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ORIGINAL PAPER

Knowledge, Attitudes, and Practices Towards COVID-19 Among Ecuadorians During the Outbreak: An Online Cross-Sectional Survey

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Abstract

Preventing the transmission of SARS-CoV-2 (causative agent for COVID-19) requires implementing contact and respiratory precautions. Modifying human behavior is challenging and requires understanding knowledge, attitudes, and practices (KAPs) regarding health threats. This study explored KAPs among people in Ecuador. A cross-sectional, internet-based questionnaire was used to assess knowledge about COVID-19, attitudes toward ability to control COVID-19, self-reported practices related to COVID-19, and demographics. A total of 2399 individuals participated. Participants had moderate to high levels of knowledge. Participants expressed mixed attitudes about the eventual control of COVID-19 in Ecuador. Participants reported high levels of adoption of preventive practices. Binomial regression analysis suggests unemployed individuals, househusbands/housewives, or manual laborers, as well as those with an elementary school education, have lower levels of knowledge. Women, people over 50 years of age, and those 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. Our findings indicate knowledge about COVID-19 is insufficient to prompt behavioral change among Ecuadorians. Since current COVID-19 control campaigns seek to educate the public, these efforts' impacts are likely to be limited. Given attitudes determine people's actions, further investigation into the factors underlying the lack of confidence in the ability of the world, and of Ecuador, to overcome COVID-19, is warranted. Edu-communicational campaigns should be accompanied by efforts to provide economically disadvantaged populations resources to facilitate adherence to recommendations to prevent the spread of the virus.

Keywords COVID-19 · SARS-CoV-2 · Knowledge · Attitudes · Practices · Public opinion · Ecuador (country)

The world is rapidly learning about the SARS-CoV-2 virus, including its origin, transmission, and progression of the condition it causes, COVID-19 [1–3]. Characterization of clinical manifestations associated to COVID-19 and diagnosis of SARS-CoV-2 infection are also improving [1, 4]. However, currently, there is no available vaccine and the efficacy and safety of potential treatments remains unproven [5].

Implementation of contact and respiratory precautions to prevent the spread COVID-19 is essential [6–9]. Although cases of this emerging disease will likely overwhelm health systems worldwide [10], transmission prevention is particularly important for the Global South, specially most of sub-Saharan Africa [11, 12] and Latin America [13, 14], where health systems were already under significant strain before the discovery of SARS-CoV-2 [15]. Ecuador's healthcare system has been among the hardest hit [16, 17], with more COVID-19 cases per capita than nearly any other country in the Global South [18] and one of the highest rates of mortality in Latin America [19].

SARS-CoV-2 transmission prevention strategies include low-cost, high-impact behaviors such as hand hygiene, face mask use, and social contact avoidance [20]. Unfortunately,

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implementation of these measures is not sufficiently widespread. To encourage adoption of these behaviors, calls have been issued for governments and health agencies to disseminate timely, accurate, and science-based information to the public, assuming this will result in behavioral change [21–23].

Effectively changing human behavior, however, often requires going beyond providing information [24–26]. Adoption of preventive measures, particularly in the context of infectious disease, is largely determined by KAPs [27–31]. In this study, we explored the understanding of COVID-19 by the Ecuadorian public, in order to inform the design of effective prevention and control strategies in the context of the current pandemic.

Methods

Participants

All data for this study were collected online from April 8 to 15, 2020. We used a snowball and referral methodology comprised of three parts. Initially, an invitation was emailed to individuals within the author's personal networks, requesting they forward the message to other people who might be interested. Second, we leveraged social media with a Facebook post boosted through advertising with a link to the survey. Finally, we forwarded the invitation through WhatsApp to the authors' personal networks with an invitation to share it forward. Ecuadorians aged 18 or greater, interested in participating, were asked to click the link to an online description of the study hosted on a Qualtrics platform.

Participants were informed that the study was completely anonymous and participation voluntary. After confirming voluntary participation and completing two screening items designed to confirm their age and nationality, participants were directed to the questionnaire.

Measures

The KAP questionnaire employed in this study was based on a previous one developed by Zhong and colleagues in Hubei province, People's Republic of China [32]. Zhong et al.'s questionnaire was translated into Spanish, adapted to the Ecuadorian context, and updated for recommended prevention practices. The first author, an Anglophone researcher, reviewed the English-version constructs, anchored their conceptual expressions in Spanish and translated the instrument. The fourth author, a Hispanophone researcher reviewed the Spanish-version and made minor edits. The questionnaire was then sent to two additional Hispanophone researchers, one informed of the research purpose and the other not, to account for linguistic and conceptual equivalences. The first author then synthesized the translations in reference to their equivalence to the English questionnaire.

