Sources of information, trust, and protective health behaviors during COVID-19 pandemic: A
UAE cross-sectional study

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Abstract

The present study has two aims (1) to identify the type of sources of information mostly used to obtain information about COVID-19 and the level of trust in those sources according to sociodemographic variables in the context of the COVID-19 in UAE and (2) to explore if the level of trust on sources of information, and citizenship are predictors of the adoption of protective behaviors to reduce the risk of being infected, considering age, gender and education as covariates. Participants (N = 1585) were recruited in April 2020 via announcements in the UAE media and through email networks. The findings indicated that the most used sources were Websites, social media, government sources, and family and friends. The sources considered more trustworthy were personal doctors, health care professionals, and government. There were differences in the use of sources and levels of trust according to age, gender, and education. Concerning the adoption of protective behaviors, there were no gender differences; however, age, education, and citizenship were significant, younger groups reported lower scores on protective behaviors, and higher educated participants reported higher adoption of protective behavior. National citizens reported lower scores on the adoption of protective behavior. The level of trust in sources of information and citizenship were predictors of the adoption of protective behavior. The use of sources of information and the level of trust vary from traditional to newly-developed sources, which can influence the adoption of protective behaviors for COVID-19. The findings suggest that the COVID-19-related contents need to be adjusted to different types of medium, considering the characteristics of the population and culture, to ensure that it is helping individuals to understand risks and develop their knowledge and skills to face the pandemic by adopting protective behaviors.

Introduction

The novel coronavirus disease (COVID-19) outbreak started in Wuhan, China, in December 2019, and quickly spread to other countries. The pathological presentation of COVID19 mimicked that of MERS (Middle Eastern respiratory syndrome) and SARS (Severe Acute Respiratory Syndrome) identified, respectively, 10 and 20 years ago [1]. However, the shortage in medical supplies, inadequate distribution of preventive measures, absence of initial coordination among infected regions within China, and unique communicability of COVID19 (long incubation period, and high transmission rate) have all contributed to the 2020 global pandemic [2]. Health authorities were particularly challenged to channel accurate information on how to protect the general population from the infection and limit the spread of the disease. Hence, public health authorities in many countries, including the United Arab Emirates (UAE), moved quickly to implement and encourage several protective measures on the personal level (i.e., wearing masks and hand hygiene), national level (i.e., social distancing) and international level (i.e., travel restrictions) [3]. However, some of these measures can be difficult to enforce, especially when their compliance cannot be easily monitored (i.e., handwashing or sanitizing in private). In the context of a pandemic as the fear spread and grows, so does misconceptions about the virus transmission and prevention, which influences health-seeking and protective behaviors [4]. Given the exponential growth of the COVID-19 pandemic, the unchecked and rapid spread of misinformation, generates confusion, hinders public trust, influences health-related behaviors, and is a pressing public health challenge to control and mitigate health measures [5]. Therefore, understanding what promotes the adoption of protective behaviors during a pandemic is particularly crucial for containing the spread of the virus.

In particular, the way new information is filtered, treated, and evaluated during a pandemic, is influenced by the individuals' daily life circumstances, as well as past experiences, including cultural factors, psychological risk orientations, traditions regarding health practices, reasoning strategies, and trust in government and public health systems [6]. Studies conducted during previous pandemics reported that psychological influence impacted engagement in protective behaviors. One factor that stood out as an essential predictor of such behaviors was trust in the source of health information [7–9]. Higher levels of trust were associated with an increase in the probability of adoption of preventive measures.

Health protective behavior

Health protective behaviors in a pandemic are categorized as following: preventive, avoidant, and management behavior [10]. Preventive behaviors involve handwashing, sanitation, and mask-wearing. Avoidant behaviors include social distancing, avoiding crowded settings, and complying with quarantine and curfew measures. Management behavior consists of seeking medical advice from health professionals.

