"Public Health Behaviors during the COVID-19 Pandemic in Greece and Associated Factors: A Nationwide Cross-sectional Survey"

Kyriakos Souliotis, PhD[1,2], Theodoros V. Giannouchos, PhD, MSc[3] iD,
Lily E. Peppou, MSc[4,5], Myrto T. Samara, MD, PhD[6], John Nimatoudis, MD, PhD[6],
Charalambos Papageorgiou, MD, PhD[4], and Marina Economou, MD, PhD[4,5]

Abstract

The objective of this cross-sectional survey was to estimate the association between multiple socioeconomic, and health-related characteristics, COVID-19 related attitudes and adoption of public health preventive behaviors. A national cross-sectional survey among 1205 adults was conducted in April 2020 in Greece. Multivariable ordered logistic regression models were used to estimate the association between COVID-19 related attitudes and knowledge and adoption of preventive behaviors, controlling for socioeconomic and health-related characteristics. A total of 923 individuals fully completed the survey. Individuals who believed that the virus is out of control, is transmitted through the air, and is not similar to the common flu were more likely to adopt public health preventive behaviors more frequently, particularly wearing masks in public spaces, washing their hands, and spending fewer hours out of their homes. Uncertainty about the virus symptomatology was associated with less frequent mask-wearing and handwashing. Increased social support, frequent media use for COVID-19 updates, trust to authorities, older age, worse health status, female gender and being a healthcare professional were also associated with uptake of some preventive health behaviors. Attitudinal and socioeconomic determinants critically affect public engagement in preventive behaviors. Health policy initiatives should focus on community outreach approaches to raise awareness and to strengthen social support mechanisms by integrating multiple stakeholders.

Keywords

preventive health behaviors, COVID-19, public health, health policy, coronavirus, survey, masks, hand disinfection, risk factors

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What do we already know about this topic?
Attitudes and knowledge about the current COVID-19 influence uptake of preventive health behaviors.

How does your research contribute to the field?
We found that individuals who believed that the virus is out of control, is transmitted through the air, is not similar to the common flu, who used media often for COVID-19 updates and trusted authorities were more likely to adopt preventive behaviors more frequently.

What are your research's implications toward theory, practice, or policy?
Strengthening social support mechanisms and community-wide approaches that integrate multiple stakeholders are critical to promote preventive behaviors.

Introduction

In response to the exponential escalation of the novel corona-virus disease 2019 (COVID-19), multiple countries introduced a series of unprecedented and aggressive medical and public health policies to restrict social interactions and to minimize the transmission of the virus.[1] Among those, the most notable decisions included wearing masks in public spaces, imposing shelter in place and social distancing orders, closing non-essential businesses, avoiding the use of public transport and banning large social gatherings.

In spite of the importance of adhering to these measures, converging evidence indicates that people's preventive health behaviors are unsatisfactory.[2-6] For example, Chen and colleagues have substantiated that 60% of primary school students engaged into improper handwashing behaviors in China during the pandemic, while a recent study among the Greek population found that 40% of individuals were not using a face mask and 60% did not wash their hands properly.[5,6] Concomitantly, evidence from a cohort study of Polish secondary school students showed that while hand-hygiene behaviors were improved during the pandemic, they were still deemed unsatisfactory.[4]

Compliance with these measures largely depends on individuals' knowledge and perceptions towards COVID-19 and the risks associated with it. Recent studies reported positive associations between higher levels of COVID-19 fear and higher COVID-19 knowledge scores and engagement in preventive behaviors.[7-9] Respondents with better knowledge or more positive attitudes towards COVID-19, individuals who perceive a high risk of contracting or being harmed by the virus and those who have greater trust in the government have been shown to be more likely to adopt the preventive measures.[2,3,7-10] The line of research addressing knowledge, attitudes and practices related to COVID-19 pandemic, has substantiated variability across various countries and settings.[2,3,5,6,9,11,12]

Beyond COVID-19 related factors, multiple individual and societal characteristics might also critically predispose and shape population behaviors.[6,9] Evidence indicates that women and older individuals are more likely to adopt preventive behaviors.[2,3,6,13] While higher education and income was found to be positively correlated with higher adherence in a general population sample, it displayed the inverse relationship in youth in Switzerland.[2,3] Hence, the effectiveness of preventive provisions is critically associated with individuals' attitudes, risk perceptions and characteristics as well as their ability to adapt, alter and engage in protective behaviors.[6,9,14]

