Knowledge, Attitude and Practices (KAP) towards COVID-19 pandemic in America: A preliminary systematic review

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Abstract

Introduction: On the eleventh of March 2020, the World Health Organization (WHO) declared the novel coronavirus disease 2019 (COVID-19) a pandemic by the number of cases and deaths worldwide: more than 91.1 million confirmed cases and approx. 1.9 million deaths globally, as of date. The aims of this systematic review were to identify and to evaluate the reports associated on Knowledge, Attitude and Practices (KAP) towards COVID-19 pandemic in America.

Methodology: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were adopted for searching reports published from December 2019 to September 2020, regarding "COVID-19 KAP" across six electronic databases. Inclusion and exclusion criteria were taken up to select the articles and focus to the topic.

Results: Thirteen scientific papers were finally eligible and included in this systematic review. The surveys were directed to common citizens, healthcare workers and patients with chronic conditions. General public acquired information about COVID-19 mainly through social media; several misconceptions due to falsehoods circulating on-line were identified. The pandemic COVID-19 has severely affected the physical and emotional health of many people in America. Nevertheless, many American citizens do not recognize or have poor knowledge about COVID-19 risks.

Conclusions: This systematic review brings information for governments and scientific community that may be useful in the development of official awareness and prevention campaigns aiming mainly at marginated groups of the society.

Introduction

At the end of December 2019, in the Chinese province of Wuhan, an unknown novel strain of coronavirus was deemed as the primary cause of countless pneumonia cases [1-5]. The virus, characterized by sustained and widespread transmission, was named as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [5-7]. It has progressed since December 2019 as serious illness, "Coronavirus disease 2019" (COVID-19), and was declared pandemic by the World Health Organization (WHO) on the eleventh of March 2020 [8].

The SARS-CoV-2 infected patients are mostly asymptomatic or generally experience mild symptoms that include fever, dry cough and sore throat [9].

However, some patients in particular the elderly or people with chronic pathologies develop severe and even fatal complications such as Acute Respiratory Distress Syndrome (ARDS) [10]. There are no standardized medical therapeutics and the first vaccines are just recently available and it seems quite probable that there is no pre-existing immunity in the worldwide population [11-13]. The SARS-CoV-2 has infected more of 91.1 million people and we have approx. 1.9 million deaths worldwide by COVID-19 [14]. The American continent is an epicenter of pandemic. The USA (22.6 million contagious - 376.7 thousand deaths) and Brazil (8.1 million contagious - 203.6 thousand deaths) are the most affected countries, followed by Colombia, Argentina, Mexico and Peru [14]. The

COVID-19 pandemic spreads in different ways, due to the different national ministerial decrees, sanitary decisions, local factors, knowledge, attitude and practices (KAP) of citizens [8]. The KAP surveys, used in health behavior research, are representative of a specific study population and are adopted to collect information on what is known, believed and done about a scientific subject. The information obtained serves as a diagnosis about the community education [15]. The KAP of citizens worldwide has played a key role in the health management of previous pandemics [16-17]. During the Swine Flu pandemic in 2009, the KAP surveys and systematic reviews showed health authorities the steps to follow in order to control the spread of novel viruses and mitigate the impact of future pandemics [18]. According to Bults *et al.* [16], education campaigns could provide valuable and up-to-date information about novel viruses and preventive measures; the communication strategy should be adjusted to the specific circumstances of each country. Moreover, health behavior theories adopted from studies of public perceptions and behaviors could facilitate the implementation of specific health care initiatives during outbreaks [17]. The health education campaigns could encourage people to adopt desirable changes in personal hygiene and behavior paying serious attention to the indications or prevention guidelines of governments and international organizations [19-21]. The risks of infection and outbreak propagation are frequently associated with little knowledge of the disease, negative attitudes and dangerous practices [22]. Gap in knowledge about COVID-19 severity are frequently associated with socioeconomic patterns [22]. The pandemic represents a social challenge in particular for the weakest categories of society such as rural and undereducated residents, income-poor households who in many cases underestimate the COVID-19 risks and have poor knowledge about its symptoms [23]. The people's KAP towards COVID-19 could be a key factor to face up the health emergency, "flatten the curve" of contagions and save lives [22]. The aims of this systematic review were to identify and evaluate, through a narrative synthesis, the scientific reports associated on KAP of COVID-19 pandemic in America.

Methodology

This systematic review was performed following the Matrix Method [24] the standardized method of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and the statement guidelines and checklist of Moher *et al.* [25]. The systematic review did not require ethics committee, institutional review board approval or patient consents. There are no previously published review protocols associated with this work. We provide a narrative synthesis of the findings from the included studies.