Studies from previous infectious disease outbreaks have identified several demographic and psychological factors associated with an increase in the adoption of protective behaviors. For instance, older and more educated individuals, as well as women, reported higher rates of compliance with hygiene practices and protective behaviors [11–13]. With regard to psychological determinants, researchers found that trust in sources of health information was particularly important, as well as the perceived risk of infection [9] and the perceived severity of symptoms [11–15]. In a recent review on public perception of a pandemic, Khosravi argued that the public

perception of the severity of the disease facilitated feelings of vulnerability, which would predict a higher likelihood of adopting preventive measures [3].

Trust in information sources

The importance of trust as a predictor of protective behavior during disease outbreaks has been well documented [14,16,17]. For example, during the Ebola outbreak in Africa, researchers found that trust in authorities was positively associated with the adherence to social distance guidelines and seeking medical care in clinics in Liberia [18] and getting vaccinated in Congo [9]. Similarly, recent research during the COVID-19 outbreak has pointed out the importance of trust in compliance with protective measures; in Australia, trust in health care professionals and scientists were associated with engagement in protective behaviors [19].

Balog-Way and McComas suggested that both transparency and the government's alignment with scientific experts were important for building trust during a pandemic [20]. These authors added that transparency was particularly useful when people understood well the risks and uncertainties of the outbreak and is understood as the transmission of honest information [21]. The government's alignment with scientific experts also played an important role, since scientists are viewed as trustworthy sources of information during a pandemic. Khosravi reported that trust in the government to convey uncensored information, even incomplete, would also contribute to adopting protective and preventive behaviors [3].

Demographics and trust in sources of information

There is evidence in the literature that various demographic variables such as age, income, and gender may influence internet health-seeking behaviors [22]. Moreover, there seems to be a consensus in the literature that young and highly educated individuals use and trust the information on the internet more often than older individuals due to their ability to judge credibility cues, and customer reviewers more efficiently [22,23]. Older individuals placed less trust within internet sources compared to middle-aged individuals, and ranked sources as internet, television as least trusted, followed by newspapers, friends and relatives, and most trusted were health experts (e.g., pharmacists) [24]. The debate on gender differences is ongoing, with some studies suggesting that women go online and trust the sources more than men, whereas other studies reveal no gender differences [22].

As for the influence of culture use and trust of healthcare services, Berger et al. urge for transparent communication in times of COVID19 as the data are dynamic and continuously evolving [25]. Berger et al. also raised historical reasons for mistrust of healthcare professionals among particularly underserved populations and the importance of delivering health messages and ensuring protective behaviors equitably [25]. In an attempt to investigate ethnic minorities, a comparative study between residents of Guam and national US mainland data was conducted to determine the demographic factors that impact health-seeking and trust of healthcare-related information [26]. The national data were taken from the Health Information National Trends Survey (HINTS) report. The results showed that when the need was strong, Guam residents would turn to the internet first whilst the US would turn to health professionals. In ranked order, both groups reported medical doctors to be most trustworthy, followed by governmental agencies and the internet. Moreover, a cross-cultural study conducted in metropolitan cities of the US, Hong Kong, and South Korea revealed that individuals from America, Hong Kong, and South

Korea had high levels of trust in social media with Hongkongers holding the highest levels of trust [27]. Moreover, in a similar study comparing the same three groups, Song et al. found a significant and higher trust of experience-based health knowledge (found in social network sites and blogs) in both Hongkongers and Koreans versus Americans [28]. Furthermore, Hongkongers and Koreans searched experience-based knowledge more often than Americans for health information.

These studies showed that age, gender, education, and cultural differences seem to impact the decision to act on health information as well as the trust and search of health information.

Given the importance of culture, cognitive, and behavioral factors in managing pandemics, it is crucial to determine how trust in sources of information can be linked to engagement in protective behaviors. Although the pandemic of COVID-19 is still ongoing, it is important to understand how the perceived trustworthiness of information sources influences the adoption of personal and interpersonal protective measures among the general public. As such, the present study had the following aims: (1) To identify the type of sources of information (e.g., government, social media, mass media, interpersonal sources) mostly accessed to obtain information about COVID-19 in the UAE, and the level of trust according to sociodemographic variables, (2) to explore whether levels of trust in sources of information are predictors of the adoption of protective behavior for COVID-19.

