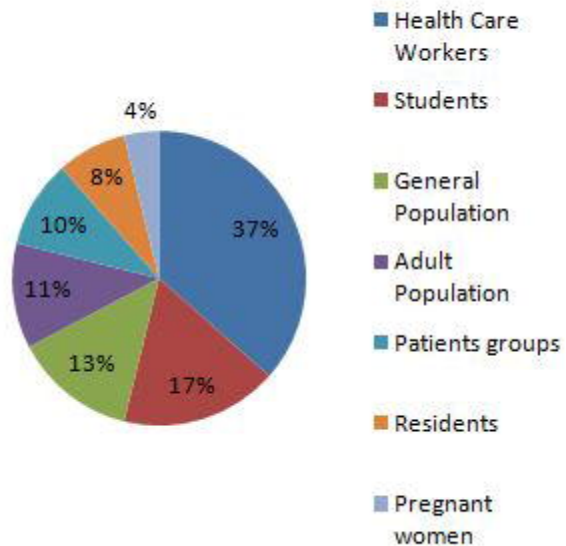
A



B

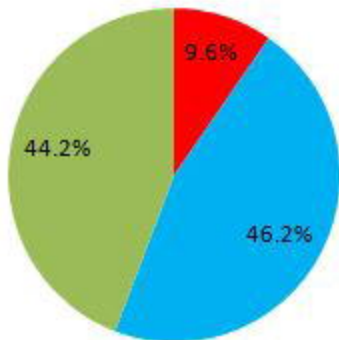


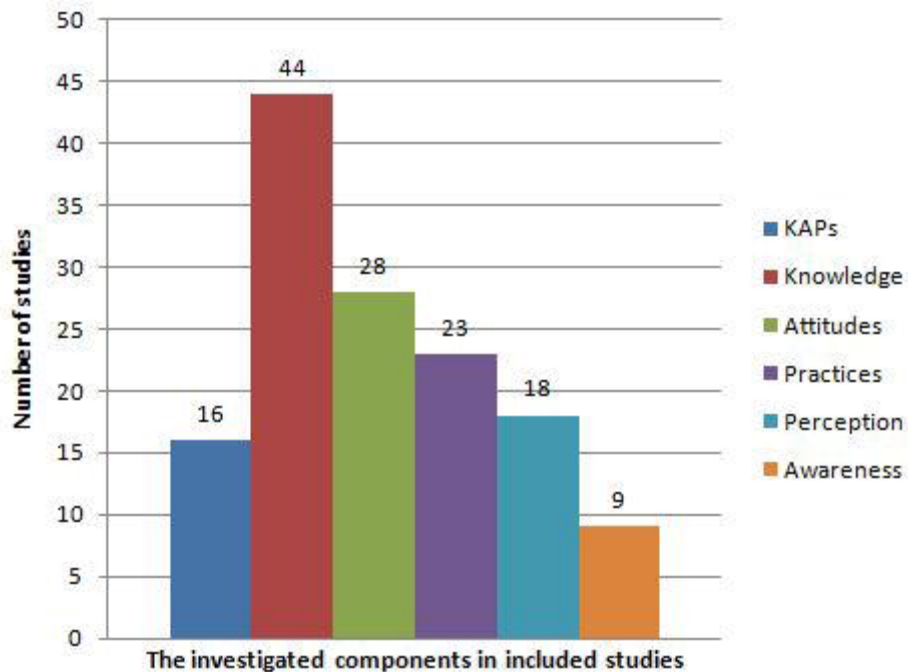
C



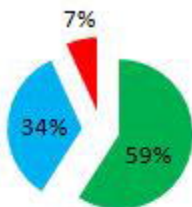
Quality appraisal of included studies

■ low ■ fair ■ good





K

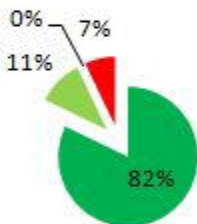


good

fair

poor

A



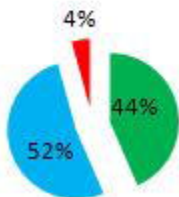
positive

fairly positive

fairly negative

negative

P



good

fair

poor