ARTICLE ORIGINAL

Personal Protective Equipment: A Cross-Sectional Study in Frontline Healthcare Workers During COVID-19 Outbreak in Tunisia

Equipement de protection individuelle: enquête chez lessoignants exposés au Covid-19 en Tunisie

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RÉSUMÉ

Introduction: Pour les soignants exposés au Covid-19, le risque de contamination est important d'où la necessitié de l'usage des équipements de protection individuelle (EPI). Donc l'objectif de cette étude était d'avoir un état des lieux concernant la disponibilité des EPI dans les différents établissements de santé ainsi que la satisfaction des personnels soignants concernant l'usage de ces EPI et les différents effets indésirables rapportés par les soignants Tunisiens.

Méthodes: C'est une étude transversale, descriptive, multicentrique, faite sous forme de questionnaire, durant une période d'un mois du 15 avril au 5 mai 2020.

Résultats: Au total, nous avons reçu 723 réponses valides. Les principaux résultats étaient un usage inadéquat des EPI favorisant le gaspillage ainsi qu'un taux élevé d'effets indésirables rapportés.

Conclusion: D'autres formations sont nécessaires afin d'optimiser l'usage des EPI ainsi que le recours à l'utilisation sessionelle des EPI pour réduire leurs effets indésirables

Mot clés : COVID-19, équipements de protection individuelle, personnel soignant, Tunisie

SUMMARY

Background:

For frontline healthcare workers (FHW) who are working with Coronavirus Disease-19 (COVID-19) patients, PPE is currently considered as one of the most discussed topics. Recommendation from international organizations concerning the use of PPE are broadly consistent but equipment use is not. No previous studies examined the use of PPE in Tunisia.

Aim: Evaluate the availability of personal protective equipment (PPE) in addition to the reality and perception regarding personal safety in workplace.

Methods: We carried out a cross-sectional survey from 15th April to 5th May 2020 across public and private institutions in Tunisia. A 33-item structured questionnaire was developed and administered to FHWs.

Results: We received 723 responses. We found that there was a likely overuse of PPE in addition to a high rate of side effects caused by PPE.

Conclusions: Additional training in PPE use might be useful, and sessional work should be considered to decrease the side effects associated with PPE use.

Key words: COVID-19, frontline health workers, personal protective equipment, Tunisia

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INTRODUCTION

In December 2019, many cases of severe pneumonia occurred in Wuhan city, China, due to a novel coronavirus, which spread rapidly throughout the whole country (1). Since January 2020, this novel condition was officially named SARS-CoV-2 attributed to the second severe acute respiratory syndrome caused by zoonotic Coronavirus which rapidly spread in the world that is why according to the world Health Organization (WHO) it was considered as a pandemic (2). As generally known, this pandemic threatened the global public health security because it was considered as more contagious than SARS-CoV-1 (3,4). On April 3, according to the Chinese Red Cross Foundation, the National Health commission of The People's Republic of China and public media, from the 77 262 patients with COVID-19 in China, a total of 3387 (4.4%) were health care workers from whom 23 had died after they became infected during the practice of medicine in China (5). Since frontline healthcare workers (FHWs) are considered as fundamental asset to control the outbreak, the risk of infection in this population is a critical issue. For this reason, all protection measures must be taken in order to reduce risks of contamination and the most important one is the appropriate use of personal protective equipment (PPE). Therefore, the WHO, in addition to the majority of national and international public health authorities have prepared several recommendations for FHWs concerning safety protocols and the adequate use of PPE and those recommendations are updated regularly (6,7). However, medical institutions dealing with COVID-19, around the world, do not always have access to the same safety resources, and the availability of basic equipment differs from an institution to another. In addition to that and in practice, donning of the PPE is often uncomfortable especially if it is for a long period without sessional use and doffing of the PPE must be done carefully also because there is a high risk of contamination (8).

As of March 2, 2020, Tunisia has reported the first confirmed case of COVID-19 and it spread rapidly with the number of confirmed cases reaching 1018, and the number of deaths reaching 43, as of May 4, 2020. A total of 143 (14%) were health care workers. Therefore, during the escalation of the COVID-19 outbreak in Tunisia, FHW while caring for suspected or confirmed COVID-19 patients were mandated to wear PPE. So, the aim of this study was to evaluate the reality and perceptions regarding personal safety in addition to the availability and the use of PPE by healthcare workers in Tunisian medical institutions during the escalation of the COVID-19 outbreak.

