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Burnout and technostress during the COVID-19 pandemic: the perception of higher education teachers and researchers

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The COVID-19 pandemic had significant impacts on working conditions of teachers and researchers, jeopardizing their mental health and increasing the risk of burnout and technostress. The purpose of this study was to assess the experiences of burnout and technostress among higher education teachers and researchers during the pandemic. A total of 333 participants responded to an assessment protocol which included the Burnout Assessment Tool (BAT) and the Computer-Induced Distress scale (CID). The protocol was disclosed via email during a 2-month period and data was collected using Microsoft Forms. The results verified the prevalence of burnout and technostress, confirmed the existence of significant differences between sociodemographic groups and found correlations between the BAT and the CID. The findings indicate moderate levels of burnout and technostress, suggest several influence factors to their development, and show a relationship between burnout and technostress. Implications of this study are discussed, reenforcing education, training, decent work, and wellbeing as the main challenges for human being to support a sustainable development. As there are few studies in this area, there is a need to pay more attention to mental health issues and needs among teachers and researchers, such the ones related to burnout and technostress, to promote their well-being, as well as to education for sustainable development.

KEYWORDS

COVID-19, pandemic, health, burnout, technostress, teachers, researchers, higher education

1. Introduction

On the 11th of March, due to the concerning levels of disease widespread, the World Health Organization (WHO) declared the existence of a pandemic (World Health Organization, 2020), caused by the SARS-COV-2, leading worldwide governments to declare emergency measures to contain the spread of the virus (Ferreira et al., 2021). In Portugal, the first case was confirmed on the 2nd of March 2020 (Portuguese General Directorate of Health; Direção Geral de Saúde, 2020), leading the Portuguese government to declare state of emergency 16 days later (Decree of the Portuguese Republic President; Decreto do Presidente da República n.o 14-A/2020, 2020). Several sanitary recommendations were made to the population, including social distancing, the use of a face mask, and frequent hand disinfection (European Centre for Disease Prevention

and Control, 2021). Additionally, several institutional resources were made available by the Portuguese government to inform and help the population cope with the pandemic, including informative websites[1,2] and a psychological helpline. The State of Emergency lasted until the 2nd of May 2020, forcing the closure of nonessential services, education facilities, and the obligation to stay at home except for essential tasks, such as buying food and medicine, working when remote work was not possible, or going for a "hygienic walk" (i.e., exercising individually) (Valente de Almeida et al., 2020). On that date, the country entered in state of calamity, starting a phased deconfinement process that allowed some services and businesses to reopen with several restrictions (Morgado et al., 2021).

The first confinement's multidimensional impact affected the entire country and is by now well reported through scientific papers, reports, editorials, and commentaries. On the psychological dimension, several studies suggested an overall deterioration of mental health manifested through higher levels of anxiety, lower levels of quality of life, increased prevalence of depression, lack of motivation in daily life activities, feelings of impatience and being upset with others, fatigue, sleep problems, changes in weight and food intake, among others (Santos et al., 2020; Ferreira et al., 2021; Vieira and Meirinhos, 2021). Additionally, a study of Cénat et al. (2021) indicated an increased prevalence of Post-Traumatic Stress during the pandemic when compared to the general population under normal circumstances. However, some studies specify that only a minority revealed low levels of mental health, particularly those lacking social support and with lower education (Gloster et al., 2020; Paulino et al., 2021). In addition, pre-existing mental health disorders may have been exacerbated by the pandemic, with an expected increase in the prevalence of mental health disorders leading to poorer mental health during and after the pandemic (Lange, 2021).

Likewise, the working conditions of most people suffered a sudden change, imposing remote work as the norm. Among those affected by this turnaround were teachers and researchers. Following the closure of education facilities, both teachers and researchers were forced to quickly adapt to new working conditions, including new methods and tools (Flores and Gago, 2020; Batista et al., 2022). For higher education teachers in particular, the adoption of Distance Education (DE) brought several challenges, including adaptation to change, lack of adequate training in online teaching, time management, work-life balance, technical problems, students' evaluation, logistic problems (e.g., class size), and feeling overwhelmed by being at the computer (Flores and Gago, 2020; Seabra et al., 2020; Vieira and Meirinhos, 2021). Recent studies, including those of Akour et al. (2020) and Casacchia et al. (2021), have also reported significant psychological impacts of such transition, including changes in sleep patterns and mood, lower levels of energy and concentration, and increased prevalence of distress and depressive symptoms among university teachers.

Along with this, the new working conditions also brought several restrictions to research activities, particularly those requiring an in-person contact for assessment and data gathering. Such restrictions hindered the collection of individuals willing to participate in the studies and caused an increase in stress levels and interpersonal problems, reduced appetite and motivation to work, sleeping problems, procrastination, and guilt feelings for not concluding the work (Sharma et al., 2020).

Given the impact of the pandemic in stress, anxiety, and fatigue levels, along with the uncertainty associated with it and the rapid changes in public health measures to address the spread of the virus, feelings of fatigue and exhaustion are expected to increase as long as the pandemic prevails, which may lead to a state of burnout.