Material and method

Participants and procedures

Participants (N = 1585) were recruited in April 2020 via announcements in the UAE media and through the email networks of UAE's National Program for Happiness and Wellbeing (2020).

Inclusion criteria were (1) for participants to be residents of the UAE and (2) aged 18 years and above. The survey was written in English and translated (using the back-translation technique) to Arabic. The sample was not representative of the whole UAE, but did it reflect many of its constituents; the UAE comprises around 85% of expatriates. The mean age was 31.94 (SD = 11.59). Females made up 83.6% of the sample, and the two most populated emirates/city-states represented, Abu Dhabi and Dubai, accounted respectively for 43.2% and 24.5 % of the sample. The majority (65%) of the sample were citizens of the UAE (Emiratis).

Ethics and survey

An online survey was disseminated in early April 2020. Ethical approval was given by Zayed University Institutional and Review Board (R201213) and Ministry of Health and Prevention Research Ethics Committee (MOHAP/DXB-REC/ MMM/No. 49/2020). The survey included online consent form - where participants had to manually click and agree to proceed - socio demographic questions, sources of information, and level of trust in obtaining information about COVID-19, as well as the adoption of protective behaviors to reduce the risk of infection.

Sociodemographic variables

The sociodemographic characteristics included age, gender, education, and citizenship. Age was measured as a continuous variable. For the group comparison analysis, some of the variables were recoded. Age was recoded into 4 groups (18 -24) (25 - 34) (35 - 44) (+45). Education was recoded into two groups (1 from primary to high school and 2 College/University). Citizenship was recoded as (1) UAE citizen (2) non-UAE citizen.

Sources of information and level of trust

Two questions were designed to inquire about the amount of information obtained from several sources and the level of trust in those sources: How much information about COVID-19 have you obtained from each of these sources? (ranging on a four-point Likert scale None (1) A little (2) Some (3) A lot (4)), and How much do you trust the information from each of these sources? (using the same Likert scale). The sources of information included were Newspapers, TV, radio, websites, social media, personal doctors, other health care professionals, Government sources, and family and friends. Higher scores indicate a higher amount of information obtained and higher levels of trust in that source.

Protective behavior for COVID-19

A Composite score of protective behavior for COVID-19 was computed by adding the variables measuring behavior such as wearing a mask, respiratory etiquette, washing hands, and using sanitizer. The scores range from 1 (no) 2 (occasionally) and 3 (regularly).

Statistical analysis

Descriptive and non-parametric analyses for ordinal data (Wilcoxon, Mann-Whitney and Kruskal-Wallis tests) were used to probe the use of sources of information and trust tabulated by socioeconomic variables. For paired comparisons, we used the Wilcoxon test. An ordinal regression analysis was carried out to probe the predictive value of the level of trust in sources of information and citizenship in predicting the adoption of protective behavior, after controlling for age, gender, and education (covariates). Considering that residents and citizens of the UAE

come from different cultural backgrounds, which may affect the adoption of protective behaviors, we added citizenship as a predictor in the model. The dependent variable (adoption of protective behaviors) was ordinal with three response categories. The predictor variables, level of trust in different sources of information, were recoded into dummy variables (yes/no) and checked for multicollinearity. The proportional odds assumption was tested with the parallel lines test ($\chi^2(117) = 131.64, p=.168$). All statistical analyses were performed with IBM SPSS Statistics, version 26 [29]. The threshold for results to be considered significant was $p=.05$. The dataset is found in S1 File.

