

Extended abstract.

# A web survey to evaluate the thermal stress among healthcare workers during the COVID-19 pandemic in Italy.

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**Abstract:** COVID 19 is a major planetary emergency and intense workloads and the potential heat stress create critical conditions for healthcare workers. A web survey was carried out in Italy during summer 2020 as part of WORKLIMATE project with the aim of assessing the interaction between Personal Protective Equipment (PPE) and heat stress in healthcare workers. Preliminary results on 191 questionnaires show an increase of heat stress perception in the areas covered by PPE determining symptoms such as thirst, sweating and general distress. This information could be useful to allow preventive measure to safeguard health and productivity of these workers.

**Keywords:** occupational health and safety; adaptation strategy; PPE; heat stress; global warming

## 1. Introduction

Since the beginning of 2020, humanity has been facing the most severe pandemic since the “Spanish flu” pandemic back in 1918. According to the World Health Organization (WHO), from January 1 to November 24, 2020, there were 58,712,326 COVID-19 confirmed cases and 1,388,528 deaths worldwide (<https://covid19.who.int/>). From the occupational point of view, healthcare workers have recorded an exponential increase in working hours [1] with intense workloads and potential heat stress. This was particularly true during the warm season, despite healthcare workers carried out most of their duties in air-conditioned environments. In addition, thermal discomfort is aggravated by the use of Personal Protective Equipment (PPE), which is necessary to reduce the risk of COVID-19 disease transmission [2]. These potential adverse conditions can cause important effects on workers’ health and productivity, adding further stress to healthcare systems already under great pressure due to the COVID-19 emergency [3]. Some studies based on surveys to assess the heat stress generated by COVID-19-PPE in the healthcare working sector have already been published internationally [3,4,5]. The main aim of this study was to evaluate the environmental thermal stress perceived by healthcare workers engaged in different activities in order to develop strategies to mitigate the effects of heat conditions, such as the development of a personalized heat-health warning system specific for occupational sectors.

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## 2. Materials and methods

A web survey was carried out in Italy within the WORKCLIMATE project (“Impact of environmental thermal stress on workers’ health and productivity: intervention strategies and development of an integrated heat and epidemiological warning system for various occupational sectors”), in order to evaluate the heat stress perceived by healthcare workers during the COVID-19 pandemic. A self-administered questionnaire, accompanied by an informed consent form, was completed by participants online (<https://forms.gle/rBbJixexAaBD6m3h9>). Participation was voluntary and anonymous. The survey was an adapted version of the original one developed by Lee et al. [3] that was used to assess the knowledge, attitudes, and practices of healthcare workers in India and Singapore regarding PPE usage and heat stress when performing treatment and care activities. Data were collected, stored and analyzed according to the Regulation on the protection of natural persons with regard to the processing of personal data (EU Regulation 2016/679 - General Data Protection Regulation - GDPR - application from 25 May 2018) and it was approved by the Italian National Research Council Ethics Committee (protocol N. 0009389/2020 of February 6 of 2020).

## 3. Results

A total of 191 workers participated in the survey, 132 women (69.1%) and 59 men (30,9%). About 56% were based in northern Italy (**Table 1**).

**Table 1.** Sample characteristics and preliminary results of the questionnaire submitted to healthcare workers.

Healthcare workers		N.	%
Region	Northern	108	56
	Central and Southern	83	44
Gender	Male	59	31
	Female	132	69
Kind of work	General practitioner	4	2
	Hospital doctor	73	38
	Dentist/Orthodontist	5	3
	Nurse/Pediatric Nurse	64	33
	Unlicensed assistive personnel	2	1
	Occupational therapist	2	1
	Physiotherapist	5	3
	Dental hygienist	2	1
	Technician of medical radiology	2	1
	Medical/biomedical laboratory technician	1	1
	Healthcare assistant	2	1
	Technician for prevention in the workplace	4	2
Work effort	Other	25	13
	At rest	2	1
	Lightweight	13	7
	Moderate	65	34
	High	82	43
Thermal environment	Very high	29	15
	Very cold	6	3
	Cold	11	6
	Slightly cold	20	10
	Neutral	40	21
	Slightly hot	33	17
	Hot	53	28
Very hot	28	15	
Dedicated rest area in the workplace		88	46
Heat stress in the areas covered by PPE		150	78
Symptoms generally perceived with PPE (multiple choice)	Thirst	11	58
	Excessive sweating	135	71
	Fatigue	88	46
	Headache	82	43
	Difficulty concentrating	56	29

	Skin reaction	51	27
	General discomfort	99	52
<b>Productivity loss perception (heat stress)</b>		<b>155</b>	<b>81</b>

N. Frequency; % Percentage.

The collected sample is quite heterogeneous and comprises many types of professions in the health sector even if the most represented are hospital physicians (38.2%) and nurses, including pediatric nurses (33.5%). With regards to work commitment and therefore work effort, about 43% declared an intense effort and 15% very intense; 34% moderate and only 7% lightweight. About 60% of workers declared they perceived hot and 14.7% even very hot conditions, despite the working environment being indoor and air-conditioned, probably because most of workers declared to be involved in intense work effort.