Search strategy

The search strategy was performed on 24 September by an author (YSG). Six electronic databases i.e. Scopus (Elsevier), ISI Web of Science (Clarivate Analytics), Science Direct (Elsevier), EMBASE (Elsevier), PubMed (National Library of Medicine of USA – NLM), SciELO (São Paulo Research Foundation – FAPESP) were used to identify full-text articles, published from December 2019 to September 2020, regarding "COVID-19 KAP". The keywords "COVID-19" and "SARS-CoV-2" were associated with the following terms: "Knowledge", "Attitude", "Practices" and "KAP"; all possible combinations were sought and examined.

Inclusion criteria

The inclusion criteria, applied to full-texts for assess their eligibility, were: a) paper focusing on knowledge and/or attitude and/or practice towards COVID-19, b) article published between 1 December 2019 and 24 September 2020, c) paper written in English, d) study limited to human beings, e) article published in peer-reviewed journals inserted in the Scimago Quartiles database, f) study developed in the American continent.

Exclusion criteria

The exclusion criteria, applied to full-texts for assess their eligibility were: a) abstract not associated to full article, b) article published in non-peer-reviewed source, c) article written not in English, d) review or meta-analyses, e) letter to editor; f) study developed in other continents; g) study with high risk of bias based on the Hoy tool [26].

Selection of studies

The articles obtained from the databases were compiled using Mendeley Desktop Reference Management System 1.19.4 and the duplicates were removed. Subsequently, two authors (YSG and NSS) have independently screened titles and abstracts. Irrelevant titles were removed. Articles that reported in their abstracts data and outcomes congruent with our topic i.e. knowledge, attitudes and practices towards COVID-19 were selected. Disagreements between the two researchers were resolved through consultation

with a third author (CF). Inclusion and exclusion criteria were subsequently applied to full-texts for assess the eligibility of the selected published material. Two authors (YSG and NSS) have independently analyzed the full-text articles; only the articles that met all criteria were finally selected. A third author (CF) made a final decision when two reviewers had differing opinions.

Data abstraction and synthesis

Article – level data was extracted from each selected paper and registered in abstraction - analysis matrix developed in MS Excel® (Microsoft for Windows) according to Garrard [24]. The summarized information was organized in columns with the following subjects: a) author name b) year of publishing c) citation number, d) journal quartile, e) country, f) goal/objective, g) risk of bias, h) type of population, i) sample size, j) sample demographic characteristics (age, gender, marital status, monthly income) k) questionnaire type, l) type of interview, m) validation instrument, n) knowledge, attitude and practice outcomes.

The organized data has simplified the interpretation of the results and the comparison between the selected articles, identifying critical issues and positive aspects on "COVID-19 KAP" of the studied populations.

Figure 1. PRISMA flow diagram.
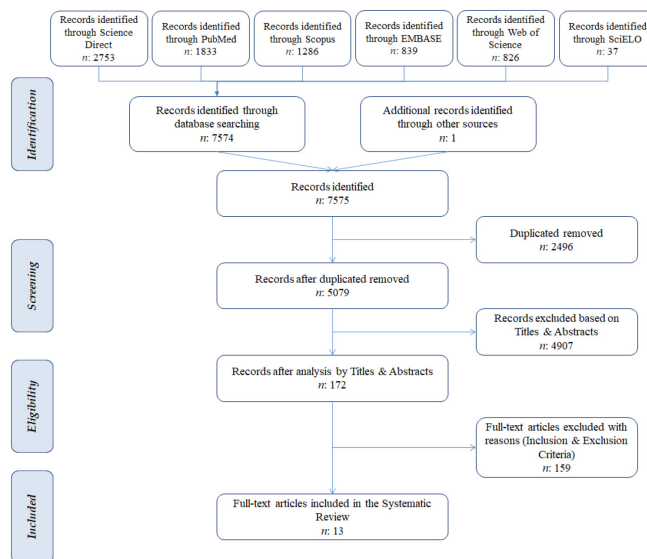
Quality assessment

The risk of bias of the full-text articles was assessed through Hoy *et al.* standard tool [26]; it is a valuable tool to examine and evaluate the quality of observational studies as demonstrated by Balouchi *et al.* [27], Nasiri *et al.* [28] and Behzadmehr *et al.* [29]. The checklist, that consists of ten items plus a summary assessment, address two dimensions i.e. a) external validity by means items 1 – 4 (domains: selection and nonresponse bias), b) internal validity by means items

Table 1. General description of studies included in the systematic review. Overview of main characteristics.