Results

(1) To identify the type of sources of information (e.g., government, social media, mass media, interpersonal sources) mostly accessed to obtain information about COVID-19 in the UAE, and the level of trust according to sociodemographic variables we used a descriptive analysis to look at the distribution of the frequencies of the amount of information obtained from different sources and the level of trust in the information obtained from those sources (Fig 1). The most used sources of information were social media, websites, government sources, and family and friends. The sources considered more trustworthy were Government sources, personal doctors, and other health care professionals, and TV. We also tested for differences between the amount of information obtained from the sources and the level of trust, using a Wilcoxon test. There was a significant difference between the amount of information obtained from all the different sources and the level of trust in those sources (Fig 1) Participants report to obtained high amounts of information from websites ($W=44664, p<.001$, social media ($W=24293, p<.001$) and family and friends ($W=55612, p<.001$), but with a low level of trust. Concerning newspapers

224 (W=437947.5, $p < .001$), TV W=256424, $p < .001$, radio (W=437054, $p < .001$, personal doctors
 225 (W=730874, $p < .001$), health care professionals (W=473959, $p < .001$) and the government
 226 (W=152369, $p < .001$), there are lower amounts of information but a high level of trust.

227
 228 **Fig 1. Amount of Information Obtained from Different Sources and Level of Trust**

229

230 **Differences according to sociodemographic variables**

231 **Gender**

232 There were statistically significant differences between males and females on the mean ranks of
233 information obtained from newspapers ($U=146759.0$; $p<.001$), radio ($U=158906.0$; $p = .043$)
234 social media ($U=148937.5$; $p< .000$), health care professionals ($U=149416.0$; $p=.006$),
235 government sources ($U=151038.5$; $p=.004$) and family and friends ($U=131796.0$; $p<.001$, as well
236 as in the level of trust in TV ($U=151404.0$; $p = .007$) and social media ($U=148899.5$; $p=.002$).
237 Females obtain higher amounts of information than males, except for newspapers and radio, and
238 have higher levels of trust in TV and social media than males (Table 1 and 2)

Table 1. Differences in Sources of Information Among Sociodemographic Variables

Variables Mean Ranks		N	Newspapers	TV	Radio	Websites	Social Media	Personal Doctors	Other Healthcare Professionals	Government	Family and Friends
Gender ^a	Females	1325	760.50	783.50	770.71	786.36	805.08	778.49	793.33	800.14	811.62
	Males	260	845.47	771.28	790.92	781.14	706.78	766.35	712.16	716.70	644.85
	U		146759.00	164551.00	158906.00	168644.00	148937.50	162269.00	149416.00	151038.50	131796.0
	Signif.		.000 ***	.068	.043*	0.84	.000***	.639	.006**	.004**	.000***
Age group ^b	18-24 yrs. old	608	661.59	737.66	695.27	777.50	909.54	690.48	737.64	860.88	941.67
	25-34 yrs. old	345	730.89	731.59	751.27	793.85	784.56	813.88	819.04	779.83	722.17
	35-44 yrs. old	389	875.82	826.43	844.48	806.50	727.42	846.90	802.88	738.78	713.15
	+45 yrs. old	243	964.04	891.20	894.31	760.02	591.86	828.19	793.81	686.47	590.35
	H (3)		128.04	29.79	65.01	2.42	129.54	52.15	9.97	37.62	145.48
	Signif.		.000***	.000***	.000***	.491	.000***	.000***	.019*	.000***	.000***
Education ^a	Primary to high school	452	672.54	746.24	711.41	758.51	905.50	699.26	700.72	832.32	939.39
	University degree	1133	814.86	795.37	798.88	796.18	742.63	807.06	811.17	768.35	722.93
	U		198666.5	231629.0	216000.0	238301.0	200926.5	210654.0	211297.5	230662.000	181125.0
	Signif.		.000***	.045*	.000***	.093	.000***	.000***	.000***	.006**	.000***
Citizenship ^a	UAE	1023	683.61	767.11	729.21	787.08	874.93	740.47	766.12	831.85	864.62
	non-UAE	562	937.57	807.61	854.74	782.63	632.95	841.22	804.84	703.87	638.66
	U		184996.0	264954.0	230049.5	280744.5	197370.5	240746.0	265616.5	236652.0	200250.0
	Signif.		.000***	.078	.000***	.833	.000***	.000***	.088	.000***	.000***