Figure 1 shows the prevalent thermal sensation declared by workers for each body district.

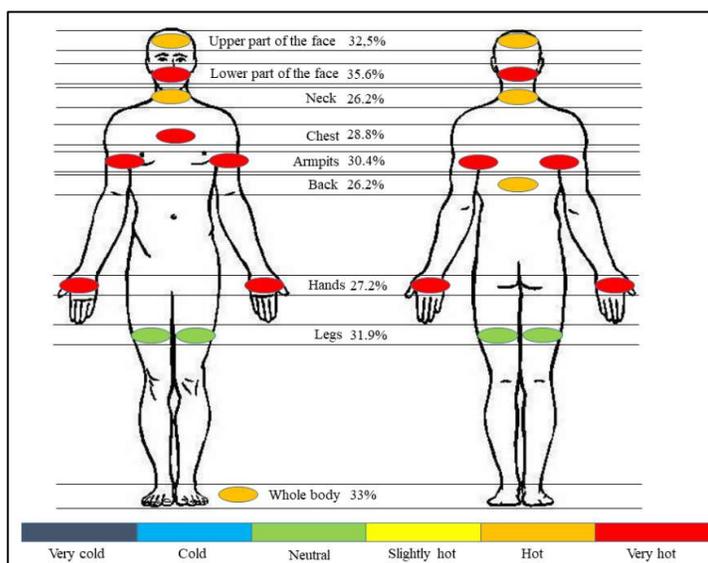


Figure 1. Prevalent thermal sensations declared by healthcare workers for each parts of the body covered by PPE during working time.

The body parts represented by prevalent “hot” or “very hot” conditions were the hands (27.2%), the lower part of the face (35.6), armpits (30.4) and chest (28.8%). A general whole body thermal sensation characterized by prevalent “hot” conditions (33%) was observed. In addition, 78% of respondents reported to perceive heat stress in areas of the body covered by PPE which, according to the workers' opinions, causes thirst (58.1%), excessive sweating (70.7%), fatigue (46.1%), headache (42.9%) and general discomfort (51.8%). Less than half of respondents (46% of workers) reported that there is a dedicated refreshment area in their workplace and, according to 81% of workers, heat stress conditions in the workplace lead to a productivity loss.

#### 4. Discussion and Conclusion

Results showed that, despite the workplaces in which the healthcare workers carry out their activities were generally air-conditioned, they often declared heat stress perception, particularly in the parts of the body that were covered by PPE. These preliminary results confirm what Tabah et al (2020) recently found in an international web-based survey conducted in Europe, Australia and New Zealand countries \ cities to elicit health care workers reports surrounding PPE related to the COVID-19 pandemic. In addition, workers declared a productivity loss linked to heat stress, as also confirmed in recent international surveys. In particular, Davey et al (2020) highlighted how 76.2% of the workers interviewed declared a loss of productivity linked to the stress conditions caused by PPE.

In addition, Lee et al (2020) confirmed that a majority of healthcare workers reported that heat stress was able to adversely influence their productivity, judgment, and emotions. Results for the survey will be reported in further detail in the special issue ""Selected Papers from the 3rd International Electronic Conference on Environmental Research and Public Health—Public Health Issues in the Context of the COVID-19 Pandemic", especially considering some individual characteristics (age, gender, physiological characteristics, tasks and behavior) which probably play an important role in the thermal perception of workers, highlighting significant differences among different categories of workers. The survey will also be replicated during next summer and an improvement in the administration strategy will also be evaluated, move from the self-administration method to the administration method assisted by a competent doctor or prevention and protection service staff , to avoid the current bias due to the self-administration.

These results may be particularly useful to plan and develop the appropriate interventions to manage the heat stress and protect the healthcare workers' health and improve their productivity, while keeping the measures to contrast COVID-19 as well as other possible occupational hazards a priority.

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