First Author, Year, Citation	Quartile	Country	Objective	Sampling time	Risk of Bias
Alobuia *et al.*, 2020 – [30]	Q2	United States of America	To determine whether disparities exist in the levels of KAP related to COVID-19 among general public.	March, 2020	Low
Bates *et al.*, 2020 – [31]	Q1	Ecuador	To explore KAP among general public in Ecuador.	April 8th to 15th, 2020	Low
Candeiro *et al.*, 2020 – [32]	Q1	Brazil	To assess knowledge levels about the COVID-19 among Brazilian endodontists.	March 28th to April 3rd, 2020	Low
Czeisler *et al.*, 2020 – [33]	Q1	United States of America	To assess attitudes, behaviors and beliefs related to COVID-19 guidance.	May 5th to 12th, 2020	Low
de Lima *et al.*, 2020 – [34]	Q1	Brazil	To investigate knowledge levels concerning COVID-19 in elderly patients with T2DM.	*N.D.*	Low
Geana, 2020 – [35]	Q2	United States of America	To explore the KAP levels in a sample of Kansans living in the times of the COVID-19 pandemic.	*N.D.*	Moderate
Geldsetzer, 2020 – [36]	Q1	United States of America	To assess knowledge and perception about COVID-19 among a convenience sample of the general public.	February 23rd to March 2nd, 2020	Low
Gharpure *et al.*, 2020 – [37]	Q1	United States of America	To characterize knowledge and practices regarding household cleaning and disinfection during the COVID-19 pandemic.	May, 2020	Low
O'Conor *et al.*, 2020 – [38]	Q1	United States of America	To evaluate knowledge levels about COVID-19 symptoms, prevention strategies and prevention behaviors.	March 13th to 20th, 2020	Low
Quandt *et al.*, 2020 – [39]	Q2	United States of America	To evaluate practice preventive behaviors among farmworker and no farmworkers.	May, 2020	Moderate
Quintana-Salcedo *et al.*, 2020 – [40]	Q4	Colombia	To evaluate the knowledge and attitudes of HCWs in the Colombian Caribbean for the care of COVID-19.	*N.D.*	Moderate
Rios-González, 2020 – [41]	Q1	Paraguay	To assess the KAP of Paraguayans in the period of the COVID-19 outbreak.	March 20th, 2020	Low
Wolf *et al.*, 2020 – [42]	Q1	United States of America	To determine the KAP towards COVID-19 among U.S. adults with comorbid conditions.	March 13th to 20th, 2020	Low

KAP: knowledge, attitude and practice; HCWs: healthcare workers, *N.D.*: not declared; T2DM: Type 2 Diabetes Mellitus.

5 – 10 (domains: measurement bias and item bias related to the analysis). Two researchers (YSG and NSS) have separately assessed the risk of bias. A third author (CF) made a final decision when two reviewers had differing opinions.

Results

Literature search

The systematic literature search, in the first phase, yielded a total of 7575 publications. Duplicates were removed and 5079 papers were reviewed for title and abstract pertinence; a total of 4907 articles were excluded during this phase. The remaining 172 full-text articles were examined based on inclusion and exclusion criteria. Finally, thirteen (13) articles [30-42] were included in this systematic review. The PRISMA Statement flow diagram, that consisted of four phases i.e. identification, screening, eligibility and inclusion, is shown in Figure 1.

General characteristics of selected studies

The main characteristics of the selected studies are summarized in Table 1. Of the thirteen selected articles, eight were performed in the USA, two in Brazil, one in Colombia, one in Paraguay and one in Ecuador. Nine papers (69.2%) were published in Q1 journals of Scimago Journal Ranking (SJR), three publications (23.1%) were found in a Q2 journal of SJR, one publication (7.7%) in a Q4 journal of SJR.

All studies were cross sectional type. The period of data collection was not similar and varied from few days to two months. All selected reports have provided data about knowledge of the citizens and guidance about COVID-19 pandemic, two thirds of the reports also indicated attitude and practice items. Approximately three-quarters of the selected studies (76.9%) had a low risk of bias, while three studies (23.1%) showed moderate risk of bias. The characteristics of the studied populations are summarized in Table 2. The questionnaires were directed to wider audience (general public), people with chronic conditions, Latin migrants in North America, endodontists or health care workers (HCWs). The sample size ranges from 30 to 11242 participants. The investigated sociodemographic variables were: age, gender, marital status and monthly income. The characteristics of KAP surveys are summarized in Table 3. The number of questions within the surveys ranged between eight and forty-five (45) close-ended questions. These questionnaires were generally developed through virtual information tools: Facebook Inc, WhatsApp, Instagram and Emails or also Amazon Mechanical Turk (M Turk), Qualtrics LLC, Prolific Academic Ltd. Platform, Porter Novelli Public Services & ENGINE Insights. Data was collected by telephone interviews in five researches. The authors applied different questionnaire validation instruments including national and international guidelines. The KAP questionnaires, employed in six studies, were based on previous investigations like that of Zhong *et al.* [43] in Hubei province, People's Republic of China.

Main KAP Results

The main results of the full-text articles included in the systematic review are summarized in Table 4. In general, the surveys had differences in the scoring systems that did not allow accurate and definitive comparisons.

General public

The knowledge, attitude and behaviors of the general public have an important bearing on the course of COVID-19 outbreak [33].

Factors such as gender, age, education level annual income and political preference have influenced the KAP about COVID-19 [30,31,35,36].