The concept of burnout was firstly introduced by Herbert Freudenberger in 1974 and later redefined by Christina Maslach as a syndrome characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment and caused by a prolonged exposure to chronic work stress (Maslach et al., 2001; Lastovkova et al., 2018). Since then, several new definitions emerged, sharing the perspective of a multidimensional construct with exhaustion at its core. For instance, Schaufeli et al. (2020), in a recent revision of the concept, defined it as a "work-related state of exhaustion that occurs among employees, which is characterized by extreme tiredness, reduced ability to regulate cognitive and emotional processes, and mental distancing" (p. 4). In addition to these core dimensions, secondary symptoms such as psychological and psychosomatic complaints, and depressed mood could be manifested. Moreover, burnout can be understood as an individual, cumulative, and progressive process that can last for years and its development frequently proceeds as a form of invisible psychological erosion, without one being conscious of it (Nagy and Takács, 2017; Queirós et al., 2020). Therefore, individuals who manifested some level of burnout before the pandemic might be feeling a magnification of their symptomatology (Shigemura et al., 2020).

Several personal and work-related factors have been pointed as contributors to the development of burnout. Among the personal factors are lack of time for family and leisure (Sardinha et al., 2019), sleep quality issues (Rothe et al., 2020), low satisfaction with life (Vazquez et al., 2019), lack of emotional stability (Nagy and Takács, 2017), and personality traits, such as perfectionistic concerns (Spagnoli et al., 2021), neuroticism, pessimism, and low conscientiousness (Schaufeli et al., 2020). Another frequently pointed factor is gender, although literature regarding this variable is heterogenous (e.g., Prado et al., 2017; Teles et al., 2020). On the other hand, work-related factors include an extensive schedule, working under pressure, the perceived workload, a hostile environment, and poor work resources (Nagy and Takács, 2017; Sardinha et al., 2019; Vazquez et al., 2019).

Considering the progressiveness of burnout's development, several studies found significant associated consequences spread across the physical, psychological, and occupational dimensions. For instance, a systematic review of Salvagioni et al. (2017) related burnout with several physical pathologies such as obesity, type 2 diabetes, hypertension, heart and musculoskeletal diseases, changes in pain experiences, prolonged fatigue, and respiratory infections. In the psychological dimension, the same authors indicated significant associations with sleep disorders (e.g., insomnia), depressive feelings, and hospitalization due to mental disorders. Concerning the occupational dimension, burnout can lead to labor dissatisfaction, lower work ability, presenteeism, absenteeism, and turnover intention (Salvagioni et al., 2017; Schaufeli et al., 2020).

1 covid19.min-saude.pt

2 covid19estamoson.gov.pt

During the first stages of the COVID-19 pandemic, many researchers focused on studying burnout in specific populations of interest, such as health professionals. However, to our knowledge, no study was published addressing burnout in both higher education teachers and researchers after the initial stage of the pandemic, representing an important gap in the scientific literature. Considering the changes in labor conditions for such population and the stress associated with the pandemic situation, other psychological comorbidities can be associated with burnout, one of which being technostress (Goebel and Carlotto, 2019; Sokal et al., 2020).

As remote work became a norm, both university teachers and researchers were forced to continue their work using Information and Communication Technologies (ICT), such as computers, tablets, and smartphones, for teaching and research-related tasks. According to a publication of the OECD (2019), only 40% of educators at all educational levels felt prepared to use digital technologies in teaching activities. In line with these results, several studies involving teachers reported limited previous experience in online learning and confirmed that the transition process raised potential stress factors associated with technology use, which can lead to experiences of technostress (Molino et al., 2020; Müller et al., 2021).

The term "technostress" was first introduced by Craig Brod in 1984 as "a modern disease of adaptation caused by an inability to cope with the new computer technologies in a healthy manner" (Dragano and Lunau, 2020, p. 408). Since then, researchers have tried to follow the evolution of the concept, driven by the progression of technology, developing new definitions and explicative models. In that sense, Tarafdar et al. (2019) defined technostress as a process that involves the presence of a technological environment, seen as demanding or stressful for the individual, requiring the implementation of changes and activating coping mechanisms which lead to physical, psychological, and behavioral responses. Complementarily, Nisafani et al. (2020) proposed a conceptual model which states that various techno stressors, present in technological environments, can cause technostress, leading to the manifestation of strains (i.e., responses to technostress) that impact various dimensions of an individual's life. According to the same author, some individual and organizational inhibitors moderate the level to which one experiences technostress.

Regarding the causes of technostress, teachers and researchers might suffer from several direct contributors to this condition during remote work, including information and communication overload, constant connectivity, dependency on technology, discrepancy between actual and desired technology use, work-home conflict, system breakdown, and usability and security issues (La Torre et al., 2019; Nisafani et al., 2020; Batista et al., 2022). Accordingly, a research model proposed by Wang and Li (2019) studied the impact of Person-Environment mistfit on the experience of Technostress among university teachers. The results emphasize the role of organizational management, considering the organizational demand of ICT use and the available ICT resources as determinant for the emergence of technostress (Wang and Li, 2019).