Greece is totaling 252 590 confirmed cases and 7826 deaths as of March 28, 2021 overall.[15] Due to the country's constrained healthcare system capacity, the Greek government rapidly adopted strict policies to address the spread of the virus after the first laboratory confirmed case on February 26, 2020 most notably the closure of all non-essential shopping centers and businesses on March 16, 2020 and imposing a shelter-in-place order on March 23, 2020 (effective until May 4th). Beyond these measures, the Greek Ministry of Health (MoH) daily informed and updated the population about the spread of the virus in the country, about COVID-19 related outcomes and risks, and promoted protective behaviors which have already proven to be effective in reducing and blocking viral transmission.[16,17]

Early evidence suggests that the combined implementation of the multiple social distancing measures was effective COVID-19 growth rate in Greece, similar to other countries.[18-21] In addition, the adoption of face masks was also estimated to reduce COVID-19 transmission and mortality by up to 65%, particularly when used in conjunction with social-distancing measures and adherence and compliance are high.[22-24] Despite these early successes, and the importance of the topic of preventive behaviors uptake and compliance, as it is closely linked to successful containment of the spread of the virus, evidence is still inconclusive with respect to the determinants of better adherence. Concomitantly, evidence regarding the rates of adherence in Europe is still scarce. Thus, it is critical to understand the factors that influence individual behavior during the ongoing COVID-19 pandemic.

In light of these considerations, a national survey to explore individual preventive health behaviors during the COVID-19 pandemic and to identify their knowledge, attitudes, and perceptions towards the virus was conducted. We then estimated the association between multiple socioeconomic, and health-related characteristics, COVID-19 related attitudes and adoption of multiple preventive behaviors. To our knowledge, this is the first study using a random and nationally representative sample to present evidence on how perceptions relate to and predispose protective behaviors. This understanding can inform optimal strategies to effectively change risk-seeking behaviors and to minimize the impact and the spread of the virus.

Methods

Study Population

This was a cross-sectional telephonic survey conducted from 10 to 14 of April 2020, almost 4 weeks after the

[1]Faculty of Social and Education Sciences, University of Peloponnese, Corinth, Greece
[2]Health Policy Institute, Athens, Greece
[3]Pharmacotherapy Outcomes Research Center, College of Pharmacy, University of Utah, Salt Lake City, UT, USA
[4]First Department of Psychiatry, Medical School, Aiginition Hospital, National & Kapodistrian University of Athens, Athens, Greece
[5]Unit of Social Psychiatry & Psychosocial Care, University Mental Health, Neurosciences and Precision Medicine Research Institute "Costas Stefanis" (UMHRI), Athens, Greece
[6]3rd Department of Psychiatry, Faculty of Medicine, School of Health Sciences, Aristotle University of Thessaloniki, Thessaloniki, Greece

Corresponding Author:
Theodoros V. Giannouchos, Pharmacotherapy Outcomes Research Center, College of Pharmacy, University of Utah, 30 S 2000 E, Salt Lake City, UT 84112, USA
Email: theo.giannouchos@utah.edu

implementation of the strict lockdown measures by the Greek government, on sample of more than 1000 individuals who were at least 17 years of age and fluent in Greek language. The sample was defined via a random multistage selection process using the National Telephone Company Directory, categorized by region, municipality, and urbanization level based on the National Census and was proportionately distributed among the 13 administrative regions of the country. Specifically, it was generated by a random stratified selection from the 2011 national telephone directory by taking into account geographic region, gender and age. All numbers were categorized by region, prefecture, municipality and urbanization level, in accordance with the 2011 National Population Census. Only telephone numbers belonging to individuals were taken into consideration. Within each household, the persons who had their birthday last was selected, provided they met inclusion criteria. Calls were made during both weekdays and weekends, during morning as well as evening hours. At least 6 callbacks were made.

The process was supported by the specialized software computer-assisted telephone interviewing (CATI). The survey was conducted by a commercial company working in the field of demographic surveys, under the close guidance and monitoring of the scientific supervisor of the study. The questionnaire was in Greek and prior to its use it was pilot tested on a random sample of 20 participants with different educational backgrounds in terms of its duration and comprehensibility. Data was gleaned through a telephone interview. A total of 1205 participants were approached and 1041 agreed to participate (response rate = 86.4%). No statistically significant differences were observed between responders and non-responders with respect to administrative region. This study was part of a more extensive project which aims to investigate multiple health outcomes during the COVID-19 pandemic among the Greek population. The project was approved by the Ethics Committee of the University of Peloponnese and was performed in accordance with the ethical standards delineated in the Declaration of Helsinki 1964/2013. It merits noting that for 17-year old respondents consent for participation was obtained by the respondents themselves (and not their parents), consonant with the national regulations.

