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Do single-use facemask users' care for the effects on the (marine) environment during the COVID-19 pandemic? Preliminary results from Greece

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ABSTRACT

This paper examines which demographic and attitudinal characteristics relate to an individual's knowledge and perception of the environmental footprint of single-use mask s/he is using in the midst of the COVID-19 pandemic. Based on a self-selected sample of Greek citizens ($N = 462$), it is found that demographic characteristics and pro-environmental concern are unrelated to the single-use mask users' knowledge and concern regarding the environmental impacts of the mask they are using. This unanticipated finding suggests that the circumstances of the COVID pandemic may mute the theoretically taken-for-granted connection between environmental interest/concern and the awareness of environmental impacts, thus any future attempts to introduce more environmentally-friendly single-use mask alternatives and/or to curb the current ones' environmental impact should start by reenergizing this suppressed nexus.

1. Introduction

The ongoing SARS-CoV-2 (COVID-19) virus pandemic is having important collateral environmental effects. On the one hand, the restrictions on citizen mobility and business activity brought many a national economy to a standstill and thus 'helped the environment to bounce back', relating to 'improvement in the quality of air, cleaner rivers, less noise pollution, undisturbed and calm wildlife' (Arora et al., 2020). On the other hand, the increasing consumption of personal protective equipment (PPE), has raised concerns about (micro) plastic pollution (Silva et al., 2021; Gorrasi et al., 2021; Fadare and Okoffo, 2020), since they are generally manufactured from polymeric nanofiber materials (Aragaw, 2020). This development poses particular challenges to the marine environment since a portion of these masks are not properly disposed but rather find their way into our seas (Aragaw, 2020; Vanapalli et al., 2021; De-la-Torre and Aragaw, 2021; Okuku et al., 2021).

While the scientific community has raised the alarm over the issue, and technical solutions have been suggested (cf. Shruti et al., 2020; Chua et al., 2020; Rowan and Laffey, 2021), our efforts to stop the (further) micro-plastic pollution of our (marine) environment due to the COVID-19 pandemic will be severely handicapped if we do not also take into

account the ordinary citizens' perceptions and understanding of the issue: available research has established that the behaviors related to plastic use are influenced by one's socio-psychological characteristics (see Heidbreder et al., 2019). Thus, it is rather surprising that, to the best of our knowledge, no study has to date examined what the actual users know and think about the environmental impacts of their PPE selection. Such a knowledge would allow us to design and promote more focused interventions regarding the alternatives-to/safer-disposal-of single-use masks, and thus guarantee that protecting ourselves against the COVID-19 pandemic will not come at the expense of our environment. In this research this issue is studied for the case of Greece. In particular it is examined which are the demographic and attitudinal characteristics which relate to an individual's knowledge and perception of the environmental footprint of single-use masks. Since this particular face-mask type is also commonly called 'surgical' mask, the two terms (i.e. 'single-use' and 'surgical' mask) will be used indiscriminately for the remainder of the text.

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2. Data & methods

2.1. Context and sampling

In November 2020 the authors conducted a research concerning the Greek public's perceptions on using face-masks in the context of the COVID-19 pandemic. For data collection an online questionnaire was used, asking participants to indicate, under conditions of anonymity, their views about face masks. The questionnaire was communicated electronically through the academic email database of the Agricultural University of Athens and the University of the Aegean, Greece, the latter's official Facebook page of as well as to the acquaintances' networks of the authors, while the recipients/readers were asked to forward the questionnaire to their own network of contacts. The questionnaire used in this research was based on the one employed by Fisher et al. (2020) in their study of the factors associated with mask usage amongst US adults. Unless otherwise stated, all answers were measured on a 5-point Likert scale ranging from '1' (Strongly Disagree) to '5' (Strongly Agree). An extra 'Don't know' option was also available to our respondents yet for the following analyses, unless otherwise explicitly stated, this is treated as a missing value. The survey ran between November 09 -three days into a national lockdown, when the use of face masks was made obligatory throughout the country and for all social encounters- and November 19, 2020. A total of 1217 answers were collected. The vast majority of our respondents claimed to be predominantly using either a cloth face mask (57.1% of all answers, $N = 695$) or a surgical/single-use surgical mask (38%, $N = 462$).