According to Bates *et al.* [31], the weakest or marginalized groups of the Ecuadorian citizens i.e. unemployed citizens, manual labourers and less educated showed unsatisfactory levels of knowledge about COVID-19. Women and people with higher schooling levels were the most optimistic about succeeding against COVID-19, but it should be emphasized that knowledge was not associated with this mood or with practices. Although most of the Paraguayan people surveyed by Rios-González [41] were university students (85.0%), the levels of knowledge about basic aspects of COVID-19 and protection measures were moderate (62%). The knowledge on the origin of SARS-CoV-2, symptoms and risk factors of COVID-19, protective measures and recommendations from national governments were acquired-influenced mainly by social media [35,36]. Generally, younger people searched information about COVID-19 pandemic in social networks while USA adults preferred to adopt government information sources or acquire information from international health organization web sites [35]. High knowledge about COVID-19 was frequently associated with positive attitude and correct behaviors. People who used official government sites to get news and clarifications often adhered to national health guidelines adopting preventative measures such as social distancing, use of face mask and proper hand hygiene.

Table 2. Description of demographic characteristics. Overview of main demographic characteristics of studied populations.

First Author, Year, Citation	Study population	Sample size	Gender	Age (years)	Marital status	Monthly (Mo.) or Annual (A) income
Alobuia *et al.*, 2020 – [30]	General Public	2906	M: 48% (1402) F: 52% (1500)	18 – 29: 22.0% (637) 30 – 49: 34.0% (974) 50 – 64: 24% (700) ≥ 65: 20% (595)	Married / Cohabiting: 57% (1662) Single / Widowed / Divorced: 43% (1232)	A – USD < 40000$: 42% (1096) 40000$ – 90000$: 30% (776) > 90000$: 28% (732)
Bates *et al.*, 2020 – [31]	General Public	2399	M: 37.0% (888) F: 62.2% (1491) Others: 0 % (8)	18 – 29: 30.1% (723) 30 – 49: 49.9% (1197) ≥ 50: 19.3% (463)	Married: 46.1% (1106) Single: 41.1% (986) Separated: 3.0% (71) Divorced: 8.4% (201) Widowed: 0.9% (22)	*N.D.*
Candeiro *et al.*, 2020 – [32]	Endodontists	2135	M: 27.0% (577) F: 72.9% (1557) Transgender: 0 % (1)	21 – 30: 18.3% (390) 31 – 40: 33.4% (714) 41 – 50: 28.9% (616) 51 – 60: 15.2% (324) 61 – 70: 4.0% (85) > 70: 0.3% (6)	*N.D.*	*N.D.*
Czeisler *et al.*, 2020 – [33]	General Public	4042	M: 45.0% (1813) F: 55.0% (2226) Others: 0 % (3)	18 – 24: 11.4% (459) 25 – 34: 15.7% (634) 35 – 44: 17.3% (701) 45 – 54: 17.1% (692) 55 – 64: 18.0% (729) ≥ 65: 20.5% (827)	*N.D.*	*N.D.*
de Lima *et al.*, 2020 – [34]	Elderly People with Diabetes Mellitus	30	M: 23.3% (7) F: 76.7% (23)	Average age: 70.0 ± 4.5 years (Age range: 65 – 79 years)	Married: 63.3% (19) Other: 37.7 (11)	Mo. – EUR 585€ ± 577€ (1 or 2 minimum wages)
Geana, 2020 – [35]	General Public	131	M: 18.3% (24) F: 81.7% (107)	Average age: 46.0 ± 15.5 years	*N.D.*	A – USD < 50000$: 27.0% (35) 50001$ – 100000$: 29.0% (38) > 100000$: 44.0% (58)
Geldsetzer, 2020 – [36]	General public	2986	M: 1467 (49.1%) F: 1519 (50.9%)	≤ 47: 1873 (62.7%) > 47: 1113 (37.3%)	*N.D.*	A – USD ≤ 50000$: 1638 (54.9%) > 50000$: 1348 (45.1%)
Gharpure *et al.*, 2020 – [37]	General Public	502	M:48.0% (241) F:52.0% (261)	Average age: 46 years (Ange range 18 – 86 years)	*N.D.*	*N.D.*
O'Conor *et al.*, 2020 – [38]	Elderly People with Underlying Health Conditions	673	M: 39.7% (267) F: 60.3% (406)	< 60: 35.1% (236) 60 – 69: 35.8% (241) ≥ 70: 29.1% (196)	*N.D.*	*N.D.*
Quandt *et al.*, 2020 – [39]	Latinx Farmworker and Not farmworker families	105	*N.D.*	25 – 29: 11.4% (12) 30 – 34: 31.4% (33) 35 – 39: 30.5 % (32) 40 – 47: 27.0 % (28)	*N.D.*	A – USD Household incomes below 200% of the USA federal poverty guideline
Quintana-Salcedo *et al.*, 2020 – [40]	Health Workers for the Care of COVID-19 Patients	283	M: 41.0% (116) F: 59.0% (167)	20 – 25: 24.0% (68) 26 – 30: 29.7% (84) 31 – 35: 15.6% (44) 36 – 40: 13.1% (37) 41 – 45: 8.5% (24) 46 – 50: 4.5% (13) 51 – 55: 2.5% (7) 56 – 60: 1.4 % (4) > 60: 0.7% (2)	Married: 26.9% (76) Cohabiting: 27.9% (79) Single: 44.2% (125) Separated: 1.1% (3)	*N.D.*
Rios-González, 2020 – [41]	General Public	3141	M: 31.9% (1002) F: 68.1% (2139)	18 – 29: 60.5% (1901) 30 – 49: 33.6% (1054) ≥ 50: 5.9% (186)	Married: 22.7% (714) Single: 67.43% (2118) Other: 9.8% (309)	*N.D.*
Wolf *et al.*, 2020 – [42]	Elderly People with Chronic Conditions	630	M: 40.3% (254) F: 59.7% (376)	< 60: 37.3% (235) 60 – 69: 35.7% (225) ≥ 70: 27.0% (170)	Married: 40.0% (252) Single: 60.0% (378)	*N.D.*