Study Variables

To explore knowledge and attitudes towards the current virus, we asked participants to indicate whether they agreed or not with 6 statements related to the COVID-19 on a 5-point Likert scale (1 = Strongly disagree; 5 = Strongly agree). The statements were self-constructed and resonated with existing evidence about the COVID-19, consistent with similar instrument in previous studies and the World Health Organization reports[9] and phrased as: i) the possibility of carrying the coronavirus without having any symptoms, ii) the coronavirus being dangerous for those who have an underlying disease and are older, iii) the coronavirus being out of control, iv) the coronavirus being engineered and serving a purpose, v) the coronavirus being like the flu, and vi) the coronavirus being transmitted by the air.

We obtained information regarding protective and preventive behaviors by asking participants to report the frequency of adopting one of the following 4 measures: i) wear a mask when outside, ii) wash hands, ii) use of public transport, and iv) hours being outside of their household. The first 3 measures were coded as "Never," "Rarely," "Sometimes," "Many times," "All the time," while the fourth measure was coded as "0 to 2 h," "2 to 8 h," "8 or more h." Participants were also asked to indicate how often they use the Media or/and the Internet to get COVID-19 related updates, followed by a question regarding their trust in the government during the pandemic ("Remained the same," "Increased," "Decreased").

We further explored respondents' access to social support by asking them to report the level of interest of other individuals in them and the level of difficulty in getting practical help from neighbors in case of need, in line with the pertinent items of the Oslo Social Support Scale.[25] Finally, we also obtained respondents' sociodemographic and health-related characteristics, namely age, gender, area of residence, education, whether the respondent was a healthcare professional or not, self-reported income, marital status, number of household members, presence of underage children in the household, vulnerability of the respondent or a household member to the virus due to an existing healthcare condition, and self-reported health status.

Statistical Analysis

We initially conducted a descriptive analysis to summarize the characteristics of the study participants using percentages for categorical variables and means and standard deviations for continuous variables and counts. Similarly, we analyzed respondents' COVID-19 related knowledge and perceptions and the use of media and the internet for updates on the virus, as well as their behaviors during the pandemic, which were the outcomes of interest in this study. To estimate the association between main independent variables of interest and respondents' behaviors, we used multivariable ordered logistic regression models, which controlled for all covariates included in the descriptive analyses. We also included regional-level fixed effects to control for unobserved regional differences. Standard errors were clustered at the geographical region of residence. We conducted all the analyses using Stata version 16.1 (StataCorp, College Station, TX).

Results

Overall, 923 individuals completed the survey in full and were included in our study (of the 1041 who participated, 118 were excluded due to not full completion). Table 1 shows the sociodemographic characteristics of the final cohort,

Table 1. Sociodemographic Characteristics of Respondents (n = 923).

Demographic	%
Gender	
Male	50.8
Female	49.2
Age categories	
17-24	10.2
25-39	23.2
40-54	28.2
55-64	16.3
65 or more	22.2
Area of residence	
Urban	72.3
Suburban	16.9
Rural	10.8
Marital status	
Married	55.9
Not married	23.3
Divorced/Widowed	20.8
Education	
Tertiary (AEI/TEI)	51.4
Primary or secondary (high school or less)	27.7
Post-tertiary (Masters/Doctoral)	20.9
Employment status	
Full-time	55.4
Unemployed	9.1
Student	3.9
Retired	25.1
Other	6.5
Income	
Very low	12.0
Low	14.8
Low to average	16.9
Average	37.9
Higher than average	18.3
Healthcare professional	
No	93.5
Yes	6.5
Number of people in household	2.7 (1.3)
Underage children in household	
No	80.2
Yes	19.8
Social capital, support, and characteristics	
Health status	
Very bad/bad	4.0
Medium	19.1
Good	54.7
Very good	22.2
Household member is vulnerable to COVID due to underlying health problem	
No	63.0
Yes	37.0
Respondent is vulnerable to COVID due to underlying health problem	
No	71.2
Yes	28.8

(continued)

Table 1. (continued)

Demographic	%
Trust in State after the pandemic	
Declined	23.0
Remained same	33.9
Increased	43.1
Other people interest in you	
A lot	50.5
Some	34.9
Uncertain	3.6
Little	8.9
None	2.2
How easy is to get practical help from neighbors if you should need it?	
Very easy	17.4
Easy	28.2
Possible	26.2
Difficult/Very difficult	28.2

which were similar to national estimates and thus our sample was nationally representative.[26] Most respondents were between 25 to 54 years old (51.4%), married (55.9%), and resided in urban areas (72.3%). Around half had tertiary level education (51.4), while 27.7% had up to high school education. The majority were fully employed (55.4%) or retired (25.1%) and 6.5% were healthcare professionals. The average household size was 2.7 (standard deviation = 1.3) people and 19.8% of households included underage children.