3. Results

In order to examine the surgical masks users' knowledge of this mask's environmental impact, they were asked to indicate whether or not, the single-use ('surgical') mask: (a) 'is made of natural ingredients (e.g. paper, cotton, etc)'; (b) 'may be recycled'; and (c) 'if it ends up in the sea, it harms the marine environment'. Three possible answers were allowed ('Yes', 'No', and 'I don't know/Unsure') and the results are presented in Table 1. In the final column of Table 1 is reported the differences in opinion between surgical mask users and cloth mask users ($N = 695$) as far as the surgical mask's environmental impacts are concerned.

As it follows from the results of the Cramer's V measure of association between type of mask used (surgical vs. cloth mask) and perceptions of environmental impact, the only statistically significant difference is observed for the case of potential marine pollution: in particular, more surgical masks users disagree that if a surgical mask 'ends up in the sea, it harms the marine environment', compared to cloth mask users (3.0% vs. 0.6% respectively).

Next, three logistic regression models ('Yes' vs 'No' answers) were fitted to the data collected, one for each environmental impact category, where a number of demographic and attitudinal variables (e.g.

knowledge about face masks, one's environmental concern and so on) serve as possible predictors. The results are reported in Table 2.

The results presented in Table 2 highlight that surgical mask users' knowledge on single-use mask environmental footprint perceptions are largely unrelated to the respondent's demographics and/or environmental concerns. Thus, the self-proclaimed level of information regarding face masks, one's age and income, as well as the self-professed interest in environmental protection, turned to be statistically not significant altogether, while one's gender, higher levels of educational attainment and of concern about plastic pollution were not consistently associated with correct answers. Thus, the odds of females thinking that single-use mask may be recycled are 1.67 times ($= 1/0.596$) the odds of males. High school as well as university graduates are less likely than other educational categories (their odds ratios are 0.405 and 0.427 respectively) to think that single use masks are made of natural materials. Finally, someone who is 'little concerned' about plastic pollution is much more likely than individuals with other levels of concern to think that surgical masks do harm the marine environment if they end up in the sea (odds ratio = 24.125).

Next it is examined (a) to which extent surgical mask users consider their selection of face mask as more detrimental to the environment vis-à-vis other alternatives, and (b) to which extent this appraisal is related to their demographic and attitudinal characteristics. For this purpose, an ordinal regression model was fitted to our data, and the results are presented in Table 3. It is worth noting that just 9.3% of surgical mask users (Strongly) Agree that 'Single-use mask pollutes the environment less than other masks', with 53.2% (Strongly) Disagreeing.

As it follows from Table 3, the single-mask users' level of (dis) agreement on whether single-use mask pollutes the environment more than other mask types, is not statistically significantly related to one's age, income, knowledge about the environmental impacts of single-use mask, interest in environmental protection or concern over plastic pollution, while, as far as educational attainment is concerned, a significant difference in opinion exists only between 'High School/College' and the other education level categories. In effect, the odds of High school graduates agreeing (versus all other opinions) that single use mask pollutes the environment less than other masks is 0.513 the odds of all other educational categories holding this opinion. This difference is statistically significant at the 5% significance level. The only factor which appears to be relevant is gender, with males being 1.834 more likely than females to agreeing that single use mask pollutes the environment less than other masks.

4. Discussion & conclusions

This research aimed at examining whether single-use mask users are aware of the environmental repercussions of the face-masks they employ during the COVID-19 pandemic, and which demographic and attitudinal characteristics influence this understanding. This is an important topic to study, since available studies and data suggest that disposable face-mask pose a mounting plastic pollution threat to our natural environment- especially the marine one.

Concerning the surgical mask users' perceptions of its environmental effects, no single demographic or attitudinal variable was found to be, consistently, a statistically significant predictor (see Table 2). This was also overall the case concerning surgical mask users' assessment of this type of mask relative environmental impact vis-à-vis other facemask types (see Table 3).

These findings are quite peculiar. While volumes of research in the domains of environmental psychology and sociology have established the strong positive correlation between environmental concern and one's knowledge of the environmental repercussions of his/her behavior, these study's results demonstrate no such relation for the case of Greek surgical masks' users. In other words, the findings suggest that more environmentally minded individuals are *not* more aware of their surgical mask's environmental footprint. Answering whether this is a

Table 1
Surgical mask users' perceptions of its environmental impacts ($N = 462$).