^a Mann-Whitney test^b Kruskal -Wallis test

* p< .05 ** p< .01 *** p< .001

Table 2. Differences in Level of Trust in Sources of Information Among Sociodemographic Variables

Variables Mean Ranks		N	Newspapers	TV	Radio	Websites	Social Media	Personal Doctors	Other Healthcare Professionals	Government	Family and Friends
Gender ^a	Females	1325	785.79	798.10	781.23	780.66	798.66	776.94	786.23	787.63	774.03
	Males	260	753.42	718.12	767.68	785.75	706.63	783.45	772.58	765.30	822.71
	U		159482.50	151404.00	163631.00	166601.00	148899.50	163843.50	164885.00	162512.50	156875.50
	p		.277	.007**	.648	.862	.002**	.818	.632	.415	.093
Age group ^b	18-24 yrs. old	608	859.18	843.48	787.04	746.54	825.36	800.10	819.60	887.42	729.00
	25-34 yrs. old	345	692.27	722.94	734.99	758.66	783.79	773.69	775.01	730.58	778.68
	35-44 yrs. old	389	756.84	750.11	804.42	832.94	765.10	756.85	760.27	718.68	820.10
	+45 yrs. old	243	743.53	781.99	780.42	818.74	706.46	762.51	745.13	704.99	858.81
	H (3)		36.51	20.25	5.06	12.39	14.07	3.10	7.87	65.94	20.42
	p		.000***	.000***	.171	.006**	.003**	.376	.049*	.000***	.000***
Education ^a	Primary to high school	452	856.68	857.26	790.61	747.87	826.83	823.36	833.07	874.29	743.65
	University degree	1133	750.10	756.30	774.38	794.86	766.19	759.99	764.48	747.96	797.27
	U		214188.5	218202.0	241607.5	233264.5	230729.5	225926.0	228099.5	209959.0	231688.0
	p		.000***	.000***	.505	.050*	.012*	.006**	.003**	.000***	.024*
Citizenship ^a	UAE	1023	798.00	819.60	779.10	763.68	820.53	791.67	796.06	833.52	742.77
	non-UAE	562	748.90	722.14	778.82	813.84	716.79	753.37	762.06	694.20	853.04
	U		261544.0	246828.5	277505.5	261496.0	244163.5	263831.0	268861.0	231265.5	240445.0
	p		.033*	.000***	.990	.026*	.000***	.079	.123	.000***	.000***

^a Mann-whitey test^b Kruskal-Wallis test

* p< .05 ** p< .01 *** p< .001

Age

There were significant differences according to the Kruskal-Wallis test by age group (original variable recoded in 4 groups) on the amount of information obtained from newspapers ($H(3)=128.04; p<.001$), TV ($H(3)=29.79; p<.001$), Radio ($H(3)=65.01; p<.000$), social media ($H(3)=129.54; p<.001$), personal doctors ($H(3)=52.15; p<.001$), other health care professionals ($H(3)=9.97; p=.019$), government ($H(3)=37.62; p<.001$) and family and friends ($H(3)=145.48; p=.000$). Younger groups of participants obtained fewer amounts of information from newspapers, TV, radio, and personal doctors than the older groups. Social media, government sources, and family and friends are significantly more used by younger groups (Table 1). Concerning levels of trust, younger groups report higher levels of trust in newspapers ($H(3)=36.51; p<.001$), TV ($H(3)=20.25; p<.001$), websites ($H(3)=12.39; p=.006$), social media ($H(3)=14.07; p=.003$), health care professionals ($H(3)=7.87; p=.049$), government ($H(3)=65.94; p=.000$), and less trust in family and friends ($H(3)=20.42; p=.000$), in comparison with older groups (Table 2).