The majority of respondents perceived their health status to be good (54.7%) or very good (22.2%). About 29% of respondents indicated they were vulnerable to the virus due to an existing healthcare condition, while 37.0% reported that one of their household members was vulnerable to the virus. About 43% revealed an increase in their level of trust in the government during and after the pandemic, while 23.0% reported the opposite. Around half of respondents claimed that other people in their life are highly interested in their personal well-being ("a lot" – 50.8%), and 45.6% reported that it is easy (28.2%) or very easy (17.4%) for them to get practical help from their neighbors in case of need.

Table 2 presents respondents' knowledge and perceptions related to the current virus, as well as self-reported media and internet use for COVID-19 updates. Individuals almost unanimously agreed with the fact that the virus might be asymptomatic (93.7%) and that the virus is particularly dangerous for older people and for those with underlying healthcare problems (87.0%). Most respondents supported the statement that the virus is out of control (44.9%), while opinions diverged on whether the virus is airborne or not. In contrast, larger shares of participants disagreed with the potential similarity of COVID-19 and the common flu (42.3%) and the statement related to the manufactured and purposeful nature of the virus (43.1%). Regarding the use of media and internet for COVID-19 updates, more than a third (38.0%) reported no or limited use of such sources, while 14.4%

Table 2. Respondents' COVID-19 Related Knowledge and Perceptions, Use of Media and the Internet for Updates, and Behavior during the Period of the Pandemic (n = 923).

COVID-19 knowledge and perceptions	%
The virus may be asymptomatic	
Disagree	1.1
Neutral	5.2
Agree	93.7
The virus is dangerous for older people and for those with underlying health problems	
Disagree	6.4
Neutral	6.6
Agree	87.0
The virus is out of control	
Disagree	27.1
Neutral	28.0
Agree	44.9
The virus is airborne	
Disagree	35.1
Neutral	27.5
Agree	37.4
The virus is manufactured and serves specific purposes	
Disagree	43.1
Neutral	32.8
Agree	24.1
The virus is similar to common flu	
Disagree	42.3
Neutral	22.6
Agree	35.1
Practices	
Media and Internet use for COVID-19 updates	
None/very basic	38.0
Few hours	26.9
Many hours	20.7
All the time	14.4
Behavior	
Use of mask when leaving the house	
Never	41.6
Rarely	17.4
Sometimes	12.4
Many times	11.9
All the times	16.7
Handwash	
Never/rarely	1.2
Sometimes	12.1
Many times	56.7
All the times	29.8
Hours outside the house	
0-2	73.9
2-8	17.1
8 or more	9.0
Use of public transport	
Never	89.4
Rarely	5.6
Sometimes	2.3
Many times	1.3
All the times	1.2

indicated that they use the media and the internet constantly ("all the time") to get updated.

Participants' behaviors during the period of the pandemic are also presented in Table 2. Most respondents indicated they never used public transport (89.4%) and that they spent 0 to 2 h outside their house (73.9%). Similarly, the majority claimed frequent ("many times": 56.7%) or constant ("always": 29.8%) handwashing, while only 1.2% revealed that they never or rarely wash their hands. However, more than 40% reported that they never wear a mask when leaving their house (41.6%), while 16.7% indicated constant use of masks ("all the times").

Table 3 presents the results from the multivariable ordered logistic regressions across all 4 outcomes of interest respectively as proportional odds ratios. A decreased likelihood in the frequency of wearing a mask and handwashing was observed for individuals who disagreed with the statements that the virus is out of control (mask: adjusted proportional Odds Ratio [OR] = 0.79, 95% Confidence Intervals [CI] = 0.60-1.05; handwashing: OR = 0.63, 95% CI = 0.46-0.88) and that virus is airborne (mask: OR = 0.54, 95% CI = 0.36-0.80; handwashing: OR = 0.61, 95% CI = 0.48-0.78), compared to those who agreed with such statements. In contrast, those who perceived that the virus is not similar to the common flu were more likely to wear mask (OR = 2.01, 95% CI = 1.30-3.10) and wash their hands (OR = 1.65, 95% CI = 1.22-2.24) more often, while simultaneously they were less likely to spend more hours outside (OR = 0.53, 95% CI = 0.45-0.62), compared to those who perceived that the virus is similar to the common flu. We also observed a decreased likelihood of wearing a mask more often among individuals who were neutral regarding the asymptomatic nature of the virus compared to those who agreed with this statement (OR = 0.57, 95% CI = 0.34-0.94).