The single use face mask...				Differences between surgical & cloth mask users (Cramer's V sig.)
	Yes	No	I don't know	
...is made of natural materials (e.g. paper, cotton, etc.)	34.4%	19.7%	45.9%	Nonsignificant
...may be recycled	18.2%	47.4%	34.4%	Nonsignificant
...if it ends up in the sea, it harms the marine environment	84.4%	3.0%	12.6%	0.003

Table 2

Logistic regression results for surgical mask users' perceptions of its environmental impacts (Reference Category of the dependent variables: 'No').

The single use face mask...	...is made of natural materials			... may be recycled			...if it ends up in the sea, it harms the marine environment		
	B (s.e.)	Wald	Exp(B)	B (s.e.)	Wald	Exp(B)	B (s.e.)	Wald	Exp(B)
Level of information about face masks	n.s.			n.s.			n.s.		
Male	n.s.			−0.517(0.179)***	8.320	0.596	n.s.		
Age cohort	n.s.			n.s.			n.s.		
Educational attainment (REF: Postgraduate)				n.s.			n.s.		
Elementary	n.s.								
Gymnasium	n.s.								
High school/college	−0.905 (0.31)**	8.502	0.405						
University	−0.851 (0.238)***	12.836	0.427						
Income	n.s.			n.s.			n.s.		
Interested in env. protection	n.s.			n.s.			n.s.		
Concerned about plastic pollution (REF: 5, A lot)	n.s.			n.s.					
2, Little							3.187(1.41)*	5.109	24.215
Constant	−1.459 (n.s.)			0.149 (n.s.)			−38.364(n.s.)		
−2 Log likelihood	794,451			918,651			185,584		
Hosmer-Lemeshow Test	4.643 (n.s.)			13.315 (n.s.)			7.388 (n.s.)		
Nagelkerke R ²	0.064			0.070			0.142		
% of correct classification	65.1%			73.5%			97.9%		

n.s.: not statistically significant.

* p < 0.05.

** p < 0.01.

*** p < 0.001.

Table 3

Ordinal regression results for surgical mask users' appraisal of its relative environmental impact.

		B (s.e.)	Wald	Exp(B)
Threshold	Single-use mask pollutes the environment less than other masks (REF: 5, Strongly Agree)			
	1, Strongly Disagree	n.s.		
	2, Disagree	2.123 (1.066)*	3.970	8.356
	3, Neither ... nor...	4.018 (1.079)***	13.876	55.605
	4, Agree	5.343 (1.105)***	23.380	209.175
	Male	0.606 (0.207)**	8.595	1.834
	Age cohort	n.s.		
	Income	n.s.		
	Educational attainment (REF: 1, Elementary School)			
	2, Gymnasium	n.s.		
Parameter estimates of covariates	3, High school/college	−0.688 (0.318)*	4.413	0.513
	4, University	n.s.		
	5, Post-graduate	n.s.		
	The surgical mask is made of natural ingredients	n.s.		
	The surgical mask may be recycled	n.s.		
	If it ends up in the sea, the surgical mask harms the marine environment	n.s.		
	Interested in environmental protection	n.s.		
	Concerned about plastic pollution	n.s.		
	−2 Log likelihood	815.471		
	Chi-square	47.216***		
	Nagelkerke R ²	0.118		

n.s.: not statistically significant.

* p < 0.05.

** p < 0.01.

*** p < 0.001.

country-specific phenomenon and studying which are the reasons for its occurrence, go beyond the scope of this short communication. Nevertheless, research in other countries also demonstrated that 'the [COVID-19] pandemic threat has clearly outgrown the perceived threat of plastic' thus resulting 'in a sudden shift in the hierarchization of values', with health concerns outweighing the environmental ones when it comes to single-use-plastic materials (Grodzinska-Jurzak et al., 2020). Thus, available evidence suggests that the circumstances of the COVID-19 pandemic may (have) mute(d) the theoretically taken-for-granted connection between environmental interest/concern and the awareness of environmental impacts. Accordingly, any future attempts to introduce more environmentally-friendly single-use mask alternatives and/or to curb the current ones' environmental impact should start by reenergizing this suppressed nexus. To this end, and as past research has established (cf. Rambonnet et al., 2019; Syberg et al., 2018) the involvement of the lay public through citizen science projects on (marine) plastic pollution is a promising and necessary tool for involving, alerting, informing and sensitizing citizens to the current pandemic's environmental repercussions on our natural environment.

CRedit authorship contribution statement

Iosif Botetzagias: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing. **Chrysovaladis Malesios:** Formal analysis, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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