Education

There were also differences in the amount of information obtained from different sources and trust according to the level of education. For analysis purposes, the original variable was recoded into two levels (1 - primary to high school) and (2 – college/University). The Mann-Whitney test showed significant differences in all sources of information, except for websites. Participants with higher levels of education (University diploma and postgraduates) report obtaining more information from newspapers ($U=198666.5; p<.001$), tv ($U=231629.0; p=.045$), radio ($U=230049.5, p<.001$), and personal doctors ($U=240746.0; p<.001$) and fewer amounts of

information from social media ($U = 197370.5$; $p < .001$), government sources ($U = 236652.0$; $p < .001$) and family and friends ($U = 200250.0$; $p < .001$) (Table 1). Concerning trust, participants with higher levels of education (University diploma and postgraduates) report lower levels of trust in newspapers ($U = 214188.5$; $p < .001$), TV ($U = 218202.0$; $p < .001$), social media ($U = 230729.5$; $p = .012$), personal doctors ($U = 225926.0$; $p = .006$), other health care professionals ($U = 228099.5$; $p = .003$) ' government sources ($U = 209959.0$; $p < .001$), and higher levels of trust in websites ($U = 233264.5$, $p = .050$) and family and friends ($U = 231688.0$; $p < .001$) (Table 2).

Citizenship

For citizenship, according to the Mann-Whitney test, we found significant differences in the amount of information obtained from newspapers, radio, personal doctors, social media, government, and family and friends. Local citizens obtained higher amounts of information from social media ($U = 244163.5$; $p < .001$), government ($U = 236652.0$; $p < .001$), and family and friends ($U = 200250.0$; $p < .001$) (Table 1). For levels of trust, significant differences were found in newspapers, TV, websites, social media, government, and family and friends. Local citizens reported higher levels of trust in newspapers ($U = 261544.0$; $p = .033$), TV ($U = 246828.5$; $p < .001$), social media ($U = 244163.5$; $p < .001$) and government ($U = 231265.5$; $p < .001$) and lower levels of trust in websites ($U = 261496.0$; $p = .026$) and family and friends ($U = 240445.0$; $p < .001$), in comparison with non-UAE citizens (Table 2).

(2) to explore whether levels of trust in sources of information are predictors of the adoption of protective behaviors for COVID-19, an ordinal regression model was used to test the predictive value of the level of trust in sources of information, and the citizenship of residents (UAE vs.

non-UAE) as predictors of the probability of the adoption of protective behavior for COVID-19, after controlling the effects of age, gender and education (2 groups). An increase in age (expressed in years) was associated with an increase in the odds of adopting protective behavior for COVID-19 [OR= 1.023 (95% CI, 1.011 to 1.034), Wald $\chi^2(1) = 15.669$, $p < .000$]. By an increase in age, participants were 2.32 % more likely to adopt protective behavior. Concerning education, an increase in the level of education (from high school to University level) was associated with an increase in the odds of adopting protective behavior for COVID-19 [OR= 1.938 (95% CI, 1.514 to 2.482), Wald $\chi^2(1) = 27.584$, $p < .000$]. No significant effect of gender as a covariate was found. Trust in information from social media and government sources increases the probability of adopting protective behaviors to prevent infection [OR = 1.605 (95%CI, 1.265 to 2.037), Wald $\chi^2(1) = 15.172$, $p < .000$]; [OR = 1.347 (95%CI, 1.017 to 1.783), Wald $\chi^2(1) = 4.332$, $p = 0.037$], respectively. Participants who trust in social media and government sources were 60.5% and 34.7% (respectively) more likely to adopt protective behaviors to reduce the risk of infection by COVID-19, than those who do not trust on these sources. Being a citizen of the UAE reduces the probability of adopting protective behavior for COVID-19 [OR = 0.668 (95%CI, 0.524 to 0.852), Wald $\chi^2(1) = 10.522$, $p < .000$]. Citizens from UAE were 33.1% less likely to adopt protective behaviors to reduce the risk of infection for Covid-19 (Table 3).