According to Riedl (2012), situations involving technostress, such as system breakdowns, can cause significant elevations in stress bioindicators (e.g., cortisol, skin conductance, and adrenaline levels). As so, technostress can lead an individual to experience various strains. Physical symptoms may include eyestrain (Nisafani et al., 2020), increased hearth rate, cardiovascular and gastrointestinal disorders, muscle tension pain, sleep disorders (e.g., insomnia), headache, chronic fatigue, cervical pain, hormonal and menstrual disorders in women, and stress-related skin disorders (Chiappetta, 2017). Concerning the cognitive strains, one can experience poor concentration and memory disturbances (La Torre et al., 2019). As for the emotional strains, irritability, depression, apathy, crying spells, decreased sexual desire (Chiappetta, 2017), anger, anxiety (Nisafani et al., 2020) and feelings of exhaustion from using ICT (La Torre et al., 2019) may be experienced.

Literature regarding the factors, either individual, technological, or organizational, that may inhibit or increase the risk of developing a technostress reaction is vast. Several studies indicated individual factors, such as age, gender, having a proactive personality, levels of technology self-efficacy and social recognition, as significative (La Torre et al., 2019; García-González et al., 2020). In addition, Nisafani et al. (2020) specified reliability, usability, and user experience related to the use of ICT as influent technological factors. As for the organizational factors, the literature pointed time pressure, not taking breaks, technical support provision, literacy facilitation, and having social support from peers as key influencers of a technostress response (La Torre et al., 2019; Wang and Li, 2019; García-González et al., 2020).

Considering the consequences of technostress, higher education teachers and researchers can experience lower levels of general and ICT-enabled productivity, job satisfaction, work engagement, and task performance, along with higher ICT use resistance, lower intentions of using it, and negative affectivity (Nisafani et al., 2020; Batista et al., 2022). These consequences may lead to antisocial behaviors, emotional exhaustion, role stress (La Torre et al., 2019), lack of motivation, and absenteeism (Chiappetta, 2017). Moreover, technostress also affects the immune response system, leaving an individual more vulnerable to diseases (Riedl, 2012).

According to Boyer-Davis (2020), faculty staff, including teachers and researchers, experienced significantly more technostress during the pandemic than before, reenforcing its importance as a relevant health matter among these professionals. However, studies on technostress, particularly in the Portuguese context, are sparse and generally focus on general population or specific groups such as health professionals. Considering both the specific and shared consequences of burnout and technostress on teachers and researchers' health and well-being, particularly in times where the accessibility to health services is limited, assessing the extent to which these problems are prevalent and affect this population is of major importance. Although most Portuguese Higher Education Institutions have a Psychological Support Office available to the academic community, their services are frequently more student-oriented, offering no specific responses regarding occupational psychology (Andrade et al., 2021).Since the first confinement, new waves of infection by COVID-19 have emerged, leading to rapid changes in public health policies and restrictions to control the spread of the virus. Although the most immediate impact of the pandemic is by now well reported, the consequences of such extended uncertainty are still to be assessed. As such, the present study aims to investigate burnout and technostress in Higher Education teachers and researchers during the COVID-19 pandemic. More specifically, we pretend to assess levels of burnout and technostress symptomatology, identify potential risk factors associated with such symptomatology, and verify the existence of relationships among the symptomatologic variables. Given the literature presented in this section, we hypothesize that the sample will present both burnout and technostress symptomatology in high levels.

TABLE 1 Sociodemographic characterization of the sample.

	N	%
Gender		
Female	188	56.5
Male	144	43.2
Country of birth		
Portugal	304	91.3
Brazil	11	3.3
Other	18	5.4
Professional activities		
Just Teaching or just Research	142	42.6
Both Teaching and Research	191	57.4
Scientific area of activity		
Arts	21	6.3
Communication sciences	9	2.7
Health sciences	35	10.5
Life sciences	21	6.3
Sports Sciences	16	4.8
Exact Sciences	42	12.6
Social sciences	59	17.7
Economy and Management	35	10.5
Education	23	6.9
Engineering	39	11.7
Humanities	23	6.9
Technology	9	2.7

TABLE 2 Cronbach's alpha scores comparison between the original and the present studies.

	Original study's alpha (α)	This study's alpha (α)	*N* of items
BAT-E	0.92	0.93	8
BAT-MD	0.91	0.84	5
BAT-S	0.90	0.86	10

BAT-E, exhaustion; BAT-MD, mental distance; BAT-S, secondary symptomatology.

2. Materials and methods

2.1. Participants

A total of 333 participants were included in the sample, comprising higher education teachers and researchers. Ages ranged from 24 to 75 years old ($M = 50$; SD = 10), counting 188 (56.5%) female participants and 144 (43.2%) males. On average, individuals reported a professional experience of about 22 years ($M = 22$; SD = 11), with most of them working in the public sector (67.0%), in comparison to the private sector (33.0%), and in universities (67.6%), in comparison to the polytechnique institutions (32.4%). Concerning professional activities, 142 individuals reported just practicing Teaching or Research, of which 122 (85.9%) only practiced Teaching activities and 20 (14.1%) only practiced Research activities, whilst 191 reported practicing both activities. Lastly, although such activities were based in diverse scientific areas, social sciences were the most expressive area in the sample. The remaining sociodemographic data is available in Table 1. Since both convenience and snowball sampling methods were used for the data gathering, this sample cannot be considered representative of the population in study.