The first part of the questionnaire consisted of demographic variables. These included age group (18–29, 30–49, or 50 +, following Zhong et al.'s groupings), gender, marital status, education, occupation, and place of current residence (the three cities in Ecuador, an open-ended option to name another large city, or living outside of a city).

The second part of the questionnaire consisted of KAP items. Following Zhong et al., the knowledge component had 12 questions: 4 discussing the clinical presentation of COVID-19, 3 regarding transmission pathways, and 5 regarding prevention and control. Participants could answer "true", "false", or "do not know." The term "COVID-19 virus" (as opposed to the more technical SARS-CoV-2) was employed, following Zhong et al., because it is more easily understood by non-specialists. Each correct answer was assigned 1 point; incorrect answers or unknown answers were assigned 0 points. A participant could receive a total knowledge score ranging from 0 to 12; higher scores indicate better knowledge of COVID-19.

Additionally, following Zhong et al. attitudes towards COVID-19 were measured by 2 questions. The first question assessed agreement or disagreement on whether COVID-19 would ultimately be controlled. The second question assessed confidence in Ecuador's ability to win the battle against COVID-19.

Finally, practices were assessed using 3 items regarding behaviors. In addition to Zhong et al.'s item asking participants to report whether they had gone to crowded places and whether they wore a face mask when outside their home during the week before taking the survey, we also assessed whether participants reported washing their hands each time they returned home or were in contact with another person. In addition to Zhong's assessment, if a participant indicated that they had ventured out of their home in the week before taking the survey, they were also requested to specify how many times they had done it, the reason, and whether they maintained a distance of at least 2 m from other people while out.

Statistical Analysis

Frequencies of correct answers and various attitudes and practices were described (see Table 1). Independent-samples t-test, one-way analysis of variance (ANOVA), and Chi-Square tests, as appropriate, were used to compare members of different demographic grouping's knowledge scores, attitudes, and self-reported practices. We used binary logistic regression analyses to identify demographic factors associated with each attitude and practice. Factors were selected with an enter method to avoid both inflationary and

Table 1 Knowledge, attitudes, and practice towards COVID-19

Questions	Correct rate, % of total sample endorsing	Options
K1.The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, and muscle pain	92.4	True, False, Don't Know
K2. Unlike the common cold, stuffy nose, runny nose, and sneezing are less common in persons infected with COVID-19	75.1	True, False, Don't Know
K3. There currently is no effective cure for COVID-19, but early symptomatic and supportive treatment can help most patients recover from the infection	91.8	True, False, Don't Know
K4. Not all persons with COVID-2019 will develop to severe cases. Those who are elderly, have chronic illnesses, and are obese are more likely to be severe cases	69.8	True, False, Don't Know
K5. Eating or handling wild animals could result in the infection with COVID-19. (R)	13.8	True, False, Don't Know
K6. Persons with COVID-19 cannot infect the virus to others when a fever is not present. (R)	93.0	True, False, Don't Know
K7. COVID-19 spreads via respiratory droplets of infected individuals	91.5	True, False, Don't Know
K8. Ordinary citizens can wear general medical masks to prevent infection by the COVID-19 virus	47.2	True, False, Don't Know
K9. It is not necessary for children and young adults to take measures to prevent the infection by the COVID-19 virus. (R)	95.2	True, False, Don't Know
K10. To prevent COVID-19, individuals should avoid going to crowded places such as bus stations and avoid taking public transportation	98.6	True, False, Don't Know
K11. Isolation and treatment of people who have COVID-19 are effective ways to reduce the spread of the virus	98.0	True, False, Don't Know
K12. People who have contact with someone infected with the COVID-19 virus should be immediately isolated in a proper place. In general, the observation period is 14 days	98.6	True, False, Don't Know
A1. Do you agree that COVID-19 will finally be successfully controlled?	47.5	Yes, No, Don't Know
A2. Do you have confidence that Ecuador can win the battle against COVID-19?	63.5	Yes, No
P1. In the past week, have you gone to any crowded place?	11.3	Yes, No
P2. In the past week, have you worn a mask when leaving home?	93.2	Yes, No
P3. In the past week, have you washed your hands for at least 20 s each time you have returned home or touched another person?	96.6	Yes, No

Note (R) indicates that the reverse is the true statement

deflationary effects. Unstandardized regression coefficients (β) and odds ratios (ORs), respectively, and their 95% confidence intervals (CIs) were used to assess the associations between demographic variables and KAP. Since only some of the individuals reported leaving their homes during the week before the survey, the follow-up questions were applied only to this subset of the study population, and the resulting data did not meet assumptions for regression Therefore, we only report frequencies for this subset. All data analyses were conducted with SPSS version 26.0. The statistical significance level was set at $p < 0.05$.

