

Original Article

Personal Protective Equipment Use among Health Care Workers during the COVID-19 Pandemic: A Comparative Study in England and Greece

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Abstract

Introduction: Personal protective equipment (PPE) use among health care workers (HCWs) during the coronavirus disease 2019 (COVID-19) pandemic has increased significantly creating various difficulties.

Aim: To examine HCWs' experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic in England and Greece.

Methods: A cross-sectional study with a convenience sample was conducted during April 2021. Due to the circumstances during the COVID-19 pandemic, we collected data through google forms using a snowball method. We created a google form with the study questionnaire asking HCWs to complete it in an anonymous way. We collected the following demographic data: gender, age, clinical experience, country of work, and profession. Also, we used 21 questions to assess HCWs experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic.

Results: Study population included 87 HCWs from Greece (51.8%) and 81 from England (48.2%) with a mean age of 38.1 years. Significant percentages of HCWs stated that PPE was insufficient (36.4%), training regarding PPE use was limited (49.1%), and information regarding PPE use was limited (43.1%). 91.1. Almost all the HCWs knew to use PPE (97.6%). The greatest difficulties that HCWs faced were the following: development of physical problems, difficulty in communication, difficulty of physical movements, lack of adequate personal protective equipment, lack of organizational support, and lack of knowledge of protocols/instructions for the correct use of the equipment. HCWs in England considered more often that: PPE is sufficient ($p < 0.001$), the availability of PPE is increased due

to the COVID-19 pandemic ($p < 0.001$), and know to use appropriate PPE ($p = 0.013$). Training and information regarding PPE use were more often in England ($p = 0.003$ and $p < 0.001$ respectively). Also, lack of adequate PPE ($p < 0.001$), knowledge of using PPE ($p = 0.002$), protocols/instructions for the correct use of the PPE ($p < 0.001$), knowledge of protocols/instructions for the correct use of the PPE ($p < 0.001$), organizational support ($p < 0.001$), motivation ($p < 0.001$), and safety culture in work ($p < 0.001$) were more often in Greece.

Conclusions: Since the COVID-19 pandemic continues to threaten public health, creating a safety culture work environment for HCWs in clinical settings is essential to decrease the spread of SARS-CoV-2, protect HCWs and their patients, and increase work performance.

Key words: COVID-19; personal protective equipment; health care workers; England; Greece

Introduction

Health care workers (HCWs) are a high-risk group for exposure to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) with a high seroprevalence of SARS-CoV-2 antibodies among them (Galanis et al., 2021). Since the coronavirus disease 2019 (COVID-19) pandemic continues to have a tremendous impact worldwide, HCWs are still the frontline workers to confront this threat (Cacciapaglia et al., 2020). Massive COVID-19 vaccination programmes have been established worldwide since December 2020, but intention of HCWs and public to accept a COVID-19 vaccine seems to be moderate (Al-Amer et al., 2021; Galanis et al., 2020; Luo et al., 2021). Moreover, real-world data from early studies revealed that COVID-19 vaccination uptake among healthcare workers ranged from 33.3% to 94.5% and in the general population ranged from 28.6% to 98% (Galanis et al., 2021c).

During the COVID-19 pandemic, HCWs encounter a variety of new difficulties, e.g. a medical condition with unknown clinical course, lack of personal protective equipment (PPE), management of patients with comorbidity, COVID-19 treatment options, worse mental health outcomes, higher levels of burnout, etc. (Albendín-García et al., 2021; Fernandez et al., 2020; Galanis et al., 2021a; Sanghera et al., 2020). Moreover, HCWs deal with COVID-19 patients wearing PPE for long periods. Thus, the prevalence of adverse events among HCWs due to PPE use is very high during the COVID-19 pandemic (Galanis et al., 2021b). The most frequent adverse events are headaches, skin reactions, dyspnoea, pressure injuries, itching, and dermatitis, while several factors increase the occurrence of adverse events, e.g. female gender,

younger age, morbidity, longer duration of shifts, etc. (Galanis et al., 2021b).