Mo.: monthly income, A: annual income, M: male, F: female, USD: United States Dollar, *N.D.*: not declared, EUR: Euro.

On the other hand, people who preferred information from social networks in addition to presenting obvious knowledge gaps were more prone to dangerous behaviors [35,37]. Approximately a quarter of USA general public (23.9%) interviewed by Geldsetzer [36] believed that the SARS-CoV-2 is a bioweapon developed by a government or a terrorist organization; the author points out that falsehoods circulating on social media are the main cause of misinformation. According to Geana [35], public television and national newspapers were the most trusted media sources on COVID-19, while often the social networks did not provide valuable scientific news. Localized sources such as family, friends, coworkers and HCWs were in many cases primary information sources as well as an opportunity to daily discussions about news and events; in particular, HCWs have provided relevant and updated information on the risks of infection and prevention measures against COVID-19. According to Gharpure *et al.* [37], many USA respondents (30.3%), showed poor knowledge of COVID-19, and have adopted at least one high-risk practice not recommended by Centers for Disease Control and Prevention (CDC) to prevent SARS-CoV-2 infection, including application of bleach to fruits and vegetables (19.0%), use of household cleaning products on hands or skin (18.0%), spraying the body with disinfectants (10.0%), inhalation of vapors from household cleaners or disinfectants (6.0%), drinking or gargling diluted bleach solutions. The COVID-19 pandemic has negative impact on Latino immigrant groups in North Carolina USA. Although their high knowledge about characteristics of SARS-CoV-2 transmission and health preventive behaviors, the structural vulnerability of the community may have amplified their exposure to the virus principally due to outside working, visiting relatives and friend homes or church attendance [39].

Table 3. Mainly description of surveys characteristics. Overview about the structure and characteristics of analysed surveys.

First Author, Year, Citation	Type of survey	Number of questions	Type of questions	Instrument of validation
Alobuia *et al.*, 2020 – [30]	Telephone interview	15	Close ended questions	*N.D.*
Bates *et al.*, 2020 – [31]	Virtual – Internet through Facebook, WhatsApp and Emails	18	Close ended questions	Previous study: Zhong *et al.* [43]
Candeiro *et al.*, 2020 – [32]	Virtual – Internet through Facebook, WhatsApp and Instagram	15	Close ended questions	*N.D.*
Czeisler *et al.*, 2020 – [33]	Virtual – Internet administered by Qualtrics LLC	20	Close ended questions	*N.D.*
de Lima *et al.*, 2020 – [34]	Telephone interview	24	Close ended questions	Brazil Ministry of Health Guidelines
Geana, 2020 – [35]	Virtual – Internet through Facebook	8	Close ended questions	Guidelines of WHO
Geldsetzer, 2020 – [36]	Virtual – Internet through Prolific Academic Ltd. Platform	22	Close ended questions	Guidelines of WHO
Gharpure *et al.*, 2020 – [37]	Virtual – Internet Administered by Porter Novelli Public Services & ENGINE Insights	25	Close ended questions	Code of Insights Association
O'Conor *et al.*, 2020 – [38]	Telephone interview	13	Close ended questions	Brief health literacy screen (BHLS) + Previous study: Chew *et al.* [75]
Quandt *et al.*, 2020 – [39]	Telephone interview	45	Close ended questions	Previous study: McFadden *et al.* [76]
Quintana-Salcedo *et al.*, 2020 – [40]	Virtual – Internet through WhatsApp	11	Close ended questions	Previous study: Shi *et al.* [12]
Rios-González, 2020 – [41]	Virtual – Internet through WhatsApp	12	Close ended questions	Previous study: Zhong *et al.* [43]
Wolf *et al.*, 2020 – [42]	Telephone survey	35	Close and open ended questions	Previous study: Kelly *et al.* [77]

N.D.: not declared, CDC: Centers for Disease Control and Prevention, WHO: World Health Organization.