Results

A total of 2491 individuals consented to participate in the survey. Participants who reported either being under 18 years of age (n = 37) or not being Ecuadorian (n = 55) on the screening questions were excluded, and no further data were recorded for them. After removing participants who skipped all substantive questions, 2399 individuals were retained. This final sample was majority female (1491, 62.5%). About half of the participants (1197, 49.9%) were between 30 and 49 years of age, married (1106, 46.1%), and college educated (1227, 51.1%). Participants represented all labor sectors and nearly all major population centers in Ecuador. A large proportion of participants (1091, 45.9%) were from the national capital, Quito. Full demographic characteristics are shown in Table 2.

The correct answer rates for the 12 questions on the COVID-19 knowledge questionnaire ranged from very low (with only 13.8% answering correctly that zoonotic transmission is not a major pathway) to near universal knowledge (with 98.6% answering correctly that isolating positive cases and avoiding crowded places each are appropriate responses to COVID-19). Table 1 reports correct answer rates for each item. The mean COVID-19 knowledge score was 9.88 (SD 1.46, range 0–12), suggesting a moderate to high rate of knowledge. Knowledge scores significantly differed among educational levels, with individuals who had only completed elementary education scoring significantly lower than all other education levels, and individuals who held a master's

Table 2 Demographic characteristics and COVID-19 knowledge score differences

Characteristics	Number of Participants (%)	Knowledge Score (mean ± standard deviation)	t/F	p
Gender				
Male	888 (37.0)	9.94 (1.33)		
Female	1491 (62.5)	9.89 (1.38)	.834	.40
Other	8 (0.3%)	–-[†]		
Age-grouping				
18–29	723 (30.1)	9.86 (1.26)		
30–49	1197 (49.9)	9.93 (1.38)		
50 +	463 (19.3)	9.98 (1.38)	1.32	.27
Marital status				
Single-never married	986 (41.1)	9.89 (1.29)		
Married	1106 (46.1)	9.96 (1.39)		
Separated	71 (3.0)	9.76 (1.33)		
Divorced	201 (8.4)	9.78 (1.39)		
Widowed	22 (0.9)	10.41 (1.05)	1.92	.10
Education				
Elementary	19 (0.8)	8.84_{a} (1.34)		
Secondary	259 (10.8)	9.37_{b} (1.88)		
Bachelor's degree	1227 (51.1)	9.93_{b} (1.24)		
Master's degree or higher	880 (36.7)	10.08_{c} (1.24)	23.55	.00
Occupation				
Manual labor	125 (5.2)	9.78_{ab} (1.20)		
Office work	533 (22.2)	9.87_{b} (1.32)		
Sales or service	244 (10.2)	9.90_{b} (1.30)		
Education sector	319 (13.3)	9.91_{b} (1.26)		
Health sector	446 (18.6)	10.35_{c} (1.14)		
Student	325 (13.5)	9.83_{b} (1.23)		
Housewife/househusband	178 (7.4)	9.70_{ab} (1.69)		
Unemployed	208 (8.7)	9.64_{a} (1.52)	9.58	.00
Residence				
Ambato	36 (1.5)	10.03 (1.08)		
Cuenca	137 (5.7)	10.02 (1.19)		
Guayaquil	315 (13.1)	9.88 (1.63)		
Ibarra	20 (0.8)	10.45 (1.05)		
Loja	77 (3.2)	9.83 (1.51)		
Machala	25 (1.0)	10.00 (1.22)		
Manta	33 (1.4)	10.00 (1.25)		
Portoviejo	23 (1.0)	9.70 (1.40)		
Quito	1091 (45.9)	9.97 (1.24)		
Riobamba	21 (0.9)	10.19 (0.70)		
Santo Domingo de los Tsáchilas	21 (0.9)	9.52 (2.14)		
Other large city[‡]	116 (4.8)	9.83 (1.37)		
Not in a Large City	461 (19.2)	9.84 (1.30)	1.05	.40

Notes Participants who did not report excluded, totals do not add to 2399 within demographic groupings
t/F indicates t values between two groups in independent sample t-tests or F values for ANOVA tests
p indicates level of statistical significance; means with different subscripts differ at $p < 0.05$ level
[†]Excluded from further analysis because test assumptions violated
[‡]Other Large Cities are all self-reported cities with fewer than 20 respondents naming that city

degree or higher scoring higher than all other educational levels. Knowledge scores also differed by employment status, with persons who were unemployed, househusbands/housewives, or manual laborers scoring lowest, and individuals who work in health and medicine scoring highest (see Table 2). Gender, age, marital status, and place of residence were not associated with differences in levels of knowledge.