Table 3. Ordinal Regression Model, Estimates, Standard-errors, Significance, Odd Ratio and 95% Confidence Intervals

Ordinal Regression (logit)		Estimate	SE	Wald	df	p	95% Confidence Interval			OR 95% Confidence Interval	
							Lower Bound	Upper Bound	OR	Lower Bound	Upper Bound
Covariates	Age	0.023	0.006	15.669	1	0.000***	0.012	0.034	1.023	1.012	1.035
	Gender	-0.109	0.139	0.615	1	0.433	-0.380	0.163	0.897	0.684	1.177
	Education	0.662	0.126	27.584	1	0.000***	0.415	0.909	1.939	1.514	2.482
Predictors Level of trust	Newspapers	-0.013	0.132	0.010	1	0.921	-0.273	0.246	0.987	0.761	1.279
	TV	0.136	0.138	0.963	1	0.326	-0.135	0.407	1.145	0.873	1.502
	Radio	0.063	0.132	0.226	1	0.634	-0.196	0.321	1.064	0.822	1.379
	Websites	0.098	0.112	0.765	1	0.382	-0.121	0.317	1.103	0.886	1.373
	Social media	0.474	0.122	15.172	1	0.000***	0.235	0.712	1.605	1.265	2.038
	Personal doctors	-0.032	0.173	0.033	1	0.856	-0.371	0.308	0.968	0.690	1.360
	Health care professionals	-0.087	0.168	0.269	1	0.604	-0.416	0.242	0.917	0.659	1.274
	Government	0.298	0.143	4.332	1	0.037*	0.017	0.578	1.347	1.016	1.783
	Family and friends	-0.049	0.111	0.193	1	0.661	-0.266	0.169	0.952	0.766	1.184
	Citizenship	-0.403	0.124	10.522	1	0.001***	-0.646	-0.159	0.669	0.524	0.853

* p< .05 ** p< .01 *** p< .001

Discussion

In the present study, we identified the most accessed sources of information for COVID-19 in UAE and the level of trust in those sources according to sociodemographic variables. There were significant differences in gender, age groups, and education concerning the amount of information obtained from different sources and the level of trust in those sources. The level of trust in social media and government sources, as well as citizenship, were significant predictors of the adoption of protective behaviors to reduce the risk of infection by COVID-19 after controlling the effects of age, gender and, education. Age and education were significant for the adoption of protective behaviors.

Various factors, including sociodemographic characteristics, social context, and individual values, can affect worry about a pandemic [6,30], and that might have implications for seeking information and for adopting protective behaviors. In the present study, gender differences were consistent with previous research, in which women seek more information from different sources, and have higher levels of trust in social media and TV than men [22]. Concerning age, younger participants obtained fewer amounts of information from traditional media and use more social media, government sources and, family and friends than the older groups.

Education seems to influence the use of sources of information, as well as the level of trust.

Higher educated participants reported obtaining more information from traditional sources (mass media and health care professionals) and less from social media, government and, family and friends, suggesting the need to adjust contents of the different online and offline health information sources to reduce information gaps for different levels of education.

Overall, there were significant differences between the amount of information obtained and the level of trust in each source. This finding suggests that prompt access to information does not

mean trustworthy information, which has been found in line with recent studies [31,32].

Nowadays, the circulation and manipulation of information are activities that encompass many aspects of cultural, economic, and social life, for what individuals might be increasingly aware of. Since the coronavirus outbreak has not been the first pandemic witnessed in the age of social media, all the outbreaks (the H1N1 virus, swine flu in 2009, Ebola virus in 2014, and Zika virus in 2015) had extensive documentation and considerable influence on social media [33] which might have influenced shared past experiences concerning sources and trust on health information.