On the social support side, increased difficulties in getting help from neighbors in situations of need, were associated with spending more hours outside the house, as expected. Interestingly, we found a significant and negative association between the frequency of wearing a mask and washing hands among those who reported no or little interest from other people respectively. We also found a significant association between constant media and internet use for virus-related updates and masks (OR = 1.48, 95% CI = 1.12-1.94) and handwashing times (OR = 2.23, 95% CI = 1.47-3.39), compared to those who never or rarely used these sources. Finally, increased trust to authorities during the pandemic was associated with a decline in the use of public transport (OR = 0.45, 95% CI = 0.27-0.73) and the hours spend outside (OR = 0.55, 95% CI = 0.39-0.78).

Among the other covariates included in the analyses, healthcare professionals were more likely to wear a mask (OR = 2.85, 95% CI = 1.68-4.82) more often, to wash their hands more times (OR = 1.76, 95% CI = 1.05-2.96) and to spend more hours outside the house (OR = 4.03, 95% CI = 2.95-5.51) compared to those who were not employed in the healthcare sector. The same association was observed for

Table 3. Multivariable Regression Results (n = 923).

	Mask				Hands				Hours out				Public transport			
	OR	95% CI		P-value	OR	95% CI		P-value	OR	95% CI		P-value	OR	95% CI		P-value
COVID-19 knowledge and perceptions																
The virus is out of control (Ref.: Agree)																
Neutral	0.96	0.76	1.21		0.95	0.67	1.34		1.10	0.79	1.55		0.66	0.41	1.06	
Disagree	0.79	0.60	1.05		0.63	0.46	0.88	**	1.27	0.84	1.93		1.32	0.78	2.19	
The virus is manufactured and serves specific purposes (Ref.: Agree)																
Neutral	0.75	0.50	1.13		0.64	0.47	0.87	**	0.71	0.52	0.97	*	0.67	0.34	1.31	
Disagree	0.78	0.55	1.11		0.68	0.45	1.03		0.62	0.44	0.88	**	0.77	0.38	1.58	
The virus is airborne (Ref.: Agree)																
Neutral	0.63	0.51	0.79	***	0.83	0.61	1.12		0.97	0.68	1.39		0.96	0.59	1.55	
Disagree	0.54	0.36	0.80	***	0.61	0.48	0.78	***	0.82	0.62	1.08		0.67	0.48	0.96	*
The virus is similar to common flu (Ref.: Agree)																
Neutral	1.15	0.90	1.46		1.33	0.92	1.94		0.77	0.62	0.95	*	0.81	0.42	1.57	
Disagree	2.01	1.30	3.10	**	1.65	1.22	2.24	***	0.53	0.45	0.62	***	0.83	0.58	1.17	
The virus is dangerous for older people and for those with underlying health problems (Ref.: Agree)																
Neutral	1.18	0.77	1.83		0.83	0.62	1.12		0.96	0.59	1.58		1.54	0.82	2.90	
Disagree	1.15	0.86	1.54		1.12	0.75	1.66	***	1.62	0.49	5.40		0.61	0.22	1.68	
The virus may be asymptomatic (Ref.: Agree)																
Neutral	0.57	0.34	0.94	*	0.75	0.40	1.38		1.28	0.52	3.16		1.43	0.47	4.31	
Disagree	0.73	0.31	1.73		0.71	0.22	2.28		1.97	0.37	10.58		-	-	-	
Practices																
Media and Internet use for COVID-19 updates (Ref.: None/basic)																
Few hours	1.32	0.91	1.90		1.08	0.85	1.38		1.24	0.88	1.75		1.74	0.95	3.19	
Many hours	1.27	0.86	1.89		1.25	0.94	1.67		1.74	1.19	2.53	**	1.82	0.97	3.43	
All the time	1.48	1.12	1.94	**	2.23	1.47	3.39	***	0.89	0.46	1.70		0.60	0.26	1.37	
Social capital, support, and characteristics																
Health status (Ref.: Very good)																
Good	1.27	1.08	1.50	**	0.97	0.72	1.30		1.06	0.73	1.53		1.36	0.66	2.78	
Medium	1.29	0.86	1.94		1.04	0.69	1.56		0.74	0.45	1.22		0.67	0.31	1.45	
Very bad/bad	1.83	0.98	3.42		1.27	0.31	5.21		0.72	0.34	1.52		0.49	0.18	1.35	
Household member is vulnerable to COVID due to underlying health problem (Ref.: No)																
Yes	1.14	0.97	1.33		1.26	0.90	1.78		0.97	0.73	1.28		0.85	0.50	1.39	
Respondent is vulnerable to COVID due to underlying health problem (Ref.: No)																
Yes	1.31	0.93	1.85	*	0.69	0.51	0.92	*	0.89	0.69	1.15		1.08	0.62	1.88	
Trust in State after the pandemic (Ref.: Declined)																
Remained same	0.82	0.58	1.15		0.69	0.51	0.93	*	0.75	0.58	0.97	*	0.40	0.23	0.71	**
Increased	0.91	0.67	1.24		0.83	0.61	1.13		0.55	0.39	0.78	***	0.45	0.27	0.73	***