Respondents displayed mixed opinions regarding whether COVID-19 will be successfully controlled. Almost one-half of the participants (n = 1134; 47.5%) agreed that COVID-19 will eventually be successfully controlled, while about one-fifth (n = 504; 21.1%) disagreed. The remainder (n = 750; 31.4%) stated that they did not know. Respondent's attitudes toward final success differed significantly by all demographic variables (see Table 3). Overall, the binary logistic regression model successfully classified 69.9% of cases and explained about 9% of all variance in attitudes to toward final successful control of COVID-19 (Nagelkerke R2 = 0.088; "Don't Know" excluded). Binary logistic regression revealed that women were less likely to predict successful control than men were (OR 0.70; (95% CI 0.56, 0.90) $p < 0.01$). Additionally, older participants were more likely to believe successful control will eventually be attained (oldest group as compared to younger groups, OR 1.42 (95% CI 1.03, 1.96, $p < 0.05$). Participants holding Bachelor's or Master's degrees were more optimistic as compared to those with less schooling (OR 1.50 (95% CI 0.31, 0.79), $p < 0.01$ and OR 1.27 (95% CI 057, 0.95), $p < 0.05$, respectively). Participants who predicted unsuccessful control displayed lower levels of knowledge than those who predicted successful final control (OR 0.90 (95% CI 0.83, 0.99), $p < 0.05$). Although preliminary Chi-square analyses indicated significant differences by occupation type, place of residence and marital status, they did not emerge as significant predictors in the regression model.

Similar to their view regarding the global situation, participants reported mixed opinion as to whether Ecuador will successfully control COVID-19. About two-thirds of participants (n = 1510; 63.5%) were confident that Ecuador would succeed, while the remainder disagreed (n = 868; 36.5%). Respondent's attitudes toward Ecuador's success differed significantly by several demographic variables: gender, age, marital status, city of residence, as well as knowledge (see Table 3). Overall, the binary logistic regression model successfully classified 64.0% of cases and explained about 8% of all variance in attitudes to toward Ecuador's winning the battle against COVID-19 (Nagelkerke R2 = 0.077). Binary logistic regression revealed that, as participants were older, they were more likely to believe successful control will eventually be attained (middle group as compared to youngest, OR 2.73 (95% CI 1.94, 3.85), $p < 0.01$; oldest group as compared to younger groups, OR 2.03 (95% CI 1.56, 2.64), $p < 0.01$). Divorced persons were more optimistic as compared to all other groups (OR 5.40 (95% CI 1.12, 25.92); $p < 0.05$). Although preliminary t-test analysis indicates significant differences by knowledge, and although Chi-square analyses indicated significant differences by place of residence and gender, they did not emerge as significant predictors in the regression model.

In the realm of practices, participants overwhelmingly stated that they followed approved practices. Most participants (n = 2122; 88.7%) stated that they have not gone to a crowded place in the prior week. Respondent's self-report that they had avoided crowded places differed significantly by gender, age grouping, marital status, and place of residence (see Table 4). Overall, the binary logistic regression model successfully classified 88.7% of cases and explained about 9% of all variance in approaching or avoiding crowded places (Nagelkerke R2 = 0.089). Binary logistic regression revealed that men were less likely to have avoided crowded places than women (OR 0.62 (95% CI 0.47, 0.82); $p < 0.01$). Furthermore, as participants were younger, they were less likely to have avoided going to crowded places (youngest group as compared to middle group, OR 0.41 (95% CI 0.23, 0.73), $p < 0.01$; younger groups as compared to oldest groups, OR 0.70 (95% CI 0.19, 0.48), $p < 0.01$). Persons who were single-never married were more likely to have gone to crowded places than all other groups (OR 1.47 (95% CI 0.07, 4.21), $p < 0.05$). Residents of some cities, specifically Guayaquil (OR 0.56 (95% CI 0.23, 0.56), $p < 0.01$), Machala (OR 0.28 (95% CI 0.12, 0.86), $p < 0.05$), Manta (OR 0.34 (95% CI 0.13, 0.78), $p < 0.05$), or Santo Domingo de los Tsáchilas (OR 0.27 (95% CI 0.09, 0.81), $p < 0.05$) were less likely to have avoided crowded places. Although preliminary t-test analyses indicated significant differences by knowledge and chi-square analyses by occupation type, they did not emerge as significant predictors in the regression model.