In addition to sociodemographic data, participants were asked about their health and COVID-19-related matters. When asked about how satisfied participants were with their health, 10 (3%) reported being "very unsatisfied," 36 (10.8%) reported being "unsatisfied," 55 (16.5%) reported being "neither satisfied nor unsatisfied," 171 (51.4%) reported being "satisfied" and 61 (18.3%) reported being "very satisfied." Regarding physical and mental health, 103 (30.9%) reported having already been diagnosed with a physical illness and 37 (11.1%) with a mental illness. Among the last, only 10 (27%) reported being in psychological support at the moment. Regarding the COVID-19 pandemic, only 55 (16.5%) participants reported belonging to a COVID-19 risk group.

2.2. Measures

The participants answered an online assessment protocol containing several sociodemographic questions and two self-report instruments: the Burnout Assessment Tool and the Computer-Induced Distress Scale. Such measurements were chosen by a panel of three Psychology specialists who analyzed several proposals regarding the assessment of both variables.

2.2.1. Burnout assessment tool

The Burnout Assessment Tool (BAT; Schaufeli et al., 2020) is a self-report questionnaire aimed at measuring burnout-related complaints. It was recently developed as an alternative to the Maslach Burnout Inventory, since several conceptual, technical, and practical limitations have been pointed to it (see Schaufeli et al., 2020). The BAT is available in two versions – a general, context-free version (for those who are not currently working) and a work-related version (used in this study) – and includes 33 items comprising core symptomatology as well as secondary symptomatology (BAT-S). As such, those items are split between four core symptomatology subscales – exhaustion (BAT-E), mental distance (BAT-MD), cognitive impairment, and emotional impairment – and two secondary symptomatology subscales – psychological distress and psychosomatic complaints –, the latter being scored and interpreted together (Schaufeli et al., 2020). In the present study, both cognitive and emotional impairment scales were not considered since they were not considered necessary to meet the proposed goals. Items are scored using a five-point Likert scale that ranges from "Never" to "Always." In terms of psychometric reliability, the original version of the BAT got good internal consistency values (Cronbach's $\alpha > 0.80$) and discriminant power (Schaufeli et al., 2020). In this study, the instrument presented adequate internal consistency (see Table 2).

2.2.2. Computer-induced distress scale

Computer-induced distress scale (CID) is a 12 item self-report scale developed by Ishola et al. (2019) to measure an individual's experiences of anxiety, depression, addiction, and distress associated with the usage of information and communication technologies (ICT) related

equipment during the last year. It uses a zero to four Likert-style scale, in which zero represents "this is not applicable to me," one represents "I do not experience this at all," two represents "I experienced this sometimes," three represents "I experienced this frequently," and four represents "I experienced this most of the time." In the original study, the authors identified three dimensions – psychological strains, depression, and physiological strains – and the scale showed good internal consistency [Cronbach alpha (α) = 0.91]. For the purpose of this study, a Portuguese translation of the instrument was used (Marrinhas, 2021), having presented good internal consistency (α = 0.84). A principal components analysis revealed the presence of three components with eigenvalues exceeding 1, explaining 38.2, 11.8, and 9.3% of the variance, respectively. The three components explained 59.4% of the variance.

2.3. Procedure

The present study was promoted by the Education and Psychology Department of the University of Aveiro. An online assessment protocol was built in Microsoft Forms and used for data gathering. The protocol was disclosed via email during a 2-month period, specifically between 15 of March and 15 of May 2021, corresponding to a period between the 3rd and 4th Portuguese waves of the pandemic. Before answering, participants were asked to agree with an informed consent which ensured the confidentiality and anonymity of their data. Reached the end of the data collection process, the resulting data was statistically analyzed, and respective output was interpreted.

2.4. Data analysis

Data analysis was performed using IBM SPSS Statistics version 27.0. Variables regarding the instruments' scores were computed and frequency statistics, including absolute and relative frequencies, mean, standard deviation, and minimum and maximum, were determined for all sociodemographic variables. Kolmogorov–Smirnov tests were conducted to verify the normality of the sample and Cronbach's alpha was used to test the internal consistency of the instruments. Once a Kaiser–Meyer–Olkin test ensured the sample was adequate (KMO = 0.91) and Bartlett test of Sphericity confirmed that the correlation matrix correlations could be factorized (p < 0,001), a factor analysis was carried with the translated items of the CID, confirming the existence of three factors, corresponding to the results obtained by Ishola et al. (2019). Furthermore, t-Student tests and ANOVAs were performed to compare means within sociodemographic groups, and a Pearson Correlations test was executed to verify the existence of correlations between variables.

3. Results

3.1. Prevalence of burnout and technostress in the sample

Descriptive measures, including average (*M*), standard deviation (*SD*), minimum (*Min*) and maximum (*Max*), were determined for each variable regarding a scale's score, as presented in Table 3.

3.2. Burnout and technostress among sociodemographic groups

Regarding the comparison between sociodemographic groups, *t*-student tests were performed considering the effect of "gender," "professional context," "type of institution," "professional activities," "physical illnesses," "mental illnesses," "belonging to a COVID-19 risk group," "isolation because of COVID-19," "having tested positive for COVID-19," and "having a family member who tested positive for COVID-19" on burnout and technostress scores, as measured by the respective scales. Significant results are presented in Tables 4, 5.

Considering the variable "gender," the results indicated a significant effect on BAT-E [$t(330) = 4.132$, $p < 0.001$] and BAT-S [$t(330) = 4.720$, $p < 0.001$]. Regarding BAT-E, women ($M = 2.78$; $SD = 0.74$) had higher scores than men ($M = 2.43$; $SD = 0.78$). Likewise, women ($M = 2.58$; $SD = 0.64$) presented higher scores of BAT-S than men ($M = 2.25$; $SD = 0.63$).