(continued)

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Table 3. (continued)

	Mask				Hands				Hours out				Public transport			
	OR	95% CI		P-value	OR	95% CI		P-value	OR	95% CI		P-value	OR	95% CI		P-value
Other people interest in you (Ref.: A lot)																
Some	1.16	0.91	1.48		0.81	0.56	1.17		1.57	1.12	2.19	**	1.89	0.86	4.18	
Uncertain	0.80	0.50	1.29		0.61	0.27	1.39		1.80	1.04	3.10	*	3.63	0.67	19.7	
Little	1.23	0.76	1.98		0.52	0.39	0.69	***	1.42	0.77	2.62		1.91	1.13	3.22	
None	0.52	0.28	0.98	*	0.41	0.13	1.30		1.32	0.48	3.61		3.78	0.47	30.6	*
How easy is to get practical help from neighbors if you should need it? (Ref.: Very easy)																
Easy	0.75	0.52	1.09		0.80	0.60	1.07		0.56	0.39	0.81	**	1.36	0.66	2.78	
Possible	0.74	0.60	0.91	**	0.90	0.51	1.60		0.70	0.48	1.02		0.67	0.31	1.45	
Difficult/Very difficult	0.77	0.56	1.05		1.20	0.88	1.64		0.70	0.48	1.03		0.49	0.18	1.35	
Demographics																
Healthcare professional (Ref.: No)																
Yes	2.85	1.68	4.82	***	1.76	1.05	2.96	*	4.03	2.95	5.51	***	1.86	0.83	4.17	
Gender (Ref.: Male)																
Female	1.59	1.11	2.27	**	1.84	1.56	2.18	***	0.60	0.38	0.95	*	1.03	0.58	1.81	
Age categories (Ref.: 17-24)																
25 to 39	1.66	0.90	3.05		1.61	1.00	2.59	*	1.33	0.99	1.79		0.89	0.42	1.87	
40 to 54	1.68	0.87	3.24		2.21	1.21	4.03	**	1.09	0.62	1.91		1.07	0.53	2.13	
55 to 64	2.52	1.15	5.53	*	2.65	1.36	5.15	**	1.39	0.74	2.60		0.72	0.24	2.14	
65 or more	2.69	1.60	4.53	***	3.56	2.09	6.08	***	0.81	0.46	1.43		0.83	0.40	1.71	
Area of Residence (Ref.: Urban)																
Suburban	0.90	0.65	1.23		1.22	0.76	1.96		1.20	0.78	1.83		0.77	0.40	1.48	
Rural	0.86	0.46	1.60		1.06	0.66	1.71		1.65	1.02	2.67	*	0.47	0.21	0.91	*
Education (Ref.: Tertiary)																
Primary or secondary	0.85	0.63	1.15		1.26	0.78	2.04		1.77	0.95	3.29		1.23	0.61	2.47	
Post-tertiary	0.96	0.72	1.26		1.05	0.71	1.55		1.71	0.97	3.04		0.64	0.27	1.52	
Working status (Ref.: Full-time)																
Unemployed	1.46	0.82	2.61		1.07	0.80	1.44		0.23	0.13	0.43	***	0.86	0.54	1.38	
Student	1.22	0.59	2.50		0.76	0.33	1.75		0.26	0.06	1.23		0.85	0.26	2.80	
Retired	1.01	0.65	1.56		0.74	0.55	0.99	*	0.26	0.15	0.43	***	0.85	0.39	1.85	
Other	0.96	0.63	1.46		1.99	1.22	3.27	**	0.50	0.32	0.77	**	0.86	0.22	3.44	
Income (Ref.: Very low)																
Low	1.36	0.83	2.25		0.69	0.42	1.16		1.33	0.53	3.34		1.26	0.69	2.31	
Low to Average	1.35	0.88	2.05		0.85	0.51	1.41		1.29	0.63	2.63		1.17	0.57	2.36	
Average	1.09	0.77	1.55		1.02	0.56	1.87		2.02	0.92	4.46		1.00	0.45	2.24	
Higher than average	1.33	0.96	1.83		0.98	0.63	1.51		1.22	0.52	2.82		1.10	0.45	2.66	
Underage children in household (Ref.: No)																
Yes	0.75	0.55	1.04		1.02	0.73	1.44		1.06	0.71	1.59		0.61	0.35	1.05	