Similarly, most participants (n = 2212; 93.2%) reported that they had worn a face mask when they had left the home in the prior week. Respondent's self-report that they had worn a mask whenever they leave the home differed significantly by all demographic variables except marital status (see Table 4). Overall, the binary logistic regression model successfully classified 93.4% of cases and explained about 9% of all variance in mask wearing (Nagelkerke R2 = 0.087). Binary logistic regression revealed that women were less likely to report wearing masks than men (OR 0.56 (95% CI 0.37, 0.83); $p < 0.01$). City dwellers were more likely to wear masks compared participants who reported living outside of big cities (OR 2.65 (95% CI 1.47, 4.76), $p < 0.01$). Although preliminary Chi-square analyses indicated significant differences by educational level, occupation type, marital status, and t-test indicated significant differences by knowledge they did not emerge as significant predictors in the regression model.

Table 3 Attitudes towards COVID-19 by demographic variables

Characteristics	Attitudes, n (%) or mean (s.d.)				
	A1. Ultimate success in controlling			A2. Confidence of winning in Ecuador	
	Agree	Disagree	Don't Know	Yes	No
Gender					
Male	506 (57.0%)	184 (20.7%)	197 (22.2%)	588 (66.7%)	294 (33.3%)
Female	624 (41.9%)	315 (21.2%)	549 (36.9%)**	916 (61.7%)	569 (38.3%)*
Age-grouping					
18–29	322 (44.7)	187 (25.9%)	212 (29.4%)	386 (53.7%)	333 (46.3%)
30–49	543 (45.4%)	246 (20.6%)	408 (34.1%)	754 (63.2%)	439 (36.8%)
50 +	265 (57.4%)	69 (14.9%)	128 (27.7%)**	364 (79.3%)	95 (20.7%)**
Marital status					
Single-never married	422 (42.9%)	258 (26.2%)	304 (30.9%)	553 (56.3%)	429 (43.7%)
Married	569 (51.5%)	189 (17.1%)	347 (31.4%)	761 (69.2%)	338 (30.8%)
Separated	33 (46.5%)	15 (21.1%)	23 (32.4%)	43 (60.6%)	28 (39.4%)
Divorced	95 (47.3%)	37 (18.4%)	69 (34.3%)	132 (65.7%)	69 (34.3%)
Widowed	12 (54.5%)	4 (18.2%)	6 (27.3%)**	18 (85.7%)	3 (14.3%)**
Education					
Elementary	14 (73.7%)	2 (10.5%)	3 (15.8%)	14 (73.7%)	5 (26.3%)
Secondary	132 (51.4%)	35 (13.6%)	90 (35.0%)	176 (68.8%)	80 (31.3%)
Bachelor's Degree	589 (48.0%)	254 (20.7%)	383 (31.2%)	778 (63.7%)	443 (36.3%)
Master's Degree or Higher	396 (45.0%)	212 (24.1%)	372 (30.9%)*	538 (61.3%)	339 (38.7%)
Occupation					
Manual labor	64 (51.6%)	23 (18.5%)	37 (29.8%)	83 (67.5%)	40 (32.5%)
Office work	261 (49.0%)	105 (19.7%)	167 (31.3%)	366 (68.9%)	165 (31.1%)
Sales or service	129 (52.9%)	44 (18.0%)	71 (29.1%)	160 (66.1%)	82 (33.9%)
Education sector	151 (47.3%)	64 (20.1%)	104 (32.6%)	203 (64.2%)	113 (35.8%)
Health sector	194 (43.5%)	120 (26.9%)	132 (29.6%)	253 (56.9%)	192 (43.1%)
Student	147 (45.4%)	85 (26.2%)	92 (28.4%)	174 (53.7%)	150 (46.3%)
Housewife/househusband	92 (51.7%)	20 (11.2%)	66 (37.1%)	132 (74.2%)	46 (25.8%)
Unemployed	88 (42.3%)	40 (19.2%)	80 (38.5%)**	129 (62.3%)	78 (37.7%)
Residence					
Ambato	13 (36.1%)	15 (41.7%)	8 (22.2%)	19 (52.8%)	17 (47.2%)
Cuenca	61 (44.5%)	28 (20.4%)	48 (35%)	80 (58.4%)	57 (41.6%)
Guayaquil	158(50.2%)	70 (22.2%)	87 (27.6%)	214 (68.2%)	100 (31.8%)
Ibarra	11 (55.0%)	3 (15.0%)	6 (30.0%)	11 (57.9%)	8 (42.1%)
Loja	42 (54.5%)	9 (11.7%)	26 (33.8%)	58 (76.3%)	18 (23.7%)
Machala	17 (68.0%)	0 (0.0%)	8 (32.0%)	21 (84.0%)	4 (16.0%)
Manta	17 (51.5%)	4 (12.1%)	12 (36.4%)	20 (60.6%)	13 (39.4%)
Portoviejo	12 (52.2%)	3 (13.0%)	8 (34.8%)	19 (82.6%)	4 (17.4%)
Quito	478 (43.9%)	241 (22.1%)	371 (34.0%)	663 (61.0%)	423 (39.0%)
Riobamba	14 (66.7%)	6 (28.6%)	1 (4.8%)	13 (61.9%)	8 (38.1%)
Santo Domingo de los Tsáchilas	9 (42.9%)	3 (14.3%)	9 (42.9%)	14 (66.7%)	7 (33.3%)
Other large city[†]	56 (48.3%)	20 (17.2%)	40 (34.5%)	73 (62.9%)	43 (37.1%)
Not in a large city	236 (51.2%)	100 (21.7%)**	125 (27.1%)	294 (64.1%)	165 (35.9%)*
Knowledge	9.99 (1.24)	9.91 (1.31)	9.81 (1.46)[‡]	9.92 (1.36)	9.93 (1.30)