Considering the variable "professional context," the results indicated a significant effect on BAT-E [$t(331) = 3.939$, $p < 0.001$], BAT-MD [$t(250.041) = 5.163$, $p < 0.001$], BAT-S [$t(331) = 2.241$, $p = 0.026$], and CID [$t(280.982) = 3.999$, $p < 0.001$]. Individuals from public institutions showed higher scores of BAT-E [$M_{public} = 2.75$, $SD_{public} = 0.79$; $M_{private} = 2.40$, $SD_{private} = 0.71$], BAT-MD ($M_{public} = 1.95$, $SD_{public} = 0.70$; $M_{private} = 1.57$, $SD_{private} = 0.60$), BAT-S ($M_{public} = 2.50$, $SD_{public} = 0.68$; $M_{private} = 2.32$, $SD_{private} = 0.61$), and CID ($M_{public} = 18.11$, $SD_{public} = 6.89$; $M_{private} = 15.43$, $SD_{private} = 5.11$) than their counterparts from private institutions.

Considering the variable "type of institution," the results indicated a significant effect on BAT-MD [$t(331) = -2.273$, $p = 0.024$] and BAT-S [$t(331) = -2.144$, $p = 0.033$]. Individuals from the polytechnique institutions presented higher scores on both BAT-MD ($M_{polytechnique} = 1.76$, $SD_{polytechnique} = 0.70$; $M_{university} = 1.95$, $SD_{university} = 0.68$) and BAT-S ($M_{polytechnique} = 2.39$, $SD_{polytechnique} = 0.64$; $M_{university} = 2.55$, $SD_{university} = 0.68$) than their university counterparts.

Considering the variable "professional activities," the results indicated a significant effect on BAT-S [$t(270.216) = 2.228$, $p = 0.027$], with individuals who are involved in both teaching and research presenting lower scores ($M = 2.37$; $SD = 0.60$) than those only involved in just one of them ($M = 2.54$; $SD = 0.72$).

Considering the variables "physical illness" and "mental illness," the results for "physical illness" indicated a significant effect on BAT-E [$t(331) = 2.306$, $p = 0.022$], BAT-S [$t(331) = -3.728$, $p < 0.001$], and CID [$t(331) = -2.581$, $p = 0.010$]. Similarly, the results regarding "mental illness" indicated a significant effect on BAT-E [$t(331) = -4.372$, $p < 0.001$], BAT-MD [$t(42.215) = -3.706$, $p < 0.001$], BAT-S [$t(331) = -5.858$, $p < 0.001$], and CID [$t(331) = -2.239$, $p = 0.026$]. For

TABLE 3 Descriptive measures of the scales' variables.

	M	*SD*	*Min*	*Max*
BAT-E	2.63	0.78	1	5
BAT-MD	1.83	0.70	1	4
BAT-S	2.44	0.66	1	4.5
CID	17.23	6.48	0	45

BAT-E, exhaustion; BAT-MD, mental distance; BAT-S, secondary symptomatology; CID, computer-induced distress/technostress.

TABLE 4 Comparison between sociodemographic groups using *t*-student tests.

	BAT-E		BAT-MD		BAT-S		CID	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Gender								
Female	2.78	0.74			2.58	0.64		
Male	2.43	0.78			2.25	0.63		
Professional context								
Public	2.75	0.79	1.95	0.70	2.50	0.68	18.11	6.89
Private	2.40	0.71	1.57	0.60	2.32	0.61	15.43	5.11
Type of institution								
University			1.95	0.68	2.55	0.68		
Polytechnic			1.76	0.70	2.39	0.64		
Professional activities								
One activity					2.54	0.72		
Both activities					2.37	0.60		
Diagnose of a physical illness								
Yes	2.78	0.82	2.28	0.81	2.64	0.69	18.58	6.93
No	2.56	0.75	2.37	0.63	2.36	0.62	16.62	6.18
Diagnose of a mental illness								
Yes	3.14	0.80			3.01	0.59	19.46	6.36
No	2.56	0.76			2.37	0.63	16.95	6.45

BAT-E, exhaustion; BAT-MD, mental distance; BAT-S, secondary symptomatology; CID, computer-induced distress/technostress.

TABLE 5 Cohen's *d* of the *t*-student tests.

	BAT-E	BAT-MD	BAT-S	CID
Gender	0.46	0.09	0.52	0.19
Professional context	0.46	0.57	0.26	0.42
Type of institution	−0.17	−0.27	−0.25	−0.22
Professional activities	0.01	−0.05	−0.25	0.08
Diagnose of physical illness	−0.27	−0.16	−0.44	−0.31
Diagnose of mental illness	−0.76	0.68	−1.02	−0.39

BAT-E, exhaustion; BAT-MD, mental distance; BAT-S, secondary symptomatology; CID, computer-induced distress/technostress.

both variables, the results indicated that those who declared previous diagnoses presented higher scores.

Considering the variable "belonging to a COVID-19 risk group," the results indicated a significant effect on BAT-S [$t(331) = -2.532$, $p = 0.012$], with those who declared belonging to a COVID-19 risk group presenting higher scores ($M = 2.65$; $SD = 0.65$) than those who did not ($M = 2.40$; $SD = 0.65$).