Note. All analyses include geographic-level fixed effects.
OR = adjusted proportional odds ratio; CI = confidence intervals; Ref. = reference category.
$*P < .05$. $**P < .01$. $***P < .001$.

individuals who were 55 years of age or older compared to those who 17 to 24 years of age although significance was achieved only for mask and handwashing frequencies. In addition, compared to those who rated their health status as very good, those with worse health, particularly those with bad or very bad health status, were significantly more likely to wear a mask more often (OR = 1.83, 95% CI = 0.98-3.42). Females were also more likely to both were a mask more often and to wash their hands more times compared to males. Finally, and unsurprisingly, compared to full-time employees all other occupational categories, were less likely to spend more hours outside the house.

Discussion

The findings of our study based on a nationally representative and random sample contribute and extend the current literature by highlighting the importance of understanding the factors that influence individual behavior during the ongoing COVID-19 pandemic. This may shed light on sociodemographic and attitudinal determinants of behavior, which are key for containing the virus as well as informing strategies towards promoting the uptake of protective measures.

We found that the majority of participants in our study sufficiently adopted preventive behaviors, similar to estimates from studies conducted across various settings and countries.[2,3,4,6,11,12] However, more than 40% of our study participants reported not wearing a mask when they leave their house. This finding is lower than rates reported in other countries, but similar to that of a recent study in Greece which reported that only 28% mentioned wearing a face mask indoors.[5] Hence, additional studies using more recent data are warranted to identify potential changes in COVID-19 related knowledge and attitudes, in the uptake of preventive behaviors and their association. Such studies might further enable policymakers to assess the effectiveness of evolving public health guidelines and initiatives adopted through the first year of the pandemic and make necessary and tailored adjustments.

Our results are in-line with the international literature and indicate that individuals who believed that the virus is out of control, is transmitted through the air, and is not similar to the common flu were more likely to adopt preventive behaviors more frequently, particularly wearing masks in public spaces, washing their hands, and spending fewer hours out of their homes.[2,3,7,8,9,10] The same was observed for older individuals compared to those under the age of 24, for females compared to males, and for those with worse self-perceived health status similar to previous work.[2,3,9,13] These results imply that individuals with increased self-perceived vulnerability engage more often in preventive behaviors when they perceive the virus as a serious threat, which could act as a motivational factor to engage in COVID-19 protective measures.[6,10,14,27,28]

Our findings are supported by previous literature on the uptake of preventive measures both during COVID-19 and past viral outbreaks.[4,6,10,11,14,27-29] Greater knowledge and awareness of a virus and its transmission, perceptions, concerns and fear about higher risk and disease severity and lack of control were consistently associated with greater adoption of precautionary behaviors with intentions to comply with quarantine restrictions.[2,6,10,14,27,30-37] The engagement in protective behaviors appears also to be consistently mediated by risk judgments based on demographic characteristics, and becomes particularly apparent in older subgroups of the population and females, suggesting the need for differential outreach strategies according to needs and vulnerability of these individuals.

In contrast, misconceptions, lack of knowledge and limited social support appear to hinder the uptake of preventive measures and pose alleviated risks for both individual and public health safety. We found that respondents who were uncertain about the symptomatology of the virus wore a mask or washed their hands less often, while the same behavior was observed for young adults, for non-healthcare professionals and for individuals with limited social support. Social expectations and peer pressure have already been significantly associated with preventive behaviors such as mask-wearing in previous studies during the SARS outbreak in multiple countries.[38-40] Our results are consistent with these findings and highlight the critical role of the community and the societal environment on individuals' conformity with protective guidelines. It becomes apparent that community-wide approaches which will focus on social integration and behavioral support, beyond communication and education about the virus, are needed for subgroups of the Greek population who are on the fence of social isolation.[41]