Notes Participants who did not report excluded, totals do not add to 2399 within demographic groupings

[†]Other Large Cities are all self-reported cities with fewer than 20 respondents naming that city

*Chi-square values significant at $p < 0.05$

**Chi-square values significant at $p < 0.05$

Table 3 (continued)

‡For A1, F value for ANOVA, t value for t-test for A2 significant at $p < 0.01$

Nearly all participants (n = 2300; 96.6%) stated that they had washed their hands for at least 20 s every time after returning home or touching another person. Respondent's self-reports of handwashing significantly by age, marital status, and knowledge (see Table 4). Overall, the binary logistic regression model successfully classified 69.9% of cases and explained about 8% of all variance in handwashing (Nagelkerke R2 = 0.075). Binary logistic regression revealed that persons who were unemployed were most likely to report always handwashing as compared to all other employment groups (OR 4.09 (95% CI 1.41, 16.35), $p < 0.05$). Persons who reported not always handwashing held lower levels of knowledge than those who reported always handwashing (OR 0.81 (95% CI 0.71, 0.93), $p < 0.01$). Although preliminary Chi-square analyses indicated significant differences by age and marital status, they did not emerge as significant predictors in the regression model.

Most participants stated that they had not left home in the prior week (n = 2130; 88.8%). Among those (n = 269) who had left the home the week before the survey, a majority had only left the home once (n = 151; 56.1%). Seventy-eight (29.0%) had left home two or three times, and only 40 people (14.9% of those who had left home, 1.7% of the total sample) had been outside their home four or more times. Most people who had left the home reported maintaining a distance of at least two meters from other people (n = 211; 78.4%), with the rest (n = 58; 21.6%) admitting that they had not maintained distance. Reasons reported for leaving home included performing essential work (n = 69; 25.6%), purchasing food for self, family, or pets (n = 190; 70.6%), purchasing medicine (n = 62; 23.0%), or visits to physicians or veterinarians (n = 18; 6.7%). Indeed, of the 269 people who had ventured outside, only one had left for a reason other than essential travel; he reported leaving home to purchase marijuana.

Discussion

This study was conducted during the COVID-19 outbreak in Ecuador. These findings outline areas that should be addressed by the Ministry of Health in Ecuador, the private sector, and non-profit actors to help prevent the spread of SARS-CoV-2.

In comparison to Zhong et al.'s Chinese sample, the Ecuadorian participants reported a substantially lower rate of knowledge about COVID-19. Among the Chinese sample, participants scored 90% on the knowledge questionnaire; however, Ecuadorian participants answered 82.3% questions correctly. Transformed into school marking terms, their grades were a letter grade lower, indicating substantial room to educate the population about SARS-CoV-2/COVID-19. Our data indicate that four items should be specifically addressed. First, there is substantial misconception about potential zoonotic transmission that should be countered. Second, the role of medical masks in limiting the spread of the virus that causes COVID-19 could be promoted. Third, differences between symptoms of the common cold and of COVID-19 are often confused in our sample. Finally, the public may wish to be aware of the populations that are most vulnerable to COVID-19—older people, people with chronic illnesses, and persons who are obese—so that they may know who in their social networks are most at risk.