In addition to t-Student tests, a One-Way Analysis of Variance (ANOVA) was performed to compare the scores of dependent variables in multiple sociodemographic groups regarding "age," "professional experience," "professional situation," and "satisfaction with health." Significant results are presented in Tables 6, 7.

Regarding "age," individuals were divided into three age groups to facilitate the analysis: the first ranging from 24 to 41 years; the second from 42 to 58 years; and the third from 59 to 75 years. As so, significant differences were found between groups in BAT-E [$F(2, 330) = 6.485$, $p = 0.002$] scores. A *Post Hoc* analysis using Tukey's Honestly Significant Difference (HSD) test was performed, indicating that BAT-E scores were lower on the third group when comparing to groups 1 ($p = 0.009$) and 2 ($p = 0.002$).

Similarly, regarding "professional experience," individuals were divided into three groups: the first ranging from 0 to 16 years; the second from 17 to 32 years; and the third from 33 to 48 years. As so, significant differences were found between groups in BAT-MD [$F(2, 330) = 3.163$, $p = 0.044$]. A *Post Hoc* analysis using Tukey's HSD test was performed, revealing lower BAT-MD scores in the first group when compared to the second group ($p = 0.034$), but not significant when compared to the third group ($p = 0.534$).

Regarding "professional situation," individuals declared having a "definitive professional bond," a "temporary or fixed-term contract" or being an "invited professor." As so, significant differences were found between groups in BAT-E [$F(2, 326) = 7.101$, $p < 0.001$], BAT-MD [$F(2, 326) = 8.669$, $p = 0.023$] and BAT-S [$F(2, 326) = 3.830$, $p = 0.023$]. Considering BAT-E, invited professors ($M = 2.27$; SD = 0.76) presented lower scores than those with a definitive bond ($M = 2.70$; SD = 0.75; $p < 0.001$) or a fixed-term contract ($M = 2.68$; SD = 0.84; $p = 0.015$). Considering BAT-MD, those with a definitive bond ($M = 1.93$; SD = 0.71) presented higher scores than invited teachers ($M = 1.53$; SD = 0.58; $p < 0.001$), but not significantly higher than those with a fixed-term contract ($M = 1.71$; SD = 0.65; $p = 0.078$). Considering BAT-S, invited professors ($M = 2.24$; SD = 0.64) presented lower scores than those with a fixed-term contract ($M = 2.56$; SD = 0.71; $p = 0.023$), but there was no significant difference when comparing with those with a definitive bond ($M = 2.46$; SD = 0.64; $p = 0.057$).

Regarding "satisfaction with health," individuals were divided in three categories, namely "Unsatisfied," "Neither Satisfied nor Unsatisfied" (NSNU), and "Satisfied." As so, the results indicated significant differences between groups in BAT-E [$F(2, 83.866) = 15.863$, $p < 0.001$], BAT-MD [$F(2, 82.958) = 6.744$, $p = 0.002$], BAT-S [$F(2, 330) = 24.394$, $p < 0.001$], and CID [$F(2, 79.1) = 10.567$, $p < 0.001$]. A *Post Hoc* analysis using a Games-Howell test was performed for all except BAT-S, which used a Tukey's HSD. As so, considering BAT-E, those who were satisfied with their health ($M = 2.47$; $SD = 0.70$) reported lower scores than those who were either unsatisfied ($M = 3.18$; $SD = 0.94$; $p < 0.001$) or NSNU ($M = 2.85$; $SD = 0.72$; $p = 0.002$). Considering BAT-MD, those who were satisfied ($M = 1.73$; $SD = 0.64$) presented lower scores than those who were unsatisfied ($M = 2.15$; $SD = 0.81$; $p = 0.005$), but no significant difference was found comparing with those NSNU ($M = 1.95$; $SD = 0.72$; $p = 0.110$). Considering BAT-S, those who were satisfied ($M = 2.29$; $SD = 0.58$) presented lower scores than those who were unsatisfied ($M = 2.82$; $SD = 0.77$; $p < 0.001$) or NSNU ($M = 2.79$; $SD = 0.61$; $p < 0.001$). Considering CID, those who were satisfied ($M = 16.07$; $SD = 5.54$) presented lower scores than those who were unsatisfied ($M = 20.65$; $SD = 7.66$; $p < 0.001$) or NSNU ($M = 19.24$; $SD = 7.61$; $p = 0.013$).

TABLE 6 Comparison between sociodemographic groups using ANOVA.

	BAT-E		BAT-MD		BAT-S		CID	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age								
Group 1 [24, 41]	2.72	0.74						
Group 2 [42, 58]	2.70	0.76						
Group 3 [59, 75]	2.34	0.79						
Professional experience								
Group 1 [0, 16]			1.69	0.67				
Group 2 [17, 32]			1.91	0.68				
Group 3 [33, 48]			1.81	0.75				
Professional situation								
Definitive professional bond	2.70	0.75	1.93	0.71	2.46	0.64		
Temporary or fixed-term contract	2.68	0.84	1.71	0.65	2.56	0.71		
Invited professor	2.27	0.76	1.53	0.58	2.24	0.64		
Satisfaction with health								
Unsatisfied	3.18	0.94	2.15	0.81	2.82	0.77	20.65	7.66
Neither satisfied nor unsatisfied	2.85	0.72	1.95	0.72	2.79	0.61	19.24	7.61
Satisfied	2.47	0.70	1.73	0.64	2.29	0.58	16.07	5.54

BAT-E, exhaustion; BAT-MD, mental distance; BAT-S, secondary symptomatology; CID, computer-induced distress/technostress.