Table 4. Knowledge, Attitude and Practice (KAP) results & conclusion in the selected articles. Overview on KAP outcomes by authors.

First Author, Year, Citation	Outcomes
Alobuia *et al.*, 2020 – [29]	Higher level of education and higher income were associated with high knowledge of COVID-19. Sex, education, income, health insurance status and political views were all associated with KAP. Participants had moderate to high levels of knowledge.
Bates *et al.*, 2020 – [30]	Participants expressed mixed attitudes about the eventual control of COVID-19 in Ecuador. Binomial regression analysis suggests unemployed individuals, househusbands / housewives, or manual laborers and less educated have low levels of knowledge. Women, people over 50 years of age and people with higher levels of schooling were the most optimistic. Men, individuals 18–29, single, and unemployed people took the riskiest behaviors. Generally, knowledge was not associated with optimism or with practices. The findings indicate knowledge about COVID-19 is insufficient to prompt behavioral change among Ecuadorians.
Candeiro *et al.*, 2020 – [31]	A total of 98.5% of endodontists reported that dental procedures can transmit COVID-19. Complete social distancing was practiced by 96.7% of the participants. About half of the respondents reported that they performed only emergency procedures in their workplaces.
Czeisler *et al.*, 2020 – [32]	Among respondents in the USA (1676), 16.8% knew someone who had positive test results for COVID-19 (42.0% of respondents in NYC and 10.8% in Los Angeles). About two thirds of participants supported government issued "Stay at Home" orders and nonessential business closures (86.7% in NYC and 81.5% in Los Angeles). Overall, 84.3% of adults in the USA believed their state's COVID-19 community mitigation strategies were the right balance or not restrictive enough (89.7% in NYC and 79.7% in Los Angeles).
de Lima *et al.*, 2020 – [33]	The most cited information medium about COVID-19 pandemic was television (96.6%). Among items relating to COVID-19 symptoms, fever was most frequently cited (76.7%). In terms of contamination, "touch or handshake" was the most cited form of transmission (76.7%). In terms of prevention, hand hygiene was the most cited item (90.0%). The Mann Whitney U-test showed no significant difference between socioeconomic variables and total checklist scores: sex (p: 0.6), marital status (p: 0.5), education (p: 0.2), income (p: 0.2), social participation (p: 0.4).
Geana, 2020 – [34]	Participants had good knowledge about the disease and preventive measures, they were willing to comply with recommendations from local authorities. However social media is not a valuable source for information pertinent to COVID-19.
Geldsetzer, 2020 – [35]	The respondents had, generally, moderate knowledge of the common COVID-19 symptoms. The survey identified several misconceptions on the characteristics, symptoms of COVID-19 and the prevention-protective measures in sporadic cases, it was due to falsehoods circulated on social media. Approximately a quarter of American respondents (23.9%) believed that the SARS-CoV2 is a bioweapon developed by a government or a terrorist organization.
Gharpure *et al.*, 2020 – [36]	Approximately one third of the respondents reported intentionally engaged in at least one high-risk practice not recommended by CDC for prevention of SARS-CoV-2 transmission, including application of bleach to food items (fruits and vegetables) (19.0%); use of household cleaning and disinfectant products on hands or skin (18.0%); spraying the body with cleaning or disinfectant products (10.0%); inhalation of vapors from household cleaners or disinfectants (6.0%); and drinking or gargling diluted bleach solutions, soapy water, and other cleaning and disinfectant solutions (4.0%).
O'Conor *et al.*, 2020 – [37]	Most participants could identify three symptoms (71.0%) of COVID-19 and three preventive actions (69.2%). Commonly reported symptoms included: fever (78.5%), cough (70.6%), and shortness of breath (45.2%); preventive actions included: washing hands (86.5%) and social distancing (86.2%). More than a third of participants reported social distancing themselves (38.3%), and 28.8% reported obtaining prescription medication to prepare for the outbreak. In multivariable analyses, no participant characteristics were associated with COVID-19 knowledge.
Quandt *et al.*, 2020 – [38]	Knowledge of COVID-19 and prevention methods was high in both groups. Farmworkers families emphasized social avoidance; not farmworkers families emphasized personal hygiene. Not farmworkers families were more inclined to use masks.
Quintana-Salcedo *et al.*, 2020 – [39]	A high percentage of HCWs interviewed indicated that they have sufficient knowledge to care for infected patients (80.2%). The main reasons for not having care for infected patients are: a) not having adequate provision of protection elements (66.1%) and b) fear of contagion or infecting their family (33.9%).
Rios-González, 2020 – [40]	The majority of the respondents agreed that COVID-19 will finally be successfully controlled (66.3%). The vast majority of the participants had opportune practices, not visiting any crowded place (88.35%) and wearing mask outside (74.31%) during quarantine.
Wolf *et al.*, 2020 – [41]	A fourth (24.6%) of participants were "very worried" about getting the coronavirus. Nearly a third could not correctly identify symptoms (28.3%) or ways to prevent infection (30.2%). One in 4 adults (24.6%) believed that they were "not at all likely" to get the virus. One in 10 respondents was very confident that the federal government could prevent a nation-wide outbreak. Afro-Americans and citizens that were living below the poverty level or low literacy were less worried about COVID-19. The participants with low health literacy had greater confidence in the federal government response.