Several studies have investigated HCWs' knowledge, practice, experiences, and attitudes with regards to PPE use during the COVID-19 pandemic (Delgado et al., 2020; Deressa et al., 2020; Fan et al., 2020; Hoernke et al., 2021; Hossain et al., 2021; Liu et al., 2020; Neuwirth et al., 2020; Ojha et al., 2021; Alexis Tabah et al., 2020). According to the literature, major concern of HCWs was the lack of PPE since this could put HCWs and their patients at risk of infection. Also, HCWs had a positive attitude towards PPE, but there was a poor practice.

Aim: We examined HCWs' experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic in England and Greece.

Methods and materials

Study design and participants: A cross-sectional study with a convenience sample was conducted during April 2021. Due to the circumstances during the COVID-19 pandemic, we collected data through google forms using a snowball method. In particular, we informed via a mail HCWs in intensive care units and COVID-19 clinics in several hospitals in England and Greece about the methods and the aim of our study. We created a google form with the study questionnaire asking HCWs to complete it in an anonymous way. We approached HCWs that we have had personal contact in the past and the treated COVID-19 patients during the COVID-19 pandemic. We conducted our study in line with the Declaration of Helsinki human rights and all HCWs provided informed consent to participate in the study. HCWs

who agreed to participate in the study completed the questionnaire anonymously.

Measures: We collected the following demographic data: gender, age, clinical experience, country of work, and profession. Also, we used 21 questions to assess HCWs experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic. Answers were in a five-point Likert scale: not at all, to a small extent, to a moderate extent, to a large extent, and to a very large extent. Cronbach's alpha for the questionnaire was 0.88 indicating very good internal consistency. Questionnaire is presented in detail in Table 1.

Statistical analysis: Categorical variables are presented as numbers (percentages), while continuous variables as mean (standard deviation). Continuous variables did not follow normal distribution and we applied non-parametric statistical tests to explore relations between demographic characteristics and healthcare workers' experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic. In particular, we used the Mann-Whitney test and the Kruskal-Wallis test. All tests of statistical significance were two-tailed, and p -values < 0.05 were considered significant. Statistical analysis was performed with the Statistical Package for Social Sciences software (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.).

Results

Study population included 87 HCWs from Greece (51.8%) and 81 from England (48.2%), while 67.9% ($n=114$) were females and 30.4% ($n=51$) were males. Mean age of the HCWs was 38.1 years (standard deviation=10.2). Half of the participants were nurses ($n=84$), 32.7% ($n=55$) were allied HCWs and 17.3% ($n=29$) were physicians.

Descriptive statistics about healthcare workers' experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic are presented in Table 2. Significant percentages of HCWs stated that PPE was insufficient at all to a moderate extent (36.4%), training regarding PPE use was

limited (49.1%), and information regarding PPE use was limited (43.1%). Ninety one point one percent of HCWs stated that PPE availability was increased during the COVID-19 pandemic and 94.8% stated there were specific protocols for PPE use. Almost all the HCWs knew to use PPE (97.6%).

Descriptive statistics about factors inhibiting the use of personal protective equipment among healthcare workers during the COVID-19 pandemic are presented in Table 3. The greatest difficulties that HCWs faced were the following: development of physical problems, difficulty in communication, difficulty of physical movements, lack of adequate personal protective equipment, lack of organizational support, and lack of knowledge of protocols/instructions for the correct use of the equipment.