TABLE 7 Partial eta squared from ANOVA.

	BAT-E	BAT-MD	BAT-S	CID
Age	0.06	0.04	0.01	0.03
Professional experience	0.01	< 0.01	0.03	0.05
Professional situation	0.02	0.05	0.02	< 0.01
Satisfaction with health	0.10	0.02	0.17	0.06

BAT-E, exhaustion; BAT-MD, mental distance; BAT-S, secondary symptomatology; CID, computer-induced distress/technostress.

3.3. Relationships between burnout and technostress

Concerning the relationships between the BAT and CID scales, a Pearson Correlations test was performed to verify the existence of such relationships. The results, as described in Table 8, indicated the existence of the following relationships: moderate positive correlations between BAT-E and BAT-MD, BAT-E and BAT-S, BAT-E and CID, BAT-MD and BAT-S, and BAT-S and CID; and a weak positive correlation between BAT-MD and CID.

4. Discussion

The main goal of the present study was to investigate burnout and technostress in Higher Education teachers and researchers during the COVID-19 pandemic. As so, we assessed the prevalence of burnout and technostress. Additionally, since burnout and technostress share stress as a main factor in the development of both conditions, we verified the existence of significant differences between sociodemographic groups to identify possible influence factors, along with testing the existence of relationships among the symptomatologic variables.

Concerning the prevalence of burnout and technostress, to our knowledge, no studies were published for the Portuguese context using BAT and CID to assess teachers and researchers, given their recency. As so, conclusions regarding their scores must be taken cautiously. When comparing BAT scores with available statistical norms, proposed by Schaufeli et al. (2020) for the Flemish population, our results indicated predominantly average to high levels of exhaustion, low to average levels of mental distance, and average levels of secondary symptomatology. Despite these results, it is noteworthy that a smaller part of the sample revealed high to very high levels of exhaustion and secondary symptomatology, which is in line with the studies of Gloster et al. (2020) and Paulino et al. (2021). Whilst the secondary symptoms assessed by the scale represent part of the burnout experience, they are not exclusive of this condition and can be due to other mental health conditions exacerbated by the pandemic. As to technostress, our results indicated predominantly low to moderate levels. This outcome contrasts with a study of Boyer-Davis (2020) in which faculty members experienced significantly more technostress during the COVID-19 pandemic than before it. This results mainly refute our hypothesis, which anticipated generally high levels of both burnout and technostress symptomatology.

In regard to the differences between sociodemographic groups, we observed that women presented higher levels of exhaustion and secondary symptoms related to burnout. Literature on gender differences in burnout is heterogenous. Therefore, this outcome is in line with some studies (e.g., Teles et al., 2020; Vieira and Meirinhos, 2021), but differs from others (e.g., Prado et al., 2017). Contrarily, age appeared to influence the manifestation of exhaustion symptomatology, as those who were older presented lower levels. This is in line with a study of Vieira and Meirinhos (2021) which found that general mental health and emotional function were positively associated with age.

Furthermore, those working in a public institution, in comparison to a private institution, presented higher levels of burnout and technostress symptomatology. Although no studies were found to perform a comparison, a possible explanation for such outcome might relate to the work-related conditions and resources provided to teachers and researchers in both contexts. Those working in a

TABLE 8 Correlations between exhaustion, mental distance, secondary symptomatology, and technostress.

	BAT-MD	BAT-S	CID
BAT-E	0.664*	0.695*	0.526*
BAT-MD		0.500*	0.426*
BAT-S			0.551*

BAT-E, exhaustion; BAT-MD, mental distance; BAT-S, secondary symptomatology; CID, computer-induced distress/technostress. *$p < 0.01$ (two-tailed).

polytechnique institution, in contrast to working in a university, also presented higher levels of mental distance and secondary symptoms associated with burnout. No studies were found to compare or explain this outcome. As so, we propose that this might also be related with the organizational specificities of each type of institution. As to professional activities, those who were only engaged in one type of activity (i.e., teaching or research) presented higher levels of secondary symptoms associated with burnout. Although these results seem to be contradicted by Nagy and Takács (2017), which suggest that a more extensive work schedule functions as a risk factor for developing burnout, individuals with higher workload might feel more prepared to manage their tasks, having a higher perception of control over their work and time. In contrast, those having less professional experience seemed to present lower levels of mental distance. These outcomes are partially supported by Teles et al. (2020), which found higher levels among mid-career professionals. On the other hand, we observed that Professional situation played a dual role in the presentation of burnout symptomatology, with major differences being found between invited professors and those with a definitive bond. Overall, invited professors presented lower levels of burnout symptomatology when compared to teachers with a definitive bond. Although no studies were found describing this difference, it might be explained by the working conditions inherent to each type of professional bond. Teachers with a definitive bond are exposed to higher work pressure, harder work quality evaluations, and are more engaged with the institution, having access to career progressions, in opposition to invited teachers.