METHODS

This study was a cross-sectional, online questionnaire-based survey administered to FHWs in private and public institutions in Tunisia. The questionnaire was created Google Forms. Questions were written in French, since it is the most used language in the health field in Tunisia. We defined FHWs as health professionals in direct contact with confirmed or suspected cases of COVID-19 and who directly involved in COVID-19 prevention and treatment (Doctors, nurses and advanced clinical practitioners working in areas most likely to encounter early cases of COVID-19). Participants were recruited by sending the survey to a key person in each Department involving FHWs. Each key person forwarded the survey to each of the identified FHWs in their Department, by email and through messages on social networks, using existing databases from the Tunisian Society of Anesthesia (STAR), the Faculty of Medicine of Tunis and the Ministry of Health, Tunisia. Reminders were sent after one week.

This study was conducted from 15 April to 05 May 2020. The survey was anonymous, and no personal identifiers were obtained using the survey.

A 33-item structured questionnaire was developed to evaluate the availability and use of personal protective equipment (PPE) by FHWs in Tunisia, as well as the FHW's perceptions regarding personal safety. The survey was divided into different sections. Section One had nine questions about socio-demographic data, including type of practice (private or public institution), work location, occupation (Doctor, nurse or allied healthcare professional), years of experience (0-3, 4-5, 6-10 and >10 years) and sex (male or female). Section Two included 14 items which were designed to evaluate availability of PPE (type of PPE used in case of direct contact with suspected or confirmed cases of COVID-19, lack of PPE, use of home-made PPE and re-use of single-use PPE), access to personal safety procedures (training in the use of adequate PPE, viewing video materials, training in how to fitfiltering facepiece 2 or FFP2 masks, whether they believe additional training is necessary), place dedicated for donning and doffing PPE (yes or no), sessional use of PPE (yes or no), regular use of gel hand sanitizer

(yes or no). Finally, section Three consisted of ten items designed to evaluate the participants' satisfaction about the availability of PPEs, their perceptions whether their team members are taking all necessary measures for an adequate use of PPEs, their perceptions of the measures taken by their medical institutions to protect their physical health in the workplace, their attitude in case of lack of PPE as well as side effects due to the use of PPE.

To calculate the required sample size, we used an estimated number of 10,000 FHWs exposed to COVID-19 in Tunisia. For a 99% confidence interval and a margin of error of 1%, the required sample size was n= 622 respondents to our questionnaire (respondents being defined as participants who fully answered the questionnaire). Estimating a response rate of 20%, this questionnaire should be sent to at least 3,000 HCW in order to have the required number of respondents. For descriptive statistics of the studied variables, we calculated absolute and relative frequencies for categorical variables; as well as means and standard deviations for continuous variables.

RESULTS

Socio-demographic characteristics:

In this cross-sectional survey, we received a total of 795 questionnaires, of which 72 were excluded because they were incomplete. We analyzed the remaining 723 questionnaires which were complete. The details of socio-demographic characteristics were presented in Table 1. The respondents were comprised of 516 doctors, 114 nurses and 78 allied healthcare professionals. Most of them were women (n=415, 57.4%), worked in a COVID-19 unit (n=306) or intensive care unit (n=384) in public institutions (n=630).

Availability of the personnel protective equipment:

In case of direct contact with suspected or confirmed cases of COVID-19, participants indicated that they had mainly used the following items: surgical masks, FFP2 masks, facial protective shields (glasses or visor), disposable fluid resistant coverall or gown and disposable plastic apron (Figure 1). However, 57.3% of them reported lack of PPE, 58.5% reported they bought some PPE by themselves and 60.6% used home-made PPE (Table 2).

Table 1. Socio-demographic characteristics of the frontline healthcare workers

Variables		Number (n)	Percentages (%)
Type of practice	Public	630	87.1%
	Private	93	12.9%
Work location	COVID-19 unit	306	42.3%
	Intensive care unit	384	53.1%
	Others	33	4.6%
Occupation	Doctors	516	71.4%
	Nurses	114	15.8%
	Others	78	12.8%
Years of experiences	0 – 3 years	341	47.2%
	4 – 5 years	193	26.7%
	6 – 10 years	101	14%
	>10 years	88	12.2%
Sex	Female	415	57.4%
	Male	308	42.6%