We also found that increased exposure to COVID-19 related Media news and online resources was associated with more frequent engagement in mask-wearing and hand washing. The transparency and openness of the Greek government with daily updates on the virus' spread in the country followed by public health messaging, guidelines and recommendations for prevention appears to be key in the public's acceptance of preventive measures. These results are supported by previous reviews which highlighted importance of government transparent communication and consistent advice to reduce the spread of SARS.[14,42,43] However, more than one-third of respondents reported no or very limited interaction with COVID-19 related news and updates. As such, provisions tailored at raising population awareness towards the virus should extend beyond such resources to universally and sufficiently reach out to different communities, such as text messages, and on-ground campaigns. In addition, involving the public in the decision-making process might also turn out to be critical to increase acceptance of recommendations.[44,45]

In our study, we found that trust in the State increased for more than 40% of the study participants during the pandemic

and increased trust was associated with higher adherence to official recommendations for social distancing – fewer hours outdoor and limited use of public transport. The same was also observed in other countries.[2,3,7-10,34,37,39] Our findings are also in-line with recent studies that revealed a negative association between COVID-19 misinformation and low-trust to authorities with compliance and uptake of preventive behaviors across multiple countries.[9,37] Trust in authorities is important particularly during public health crises, such as the COVID-19 pandemic, since it affects how people process and interpret health messages and perceive governmental public health messaging as credible, which in-turn influences individuals' behaviors.[14,46] This implies that the public's responses will differ according to political partisanship. A recent study in the United States found that political differences were the most consistent factor that differentiated health behaviors and adherence to recommendation in the early stages of the COVID-19 pandemic.[14,47] Thus, public health messaging and outreach must transcend political bureaucracy, interests and conflicts to result in widely accepted health behaviors.[45]

Our study emphasizes the need for timely and easily available information and updates, as well as education and communication initiatives to increase public awareness, particularly for certain sociodemographic subgroups.[48,49] These should focus on using plain language to incorporate information on COVID-19 transmission and risks based on evidence-based outcomes and advice on the effectiveness of risk-minimization through protective measures. As our findings suggest a certain level of perceived susceptibility is required for individuals to adhere to official guidelines and to engage in protective behaviors.[14] However, these initiatives must extend beyond Media and online resources to reach out to the entire population. Healthcare professionals and public health departments, schools, patient advocacy groups, and social networks can also be encouraged to have a more active role in providing credible information and educating the public about this topic, particularly due to the public's respect and trust in those. This might in turn cultivate and bolster preventive behavior as a standardized and socially acceptable practice. A recent survey among healthcare professionals in Greece found that almost 40% of healthcare professionals deemed their level of knowledge about COVID-19 inadequate.[50] Thus, it is imperative to first educate healthcare professionals, who are commonly identified as the most trustworthy source of information, in order to convey consistent and credible information about the virus and the importance of adopting preventive behaviors.

Our study may be limited by sampling bias due to recruiting participants from the telephone household databank. The mode of data collection resonated with the lockdown measures; whereas the inclusion of landline phones, rather than mobile ones, served best the random selection of respondents, as some citizens have more than 1 mobile phone numbers. However, the majority of households in Greece have fixed telephone access, methods employed concur with other nationwide surveys in the country, and our sample was similar to national estimates and representative of the Greek population.[26,51,52] Moreover, preventive health behaviors relied on self-report rather than objective observation and therefore one cannot exclude the emergence of bias (eg, by providing the social desirable responses or by mistakenly considering their health behaviors to be in line with expert recommendations). Due to the strict lockdown measures, alternative methods of data collection (eg, direct observation) were not feasible.[53] Additionally, findings are germane only to the Greek population and thus cannot be extrapolated to other countries. Nonetheless, most of our results are supported by and are consistent with previous literature on the adoption of preventive behaviors in other countries and during past outbreaks as well, suggesting the similarities of population responses under healthcare crises and uncertainties.

Conclusion

Our study extends the growing literature that explores factors associated with preventive health behaviors during the current pandemic and provides novel evidence on the sociodemographic and attitudinal determinants that critically affect the public's engagement in preventive behaviors in Greece. Results demonstrate that individual behaviors impact the course of COVID-19. Health policy initiatives should focus on evidence-based information provision to maximize public trust, on strengthening social support mechanisms and on community-wide outreach approaches that integrate multiple stakeholders which are critical to reach-out to the entire population.

Authors' Contributions

KS: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data Curation, Writing—Original Draft, Writing—Review & Editing, Supervision, Project administration; TVG, LEP and MTS: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data Curation, Writing—Original Draft, Writing—Review & Editing, Supervision; JN, CP and ME: Validation, Investigation, Writing—Review & Editing, Supervision.

ORCID iD

Theodoros V. Giannouchos https://orcid.org/0000-0002-1574-6767

Data Availability Statement

Data are available upon request.

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