Promoting improved understanding of COVID-19 may also help promote confidence that COVID-19 will eventually be controlled. Less than half of the participants were confident that COVID-19 would ultimately be controlled, and only two-thirds had confidence in Ecuador's ability to defeat COVID-19. This stands in sharp contrast with Zhong et al.'s findings where over 90% of the Chinese participants believed that COVID-19 would eventually be controlled and over 97% believed that China would be successful in its battle against COVID-19. Ecuadorians, at least in this sample, are much less optimistic. Women, older people, and more highly educated people are the least optimistic about succeeding against COVID-19, representing primary targets for persuasion. This persuasion will not be a problem of simple education. Our data indicate that people with higher knowledge of COVID-19 had fewer "I don't know" answers about eventual success, but they were not more likely to believe in eventual success. Moreover, greater knowledge had no association with optimism about Ecuador's ability to win this battle. These findings indicate that greater knowledge is insufficient to change attitudes by itself. Attitudes are a primary motivator for action on threats to health [25, 33, 34]. That is, when people believe that success is likely, they are also more likely to act. Therefore, it is essential that future studies determine why people are not optimistic about the world's and Ecuador's ability to overcome COVID-19. Reasons for this could include distrust in governing institutions, pessimism about science and medicine, or other potential explanations.

Overall, participants in this study reported adopting the practices recommended to limit the spread of COVID-19. A supermajority of the participants reported avoiding crowded places, always wearing a mask when outside the home, and washing their hands for at least 20 s upon returning home. When leaving their home, usually once a week, participants reported having done so for essential purposes,

Table 4 COVID-19 Control Practices by demographic variables

Characteristics	Practices, n (%) or mean (s.d.)					
	P1. Going to Crowded Places		P2. Wearing a Mask		P3. Handwashing	
	Yes	No	Yes	No	Yes	No
Gender						
Male	118 (13.3%)	770 (86.7%)	846 (95.6%)	39 (4.4%)	852 (96.4%)	32 (3.6%)
Female	151 (10.1%)	1340 (89.9%)*	1356 (91.9%)	120 (8.1%)**	1436 (96.7%)	49 (3.3%)
Age-grouping						
18–29	83 (11.1%)	640 (88.5%)	655 (90.8%)	66 (9.2%)	685 (95.0%)	36 (5.0%)
30–49	164 (13.7%)	1033 (86.3%)	1124 (94.5%)	66 (5.5%)	1161 (97.2%)	33 (2.8%)
50+	22 (4.8%)	441 (95.2%)**	426 (93.6%)	29 (6.4%)**	447 (97.6%)	11 (2.4%)*
Marital status						
Single-never married	131 (13.3%)	855 (86.7%)	902 (91.9%)	79 (8.1%)	937 (95.3%)	46 (4.7%)
Married	104 (9.4%)	1002 (90.6%)	1030 (93.9%)	67 (6.1%)	1073 (97.5%)	28 (2.5%)
Separated	7 (9.9%)	64 (90.1%)	67 (94.4%)	4 (5.6%)	70 (98.6%)	1 (1.4%)
Divorced	27 (13.4%)	174 (86.6%)	187 (94.4%)	11 (5.6	194 (97.5%)	5 (2.5%)
Widowed	1 (4.5%)	21 (95.5%)*	21 (95.5%)	1 (4.5%)	22 (100.0%)	0 (0.0%)*
Education						
Elementary	1 (5.3%)	18 (94.7%)	16 (84.2%)	3 (15.8%)	17 (89.5%)	2 (10.5%)
Secondary	30 (11.6%)	229 (88.4%)	233 (90.7%)	24 (9.3%)	246 (95.3%)	12 (4.7%)
Bachelor's Degree	147 (12.0%)	1080 (88.0%)	1136 (93.3%)	81 (6.7%)	1175 (96.3%)	45 (3.7%)
Master's Degree or Higher	91 (10.3%)	789 (89.7%)	821 (93.8%)	54 (6.2%)	857 (97.6%)	21 (2.4%)
Occupation						
Manual labor	20 (16.0%)	105 (84.0%)	118 (94.4%)	7 (5.6%)	121 (96.8%)	4 (3.2%)
Office work	59 (11.1%)	474 (88.9%)	501 (94.4%)	30 (5.6%)	514 (97.2%)	15 (2.8%)
Sales or service	26 (10.7%)	218 (89.3%)	227 (94.2%)	14 (5.8%)	236 (97.1%)	7 (2.9%)
Education sector	43 (13.5%)	276 (86.5%)	300 (94.9%)	16 (5.1%)	306 (95.9%)	13 (4.1%)
Health sector	53 (11.9%)	393 (88.1%)	422 (95.3%)	21 (4.7%)	434 (97.5%)	11 (2.5%)
Student	28 (8.6%)	297 (91.4%)	286 (88.0%)	39 (12.0%)	310 (95.7%)	14 (4.3%)
Housewife/househusband	18 (10.1%)	160 (89.9%)	155 (90.1%)	17 (9.9%)	164 (93.7%)	11 (6.3%)
Unemployed	23 (11.1%)	185 (88.9%)	191 (91.8%)	17 (8.2%)**	203 (97.6%)	5 (2.4%)
Residence						
Ambato	2 (5.6%)	34 (94.4%)	35 (97.2%)	1 (2.8%)	36 (100.0%)	0 (0.0%)
Cuenca	11 (8.0%)	126 (92.0%)	130 (95.6%)	6 (4.4%)	129 (94.9%)	7 (5.1%)
Guayaquil	63 (20.0%)	252 (80.0%)	294 (93.6%)	20 (6.4%)	305 (96.8%)	10 (3.2%)
Ibarra	3 (15.0%)	17 (85.0%)	19 (95.0%)	1 (5.0%)	19 (95.0%)	1 (5.0%)
Loja	6 (7.8%)	71 (92.2%)	75 (97.4%)	2 (2.6%)	75 (97.4%)	2 (2.6%)
Machala	6 (24.0%)	19 (76.0%)	25 (100.0%)	0 (0.0%)	24 (96.0%)	1 (4.0%)
Manta	8 (24.2%)	25 (75.8%)	31 (93.9%)	2 (6.1%)	33 (100.0%)	0 (0.0%)
Portoviejo	2 (8.7%)	21 (91.3%)	23 (100.0%)	0 (0.0%)	23 (100.0%)	0 (0.0%)
Quito	100 (9.2%)	991 (90.8%)	1018 (94.2%)	63 (5.8%)	1042 (96.1%)	42 (3.9%)
Riobamba	4 (19.0%)	17 (81.0%)	20 (95.2%)	1 (4.8%)	21 (100.0%)	0 (0.0%)
Santo Domingo de los Tsáchilas	5 (23.8%)	16 (46.2%)	21 (100.0%)	0 (0.0%)	20 (95.2%)	1 (4.8%)
Other Large City[†]	16 (13.8%)	100 (86.2%)	93 (80.9%)	22 (19.1%)	112 (97.4%)	3 (2.6%)
Not in a Large City	42 (9.1%)	419 (90.9%)**	416 (91.0%)	41 (9.0%)**	448 (97.4%)	12 (2.6%)
Knowledge	9.86 (1.42)	9.92 (1.35)	9.94 (1.32)	9.51 (1.64) [‡]	9.93 (1.33)	9.28 (1.99) [‡]