Statistically significant relations between demographic characteristics and healthcare workers' experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic are presented in Table 4. HCWs in England considered more often that: PPE is sufficient ($p < 0.001$), the availability of PPE is increased due to the COVID-19 pandemic ($p < 0.001$), and know to use appropriate PPE ($p = 0.013$). Training and information regarding PPE use were more often in England ($p = 0.003$ and $p < 0.001$ respectively). Also, lack of adequate PPE ($p < 0.001$), knowledge of using PPE ($p = 0.002$), protocols/instructions for the correct use of the PPE ($p < 0.001$), knowledge of protocols/instructions for the correct use of the PPE ($p < 0.001$), organizational support ($p < 0.001$), motivation ($p < 0.001$), and safety culture in work ($p < 0.001$) were more often in Greece. Moreover, improper design of PPE ($p = 0.008$), difficulty of physical movements ($p < 0.001$), difficulty in communication ($p < 0.001$), development of physical problems ($p < 0.001$), and development of psychological problems ($p < 0.001$), were more often among HCWs in Greece. Physicians and nurses used PPE more often than allied HCWs ($p = 0.042$) and had more difficulties in physical movements ($p = 0.006$).

Table 1. Study questionnaire to assess healthcare workers’ experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic.

Question	Answer				
	Not at all	To a small extent	To a moderate extent	To a large extent	To a very large extent
To what extent do you consider that there is sufficient personal protective equipment for health professionals in the unit in which you work?					
Has there been an increase in the availability of personal protective equipment for health professionals in the unit where you work due to the Covid-19 pandemic?					
Are there specific protocols for the use of personal protective equipment for healthcare professionals?					
Do you know how to use protective equipment?					
Has any training organized regarding the use of personal protective equipment?					
Were you given any information about the use of personal protective equipment?					
To what extent do you personally use personal protective equipment?					
Overall, to what extent is personal protective equipment used in the unit where you work?					
To what extent are the following factors inhibiting the use of personal protective equipment?					
Lack of adequate personal protective equipment					
Lack of knowledge of using protective equipment					

Lack of protocols/instructions for the correct use of the equipment					
Lack of knowledge of protocols/instructions for the correct use of the equipment					
Lack of confidence in the effectiveness of protective equipment					
Improper design of protective equipment					
Difficulty of physical movements					
Difficulty in communication					
Development of physical problems (e.g. headache, shortness of breath, skin problems)					
Development of psychological problems (e.g. fear, depression)					
Lack of organizational support					
Lack of motivation					
Lack of safety culture in the health unit					

Table 2. Descriptive statistics about healthcare workers' experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic.

Question	Answer				
	Not at all	To a small extent	To a moderate extent	To a large extent	To a very large extent
To what extent do you consider that there is sufficient personal protective equipment for health professionals in the unit in which you work?	2 (1.2)	9 (5.4)	50 (29.8)	70 (41.7)	37 (22.0)
Has there been an increase in the availability of personal protective equipment for health professionals in the unit where you work due to the Covid-19 pandemic?	4 (2.4)	11 (6.5)	42 (25.0)	72 (42.9)	39 (23.2)
Are there specific protocols for the use of personal protective equipment for healthcare professionals?	4 (2.4)	4 (2.4)	0 (0)	14 (9.1)	132 (85.7)
Do you know how to use protective equipment?	2 (1.2)	2 (1.2)	15 (8.9)	67 (39.9)	82 (48.8)
Has any training organized regarding the use of personal protective equipment?	9 (5.4)	30 (18.0)	43 (25.7)	57 (34.1)	28 (16.8)
Were you given any information about the use of personal protective equipment?	3 (1.8)	23 (13.8)	46 (27.5)	58 (34.7)	37 (22.2)
To what extent do you personally use personal protective equipment?	2 (1.2)	5 (3.0)	20 (11.9)	61 (36.3)	80 (47.6)
Overall, to what extent is personal protective equipment used in the unit where you work?	2 (1.2)	7 (4.2)	25 (14.9)	71 (42.3)	63 (37.5)

Values are expressed as n (%).

Table 3. Descriptive statistics about factors inhibiting the use of personal protective equipment among healthcare workers during the COVID-19 pandemic.