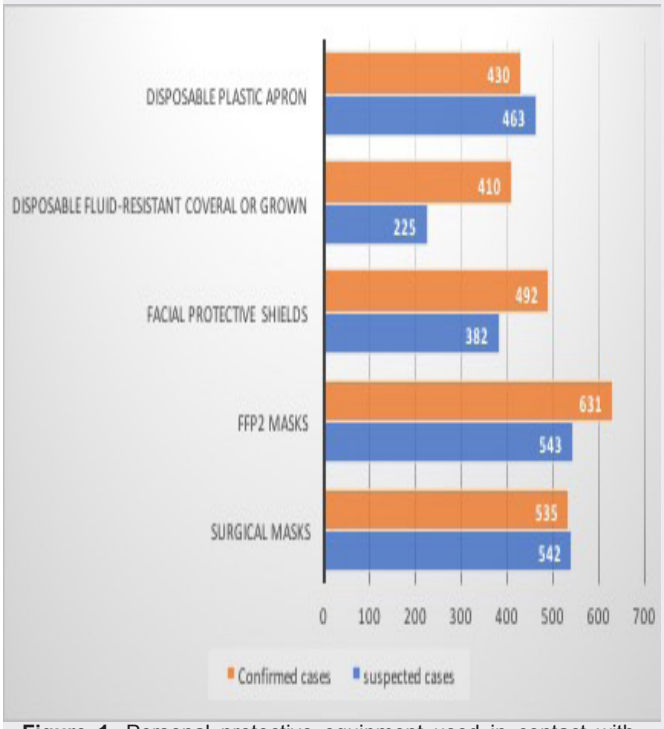

Figure 1. Personal protective equipment used in contact with COVID-19 patients

Table 2. Problem with personal protective equipment availability

Variables		Number (n)	Percentages (%)
Lack of PPE	**Yes**	414	57.3%
	No	309	42.7%
Buying PPE by themselves	**Yes**	423	58.5%
	No	300	41.5%
Home-made PPE	**No**	285	39.4%
	Facial masks	116	16%
	Facial protective shields	371	51.3%
Re-used disposable PPE	**No**	199	27.5%
	Facial protective shields	394	54.4%
	Surgical masks	103	14.2%
	FFP2 masks	136	18.8%

PPE: personal protective equipment

Table 3. Access to personal safety procedures

Variables		Number (n)	Percentages (%)
Official training on use of PPE	**Yes**	273	37.8%
	No	450	62.2%
Addition training needed	**Printed media**	55	7.6%
	Simulation	589	81.5%
	No	79	10.9%
Training in how to fit FFP2 masks	**Yes**	236	32.6%
	No	487	67.4%
Viewing video materials	**Yes**	695	96.1%
	No	28	3.9%
Place dedicated for donning PPE	**Yes**	442	61.1%
	No	281	38.9%
Sessional use of PPE	**Systematically**	191	26.4%
	Occasionally	248	34.3%
	Never	284	39.3%

PPE: personal protective equipment

Access to personal safety procedures:

Only 273 participants received an official training on donning and doffing PPE. That is why 644 (89.1%) of them believed that they should receive an additional training. Moreover, 442 respondents indicated that they used a specific room dedicated for donning PPE and only 191 participants had sessional use of PPE systematically (average time of the session was seven hours) essentially due to the imposed stock management limitations (Table 3).

Satisfaction about the availability of PPEs:

When asked about their perceptions of the measures taken by their medical institutions to protect their physical health in their workplace, 27.4% of FHWs were not satisfied and 35.5% were slightly satisfied (Figure 2). In addition, 30% were slightly confident concerning their aptitude in using PPEs and 36.4% were not at all confident concerning the measures taken by their team members for an adequate use of PPEs. Although, in case of lack of PPEs, only 58 participants (8%) indicated that they would deliver care to a confirmed COVID-19 patient without PPE.

Side effects due to the use of PPEs:

When asked about the side effects due to prolonged use of PPEs, 81.5 % of the participant reported the following signs: feeling of suffocation (58.1%), warmth (55.5%), pressure zone (35.7%), inability to go to the toilet (33.7%), thirst (26.4%), headache due to hypercapnia (24.6%), skin irritation (15.4%)…