Notes Participants who did not report excluded, totals do not add to 2399 within demographic groupings

[†]Other Large Cities are all self-reported cities with fewer than 20 respondents naming that city

*Chi-square values significant at $p < 0.05$

**Chi-square values significant at $p < 0.01$

[‡]t value significant at $p < 0.01$

and maintaining the recommended 2-m distance from other people. Men, young people, single people, and unemployed people engaged in the riskiest behaviors. Even among these populations, however, reported compliance with recommended behaviors was extremely high. Importantly, knowledge was not a predictor for avoiding crowded places or wearing a mask. Although handwashing was associated with knowledge, it only explained part of the variance. Rather than repeating information about the importance of these practices, it may be more important to look at why men, younger people, single people, and unemployed people are less likely to adopt the recommended behaviors. Expected gender roles may be encouraging men to take more risks of going out in public. Younger people may believe they are less vulnerable to COVID-19 or its complications. Single persons may have no one else in the household to purchase food and medicine or have less access to protective resources, and unemployed persons may be unable to afford to stockpile food or to purchase face masks. Additionally, many unemployed individuals in Ecuador (46.3% in 2018) subsist through informally selling products or services in the streets [35]. Certainly, the informal sector is larger in Guayaquil (40.3%), the most populous city in Ecuador, than in Quito (20.8%). These people depend on their daily earnings to survive and, therefore, may be forced to leave their homes on a daily basis. Therefore, public messaging campaigns should be accompanied by even stronger efforts to provide goods and resources to the most in need segments of the population to encourage these groups to adopt the actions recommended to prevent the spread of COVID-19.

Limitations

Although this study is the first, to our knowledge, to examine knowledge, attitudes, and practices related to COVID-19 in a South American population, there are some limitations. In our sample women, people living in urban areas and people with high levels of education were overrepresented. Greater participation of individuals from rural areas or with lower educational levels could have reduced the measured knowledge about COVID-19. Therefore, KAP towards COVID-19 among these populations deserves attention. However, in the present context, face-to-face methods of recruitment would place both researchers and participants at greater risk of COVID-19. Therefore, studies like this one should carefully weigh the potential benefits and risks of face to face data collection methods.

Conclusion

In summary, our findings indicate that people in Ecuador are likely to have moderate to high levels of knowledge related to COVID-19 and are likely to practice recommended behaviors to prevent the further spread of COVID-19. The greatest area for improvement is regarding pessimistic attitudes on the eventual control of COVID-19, which suggests that health education and outreach should not only focus on knowledge and prevention practices, but should also promote optimistic attitudes.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interests.

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