KAP: knowledge attitude and practice; CDC: Centers for Disease Control and Prevention, HCWs: health care workers.

Health Care Workers

Medical personnel and more in general all HCWs are more exposed than common citizens to hazards of infection by SARS-CoV-2. According to Quintana-Salcedo *et al.* [40], many Colombian HCWs (80.2%) including nurses, nursing assistants, doctors or technologist in the hospitals of Cartagena de Indias had good knowledge about COVID-19 risks; they have expressed a willingness to take care of infected patients. Nevertheless, critical issues such as lack of training and experience as well as deficiency of adequate protection equipment resulted in bad attitudes and fear of being infected [40]. The COVID-19 pandemic represents a serious challenge also for the dental care workers. Brazilian endodontists interviewed by Candeiro *et al.* [32] demonstrated adequate knowledge of main symptoms of COVID-19 and the risks of infection during dental procedures (98.5%). Most professionals have suspended elective dental care during quarantine; while, about half of them, performed only emergency procedures in their workplaces. Moreover, in their daily practice, approx. three-quarters (72.1%) of endodontists implemented biosecurity measures in preventing COVID-19. Most participants did not consider the conventional personal protective equipment (PPE) as suitable protection measure against SARS-CoV-2 infection.

People with chronic diseases

Elder people and those with chronic diseases are more vulnerable to complications of infection with COVID-19 [34,38]. According to Wolf *et al.* [42], most elderly people surveyed in the USA (mean age 62.1 years) with at least one chronic condition, perceived the COVID-19 as a serious threat, although one third of them could not identify symptoms or proper measures to prevent infection. The socioeconomic partners have influenced the outbreak perception e.g. elderly who were living below the poverty level or had low literacy were less worried than women or people with higher levels of schooling about COVID-19 infection risks. In many cases, unmarried, unemployed, or retired people believed that they are not likely to contract the illness. O'Conor *et al.* [38] observed that most elderly participants (71.0%) could identify the common symptoms of COVID-19 such as fever, cough and shortness of breath. Also, two thirds of them (69.2%) correctly indicated preventive mitigation actions including washing hands and social distancing. Around one third of participants assumed social distancing and have requested medical consultation during the outbreak. Elderly people (mean age 69.9 years) with

type 2 diabetes mellitus in Brazil were consulted to investigate their knowledge about COVID-19 [34]; the obtained results were unsatisfactory. Participants could not identify the symptoms, routes of transmission or prevention actions against SARS-CoV-2 infection. The only preventive measures indicated were washing hands and sanitize with alcohol. Authors concluded that maybe the sources of information were deficient.

Discussion

Outbreaks repeat themselves periodically in the human history and citizens worldwide face several problems during such periods [44]. The KAP plays a key role to better face these global health challenges, and right now to "flatten the curve" of COVID-19 contagions in many countries of the world. Various factors could determine the KAP levels regarding COVID-19 pandemic in the wide audience (general public) and in specific groups of people such as HCWs or people with chronical pathologies. We have divide the patterns associated with the KAP into three macro categories: a) scientific and social information i.e. reliability of information and credibility of the source; b) sociodemographic aspects i.e. gender, age, education level, ethnic background, annual income and political preference; c) interpersonal relationships i.e. social belonging and family relationships.

Scientific and social information

The most used information sources about COVID-19 were television programs, websites as local/national networks, newspapers and social networks [22,35]. The social media, in particular, have become primary sources of information [45], and at the same time, the misinformation and falsehoods on social media have exponentially increased in the recent years. It seems that people prefer information that appears novel and astounding than accurate and scientific reports [46]. Many authors have pointed out the danger of fake news and misinformation across social media [47-49]. The vast majority of citizens worldwide acquire information about COVID-19 through social media without checking the source [22,34,36,50]. It translates into erroneous knowledge, bad attitudes and sometimes in irresponsible behaviors. For example, misinformation circulated in social networks about the efficiency of hydroxychloroquine and chloroquine against COVID-19 caused inappropriate stockpiling by general public and at the same time shortage of those drugs for arthritis or lupus patients who really needed them [51,52]. Conspiracy theories about COVID-19 have proliferated on social media during outbreak [53], and the

conspiracies has taken on many variants. Geldsetzer [35], Mitchell and Oliphat [54] and Frankovic [55] indicated that many citizens in the USA believed the SARS-CoV-2 is a bioweapon intentionally and purposefully developed by a government or a terrorist organization for political or economic gains. Contrary to the above, statements misleading and incorrect have caused false feelings of security, low knowledge of the health risks and inappropriate behavior in local populations [37,56]; many people played down the danger of COVID-19, considering it as a flu [57]. Digital platforms should help their users to distinguish misconceptions and falsehoods about COVID-19 emergency [53]. We recommend to crosscheck information on COVID-19 disease obtained through social media with at least two other information sources such as certificated international organizations, government websites or high-quality recognized journals.