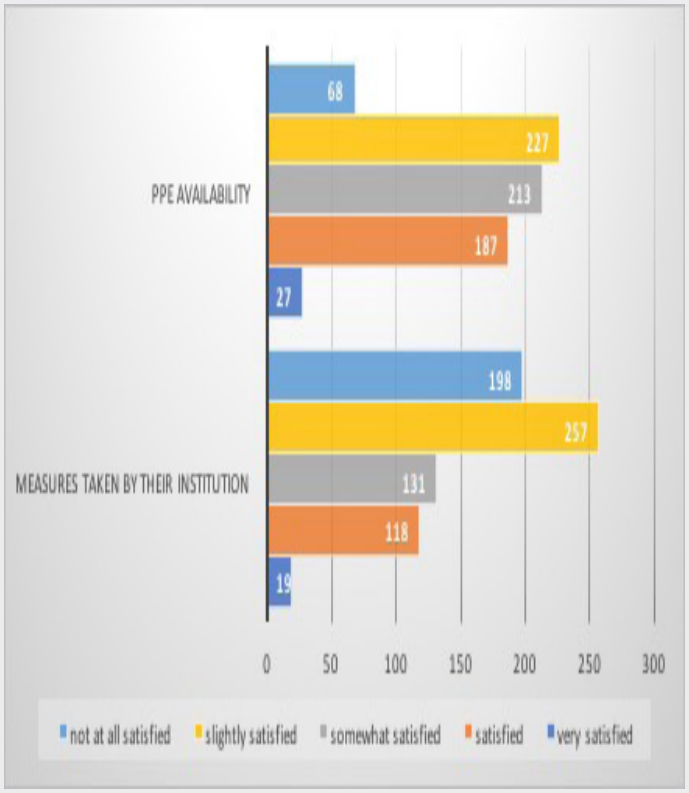

Figure 2. Participant satisfaction concerning the personal protective equipment's availability and the measures taken by their institutions

DISCUSSION

This survey was conducted in the middle stages of the COVID-19 outbreak in Tunisia. The majority of the respondents were Doctors actively based in public institutions. However, two thirds of participants had fewer than 10 years of experience, possibly reflecting lack of experience in preparing for novel infectious diseases. Indeed, in a cross-sectional survey conducted in England (9), the majority of their FHWs have been practicing during the emergence of MERS-CoV in 2012 and influenza A(H1N1) in 2009 which likely provided them with needed experience. In addition, we noticed that, in Tunisia, the majority of healthcare workers who were in contact with suspected cases were working either in unit dedicated to COVID-19 or in an intensive care unit.

Concerning the availability of PPEs, our study showed that FHWs had access to basic PPE but they were using almost the same equipment in contact with suspected or confirmed cases of COVID-19. This is considered as a potential waste of resources, that might aggravate the lack of PPE in certain settings. Indeed 57.3% of participants reported lack of PPE which could be extremely stressful and detrimental to them. This lack of PPE is not specific to Tunisia but it is part of an ongoing international crisis. Indeed, a national survey in United States reported that by the end of Marsh 2020, many medical facilities were nearing the end of their PPE supplies (10). For this reason, a rational use of PPEs is emphasized by the WHO (6). For example, we reported that surgical masks and FFP2 masks were used at the same time. However high filtration masks should be reserved only for aerosol-generating activities (11). Furthermore, 72.5% of respondents re-used disposable PPE, especially facial protective shields and FFP2. This contrasts with important safety requirements (12).

During the early phase of a pandemic outbreak, healthcare systems should be prepared to manage infected cases and one of the important components is providing concerning staff with the knowledge they require. In Tunisia, at the time this survey started there was already formal guidance on COVID-19 issued by the National Authority For Health Assessment and Accreditation (INEAS) (13). However only 37.8% of FHW had received an official training on the correct use of PPE especially for how to fit FFP2 masks (only 32.6%). Therefore, exceptional efforts have been made by FHW in order to protect their health in their workplace, like for example the fact of viewing video materials on donning and doffing PPE (96.1% of the participants). Our study showed that the majority of participants were not at all or were only slightly satisfied by the measures taken by their institutions. This probably highlights that there is much work to be done by public health authorities (89.1% of participants believed that they needed additional training).

Wearing those equipments for a long time causes many side effects to health workers, thus adversely affecting the quality of their work. Poor breathability in addition to compression and friction are the causes of various skin problems (allergies, local mechanical injuries, excessive skin hydration) (14). Besides, prolonged pressure from FFP2 masks could be the cause of pain and device-related-pressure ulcers that is why hydrocolloid dressing strip over bridge of noise could be benefic (15). In addition to that, most FHWs developed de novo PPE-associated headaches or exacerbation of pre-existing headache

disorders (16). This explains why sessional use of PPE is recommended by the WHO in order to reduce those side effects. Nonetheless, only 26.4% of our participants used PPEs sessionally, probably because of stock management issues.

Finally, this study has some limitations that should be considered. The majority of respondents were from public institutions thereby limiting the generalizability of the findings to both the public and private sectors in Tunisia. In addition, more than half of participants were Doctors, which hinders the generalizability to all health professionals.

CONCLUSION

During the COVID-19 epidemic, personal protective equipment has become an important subject because there is evidence that the correct use of PPE protects staff by reducing rates of disease transmission. It is important that healthcare workers understands the purpose of PPE and use it appropriately in order to preserve limited stocks. That is why, we have done this study which is to the best of our knowledge the first and only survey that evaluates the availability and use of PPE in Tunisia and the African continent.

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