To what extent are the following factors inhibiting the use of personal protective equipment?	Mean	Standard deviation
Lack of adequate personal protective equipment	2.38	1.13
Lack of knowledge of using protective equipment	2.20	1.12
Lack of protocols/instructions for the correct use of the equipment	2.15	1.14
Lack of knowledge of protocols/instructions for the correct use of the equipment	2.34	1.13
Lack of confidence in the effectiveness of protective equipment	2.11	1.05
Improper design of protective equipment	2.31	1.05
Difficulty of physical movements	2.53	1.21
Difficulty in communication	2.64	1.17
Development of physical problems	2.78	1.19
Development of psychological problems	2.23	1.11
Lack of organizational support	2.36	1.10
Lack of motivation	2.30	1.14
Lack of safety culture in the health unit	2.27	1.24

Table 4. Statistically significant relations between demographic characteristics and healthcare workers' experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic.

Question	Mean rank	P-value
To what extent do you consider that there is sufficient personal protective equipment for health professionals in the unit in which you work?		
Country		<0.001
Greece	67.6	
England	102.6	
Has there been an increase in the availability of personal protective equipment for health professionals in the unit where you work due to the Covid-19 pandemic?		
Country		<0.001
Greece	70.7	
England	99.3	
Are there specific protocols for the use of personal protective equipment for healthcare professionals?		
Country		0.012
Greece	89.8	
England	78.8	
Do you know how to use protective equipment?		
Country		0.013
Greece	76.4	
England	93.2	
Has any training organized regarding the use of personal protective equipment?		
Country		0.003
Greece	73.8	
England	95.2	

Were you given any information about the use of personal protective equipment?		
Country		<0.001
Greece	70	
England	99.2	
Overall, to what extent is personal protective equipment used in the unit where you work?		
Profession		0.042
Physicians	87.9	
Nurses	89.1	
Allied healthcare workers	75.1	
To what extent are the following factors inhibiting the use of personal protective equipment?		
Lack of adequate personal protective equipment		
Country		<0.001
Greece	95.1	
England	67.2	
Lack of knowledge of using protective equipment		
Country		0.002
Greece	91.7	
England	69.6	
Lack of protocols/instructions for the correct use of the equipment		
Country		<0.001
Greece	96.5	
England	66.2	
Lack of knowledge of protocols/instructions for the correct use of the equipment		
Country		<0.001
Greece	91.2	

England	68.3	
Improper design of protective equipment		
Country		0.008
Greece	90	
England	71.4	
Difficulty of physical movements		
Country		<0.001
Greece	96.7	
England	64.3	
Profession		0.006
Physicians	94.5	
Nurses	87.4	
Allied healthcare workers	62.1	
Difficulty in communication		
Country		<0.001
Greece	88.9	
England	68.2	
Development of physical problems (e.g. headache, shortness of breath, skin problems)		
Country		<0.001
Greece	93.9	
England	67.8	
Development of psychological problems (e.g. fear, depression)		
Country		<0.001
Greece	91.8	
England	68.3	

Lack of organizational support		
Country		<0.001
Greece	95.1	
England	66.9	
Lack of motivation		
Country		<0.001
Greece	94.9	
England	66.7	
Lack of safety culture in the health unit		
Country		<0.001
Greece	95.1	
England	62.7	

Discussion

We conducted a study to examine HCWs' experiences, practice, and attitudes regarding PPE during the COVID-19 pandemic in England and Greece. A significant percentage of HCWs stated that PPE was insufficient at all to a moderate extent (36.4%). This finding is confirmed by the literature since several studies worldwide found that lack of PPE during the COVID-19 pandemic was one of the major problems that HCWs face (Chersich et al., 2020; Cohen and Rodgers, 2020; Delgado et al., 2020; Deressa et al., 2020; Hoernke et al., 2021; Alexis Tabah et al., 2020). Severe shortages in PPE have notified in a great number of countries since COVID-19 causes a very large demand shock. Moreover, the lack of an effective plan of the governments to maintain and distribute appropriately the PPE increases the problem. Although PPE availability is increased during the COVID-19 pandemic, there is still a shortage especially in developing countries.