As for the symptomatic differences in health-related sociodemographic groups, we observed that satisfaction with health was, expectably, linked to lower burnout and technostress indicators. Accordingly, results indicated that those having a previous physical or mental illness diagnosis presented higher burnout and technostress symptomatology. However, studies that test the relationship between mental health and technostress are sparse (Dragano and Lunau, 2020), reenforcing the importance of our results. In line with those results, those belonging to a COVID-19 risk group presented higher levels of secondary symptoms associated with burnout. Although such condition was self-reported by the participants, belonging to a risk group is generally associated with pre-existing physical and mental conditions which put the individual in higher risk of contracting the virus.

Concerning the existence of relationships between symptomatologic variables, our results indicate that technostress levels tend to follow exhaustion, mental distance, and secondary symptomatology to a moderate degree, suggesting a bond between technostress and burnout. This is in line with previous studies (e.g., Goebel and Carlotto, 2019) and could be explained by the fact that both have stress as a common cause, either being as a response to certain stimuli, in the case of technostress (Nisafani et al., 2020), or as a development factor, in the case of burnout (Maslach et al., 2001). As so, burnout symptomatology might have an effect on the development of technostress, although further studies are needed to confirm this link.

5. Conclusion

Overall, our results indicate that higher education teachers and researchers are experiencing predominantly moderate levels of burnout and technostress, although a smaller portion of the sample revealed significantly higher symptomatology. In addition, the analysis of sociodemographic groups allowed for the identification of several factors which might influence both burnout and technostress manifestations. Regarding the development of burnout symptomatology, sociodemographic indicators including gender and age, and professional indicators including professional experience, context (i.e., public or private) and bond (i.e., definitive, temporary or invited professor), type of institution (i.e., university or polytechnique), and professional activities in which one is engaged, were found to be significant factors. Additionally, satisfaction with health and belonging to a COVID-19 risk group were also found to represent significant factors. Regarding the development of technostress, only the professional context and satisfaction with health were found to be significant factors. Interestingly, results regarding the relationship between burnout and technostress were also significative, revealing a link between the two conditions.

5.1. Limitations

The present study presents some limitations. As a start, methodological limitations, such as the use of convenience sampling procedures, hinder the generalization of the results, requiring some caution when taking conclusions. Moreover, the use of an online self-report questionnaire spread via email may have conditioned the sample, since those more affected by burnout and/or technostress might not be willing to participate. Another limitation has to do with the lack of studies using the BAT and the CID, hindering the comparison of our results with already published literature. Likewise, the lack of studies focusing on higher education teachers and researchers, particularly during the pandemic, limited a wider understanding of their situation in this context.

5.2. Theoretical and practical implications

The results reached by this study allow for some theoretical and practical implications. Considering the theoretical implications, this study contributes to tackle three important gaps in literature: the first relates to the fact that, according to Guthrie et al. (2017), mental health issues in researchers, such as burnout and technostress, have not been studied in other pandemics; the second gap regards the lack of studies on teachers' technostress, particularly in Portugal, as most articles focus their attention on general population or very specific professionals, such as those in the health sector; the third gap has to do with the overall lack of studies addressing mental health among higher education teachers and researchers in general. This study intends to alert to the need of conducting more studies with such

populations, as the available data is not abundant. As so, this study also presents several practical implications. For instance, it contributes to a broader understanding of some of the psychological issues and needs among this population, warning to the necessity of delivering further mental health care services on the occupational context, such as general mental health screenings and interventions, promotion programs made available by the higher education institutions, or even personal wellness spaces for both teachers and researchers. Finally, this study represents a step toward verifying the need for preventing an escalation of specific mental health problems derived from the pandemic, being in line with the Sustainable Development Goals proposed by the United Nations Organization, namely Goals 4 and 8. According to the United Nations (2015), Goal 4 aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all, and Goal 8 aims to promote inclusive and sustainable economic growth, employment and decent work for all. Considering that education, training, decent work, and wellbeing present increasingly bigger challenges for the human being, this study brings attention to those challenges that may hinder the development of a sustainable future and builds the foundations for the development of any necessary solutions to ensure that such future is achievable.

5.3. Future research

As for future investigations, we suggest that more studies focusing on mental health, and particularly burnout and technostress, in higher education teachers and researchers in the Portuguese context are necessary to fulfill an important gap in the literature. Moreover, a longitudinal study regarding the evolution of mental health throughout the COVID-19 pandemic might represent a very important contribute, providing relevant clues on how to prevent mental illness in future pandemics. Lastly, considering the results of this and other studies during the pandemic indicating that a minority of the population might be suffering with higher levels of psychological symptomatology, the development of post-pandemic intervention programs will provide an answer to a growing need in psychological intervention. Since the Portuguese context presents specific challenges to teachers and researchers (highlighted by the results of this study), the development and implementation of significant public policies in the fields of education and health are urgent and required to improve their working conditions and, therefore, their mental health.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by University of Aveiro Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

Author contributions

AP, VS, DP, and DM designed the study. DM developed the theoretical framework. DM and CS performed the literature review. AP, VS, and DM performed the statistical analyses. All authors participated in results' discussion and final version of the manuscript, have directly participated in the planning, execution, and analysis of this study, and have read and agreed to the published version of the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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