Trust in social media and government were significant contributors to the adoption of protective behaviors. This finding is consistent with a previous study in which trust in formal (government/media) information about influenza (H1N1) was associated with higher reported hand hygiene [8]. Previous research has also shown that at the H1N1 influenza outbreak, participants reported that they first knew about it through one form of media, suggesting the importance of mass media as an information source [34]. Trust is central to how public health messages are heard, interpreted, and responded to and can determine whether communications are successful in increasing motivation and intention to adopt or maintain recommended self-protective actions during a pandemic [6]. It has been demonstrated that for social media, resources such as Facebook, Twitter, Instagram, Google+, and other social tools have created innovative opportunities to draw the interactions between social connectivity and health, and contributed significantly to new insights into the dynamics of opinions on health-related behaviors [35]. The findings of the present study suggest that trust in social media can be associated with sharing information from different sources, including scientific findings and government information, ease of use, and type of content, which may have a positive effect on

trust and credibility formation. This is consistent with a recent study that argued that trust plays an essential part in managing a threat by affecting the public's judgments about the risks and the related benefits [3]. The same author states that trust is believed as the central core of hearing, interpreting, and responding to public health messages, and it can indirectly impact the adoption of the recommended measures. Our findings suggest that concerning protective behaviors the public is more likely to seek information from government sources, to make sure an official source verifies it. Previous research during a pandemic has stated the importance of the government providing information about risk and the effectiveness of preventive or protective actions in collaboration with health care providers, to control the spread of the disease [36]. Further, we found that citizenship is a predictor of protective behaviors. The participants are from different cultural groups and likely to be influenced by various aspects of socio-cultural nature, which suggests the need to invest in identifying sources of information that are credible to different audiences, to promote protective behavior as a way of aligning individual and collective interests, promoting the in-group feeling, as suggested by recent research [37]. Other questions may arise from the findings. For instance, when individuals are repeatedly exposed to health-related information, they may develop defensive reactions [38]. They may also discount information based on social comparison and reactions to how the information is framed by the media and shared in the community [39]. This may have implications for the adoption of protective behaviors, in the real-life setting of the COVID-19 pandemic.

The growing popularity of social media offered new approaches to health issues [40]. The present findings give further support to the significance of social media platforms and government sources as trustworthy sources of information for COVID-19. These sources of information are Internet-based, and its preference over traditional sources (e.g., mass media)

relates to its speed, variety, and easier access, not so much to the accuracy of the online information [40]. Previous research argued that there is a consensus that website design, including layout, interactive features, and the recognition of the owner have a positive effect on trust or credibility [41]. However, and according to a recent study, in a pandemic situation like the Covid-19 outbreak, social media become the most-searched venue for information-gathering. There is a daily-basis challenge to control the spreading of information and misinformation, including sensationalism and fake news, making it crucial for governments and experts to fight the pandemic as well as the infodemic [33]. New digital platforms, such as social media and online support groups, allow a growing number of people to find peers who experience similar medical conditions or concerns or to follow others' experiences of health [28]. The use of the internet as a significant source of health information raises the issue of source credibility and trust, as well as the need to consider target groups to tailor information accordingly.

The increase in the use of online health information has implications for the accuracy of information provided to those who retrieve it, particularly during a pandemic. Different sources of information from traditional to newly-developed can influence decisions, and the adoption of protective behaviors for COVID-19. Using online health information more critically can help individuals to take control of their health decisions and suitable protective behaviors. The COVID-19-related contents need to be adjusted considering the characteristics of the population and culture, to ensure that it is helping individuals to understand risks and develop their knowledge and skills to face the pandemic. Also, due to the continued and increased use of the internet as a source of information, credible and accurate data, as well as appropriate access to new technology, needs to be ensured to promote accessibility to sources of health information, trust, and the adoption of protective behaviors for COVID-19.

The present study has some limitations we would like to acknowledge. First, its cross-sectional nature does not allow us to investigate changes in behavior over time. We used an opportunistic sample, non-representative of the population of the UAE. We considered trust and credibility as similar aspects of the same concept, being aware that there is some debate over this issue. However, we consider that the present study contributes to explore further the role of sources of information and trust in predicting the adoption of protective behavior for COVID-19 in the UAE context.

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Supporting information

S1 File. Analysis dataset.