Almost all HCWs in our study stated there were specific protocols for PPE use. This finding is quite encouraging since the existence of standardized protocols to use PPE can improve healthcare and clinical outcomes and minimize self-contamination during patient care which may lead to HCWs infection. Studies have shown that absence of standardized protocols for PPE use and improper adherence in PPE use result on failures and accidental contact of HCWs with pathogens (Alhmidi et al., 2019; Tomas et al., 2015; Wilder-Smith et al., 2020; Wong et al., 2019). Standardized protocols to use PPE decrease contamination of the skin and clothing of HCWs and interrupt human-to-human transmission minimizing spread of SARS-CoV-2 among HCWs in clinical settings.

Moreover, we found that almost all the HCWs knew to use PPE appropriately. This issue is controversial with contradicting results among studies (Delgado et al., 2020; Hossain et al., 2021; Ojha et al., 2021). Training sessions and information regarding PPE use help HCWs to use PPE in the proper way. Also, training courses improve HCWs' positive attitudes towards PPE, adherence to PPE use, and proper selection and use (Hon et al., 2008; Kang et al., 2017; Verbeek et al., 2020). Implementation of innovative PPE

education is essential to ensure a safe work environment during the COVID-19 pandemic.

Physical problems due to PPE use was one of the greatest difficulties that HCWs faced during the hospitalization of COVID-19 patients. A great number of studies have already shown the impact of PPE use on HCWs physical health (Battista et al., 2021; Çağlar et al., 2020; Coelho et al., 2020; Guertler et al., 2020, 2020; Hu et al., 2020; Lin et al., 2020; Metin et al., 2020; Ong et al., 2020; A. Tabah et al., 2020; Zhao et al., 2020; Zuo et al., 2020). In particular, the prevalence of adverse events ranges from 42.8% to 95.1%, while headaches, pressure injuries, skin reactions, dyspnoea, and dermatitis are the most frequent adverse events (Galanis et al., 2021b). Since the prevalence of adverse events among HCWs due to PPE is very high, stakeholders should pay attention to improve the equipment and change the working conditions to decrease harm.

According to HCWs of our study, experiences and conditions regarding PPE were better in England than in Greece, e.g. availability PPE, appropriate use of PPE, training, information, knowledge, organizational support, safety culture, design of PPE, physical problems etc. Differences between countries are expected since the healthcare systems are different and resources that are allocated to confront the COVID-19 pandemic are not the same. Moreover, the preparedness of the countries against the COVID-19 pandemic is different since stakeholders apply different interventions and measures in clinical settings to confront SARS-CoV-2. Also, knowledge and clinical approach are different in the two countries since the COVID-19 pandemic does not have the same course, e.g. the first wave of COVID-19 pandemic in Greece is very mild and the pressure in healthcare system is low.

Our study had several limitations. Firstly, the sample size was small since the number of HCWs in England and Greece is quite larger. Also, we performed a study through a snowball method sampling and thus our sample could not be representative of the total population of HCWs in England and Greece. Moreover, we investigated only a few demographic variables as possible determinants of HCWs' experiences, practice, and attitudes regarding PPE during the COVID-19

pandemic. Information bias is probable since we used a questionnaire with a pool of items to examine HCWs' experiences, practice, and attitudes regarding PPE.

Despite the above limitations, our study provides some useful information regarding HCWs' experiences, practice, and attitudes regarding PPE in England and Greece. Since the COVID-19 pandemic continuous to threat public health, creating a safety culture work environment for HCWs in clinical settings is essential to decrease the spread of SARS-CoV-2, protect HCWs and their patients, and increase work performance.

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