Governments should make use of high quality scientific studies and the opinion of recognized experts or virologists on COVID-19 disease in order to deliver, clear, correct and impartial information to the population through awareness campaigns, television interviews or through informatics material. Despite many young people having good knowledge about COVID-19 their attitude and practices were inadequate; in particular, the students behaviors will be decisive in the later stage of reopening schools and universities to avoid new clusters of contagious [37]. The e-learning and the generation of specific contents are crucial activities to educate the citizens about prevention measures against COVID-19 [58]. In a smaller audience like healthcare workers in Colombia, including nurses, nursing assistants and doctors, Internet and scientific papers are the main sources of information, as reported by Quintana-Salcedo *et al.* [40]. Nevertheless, the HCWs, need specific information and guidelines promptly notified by the WHO and CDC, to adopt the required mitigation and prevention measures in their hospital, clinic, ambulatories and when required in home visits [32,40,59]. It is gratifying to know that the majority of medical in the Colombian survey expressed strong willingness to care for their patients suffering from COVID-19 disease including frequent overtime working [40].

Sociodemographic aspects

The most marginalized communities, with low levels of education and minimal incomes, are generally most impacted by pandemics because they simultaneously face other dangerous threats to their psychophysical health [60]. It is not at all surprising that wider gaps on KAP levels were generally found among elderly, less educated and rural residents including Latin immigrant in the USA [30,31,61]. The socioeconomic discrepancy between rural and urban residents could explain in part the differences in knowledge and behavioral intentions [62]. The findings are supported by other studies worldwide that indicate women, people living in urban areas and with an MPhil/PhD level of education scored better than rural residents [63,64,65]. In particular, woman whit rewarding employment, high economic standard and high education level showed generally satisfactory knowledge, positive attitude and good practices such as practicing physical distancing, using mask face, washing hands frequently and removing the shoes before entering the house [66,67]. Moreover, Chen and Chen [68] highlighted that Chinese rural residents were less likely to evaluate the reliability of information sources about COVID-19 and consequently to adopt the appropriate preventive measures, while Yue *et al.* [63] suggested the importance of developing relevant education programs targeting particularly the rural and undereducated residents. Efforts by local, national and international institutions are needed to communicate with these disadvantaged and most marginalized sections of the populations that in many cases do not have access to Internet connection [69]. Strategies have to be developed to build Internet services (DSL, dial-up, cable and wireless services) and subsequently to educate the rural citizens in using responsibly online tools because of the word of mouth in the little rural communities, could cause the spread of falsehoods and uncertain news [64]. Awareness-raising and education campaigns should be accompanied by economic support in favor of the disadvantaged population groups to facilitate their adherence to national recommendations and mitigate the impact of the pandemic as also suggested by Bates [31]. Countries with low and medium economic resources, such as those grouped in Latin America, have a different demographic profile from the rich countries of Europe and North America. Their populations are much younger, and the there elderly live frequently in their homes with a large part of family [70]. Health regulators should use multiple communication approaches, to increase preventive practices towards COVID-19 among these populations considering also the difficulties derived from the fact of large families living together in small spaces during the quarantine [71].

Interpersonal relationships

The daily habits and behavior of many families have changed during the COVID-19 pandemic [72]. The families, especially with young children, are frequently more careful than single people, following preventive measures against COVID-19. Social belonging produces positive and lasting interpersonal relationships, it consents to have empathy and also to think about caring for the other [39]. For instance, religious communities in the USA were mobilized to recruit volunteers to disseminate information on COVID-19 outbreak and engage citizens [73]. During the COVID-19 emergency, many people who are single may felt lonely and stressed manifesting sleep difficulties and paranoia [42,74]. Governments and civil associations should provide psychosocial support, stimulate constructive dialogue and the participation in social activities also in virtual modality. The health social-education campaigns could encourage the people to adopt desired changes in personal hygiene and behavior paying serious attention to the health indications or prevention guideline, and at the same time, reduce anxieties and worries related to COVID-19 pandemic.

Limitations of the review

The studies developed in the American continent indicated mixed results and conclusions. The surveys had differences in the scoring systems that didn't allow accurate and definitive comparisons (meta-analysis).

Conclusions

Many people in the American continent do not recognize or have poor knowledge towards COVID-19 disease risks. Education activities such as social awareness campaigns and training material will be extremely important to better face this global health problem, to "flatten the curve" of COVID-19 contagions and to save lives. Specific educational tools are promptly needed to communicate with the most disadvantaged population groups inasmuch they, in many cases, have showed unsatisfactory knowledge, bad attitude and dangerous behavior. The thorough knowledge, positive attitude and correct practices could make a difference in the battle against this invisible enemy.

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