



Research article

Lessons for the COVID era and beyond: The impact of inactive lifestyle and mental health events on burnout syndrome in university professors working from home during the pandemic

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ARTICLE INFO

Keywords:

Emotional exhaustion
University professors
Telecommuting /home office
Protective and risk factors
Inactive lifestyle

ABSTRACT

The rapid shift to remote work due to the COVID-19 pandemic has profoundly impacted work environments, intensifying challenges related to mental health and burnout among university professors. This study aimed to evaluate the presence of Burnout Syndrome (BS) in university professors following the adoption of remote home work (RHw) mandated by COVID-19 health measures and to identify key predictors, including both risk and protective factors. Virtual questionnaires were administered to 345 professors of both genders, collecting data on bio-sociodemographic, clinical health and lifestyle screen. The Maslach Burnout Inventory was used to assess BS. Results showed high levels of emotional exhaustion, low levels of depersonalization, and moderate levels of reduced personal accomplishment among professors. Protective factors against emotional exhaustion included older age, lack of irritation with RHw, and regular

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<https://doi.org/10.1016/j.heliyon.2025.e42256>

Received 2 October 2024; Received in revised form 9 January 2025; Accepted 23 January 2025

Available online 24 January 2025

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physical activity, while risk factors included excessive workload, dissatisfaction, irritability, fatigue, changes in body mass, and physical inactivity. Older professors showed lower levels of depersonalization, while body mass changes and frequent alcohol consumption increased it. For reduced personal accomplishment, protective factors included older age, greater work experience, and employment in private institutions, whereas dissatisfaction was a risk factor. Findings indicate that RHW results in chronic stress for professors, primarily through emotional exhaustion. Key contributing factors include excessive workload, dissatisfaction, irritability, fatigue, and pandemic-related lifestyle changes, while protective factors include older age, positive attitudes toward RHW, and regular physical exercise.

1. Introduction

The COVID-19 pandemic, caused by the novel strain of Coronavirus (SARS-CoV-2), represented one of the most significant transformational challenges in recent history [1,2], profoundly affecting the educational sector and the lives of individuals [3]. The routine of educators was completely altered, abandoning traditional teaching methods in favor of remote homework (RHW), leading to a transition to emergency remote teaching [4]. The “new” method of RHW requires the incorporation of a dedicated workspace within the educator’s residence, utilizing technology to facilitate professional activities without defined spatial boundaries [3,5]. This model demands significant adaptation and training, particularly in the teaching profession, which encompasses numerous challenges [6].

In Brazil, educators are expected to prepare lessons outside of standard school hours, engage in research activities, manage extension projects, and perform administrative tasks, all contributing to an intense workload [7]. The shifts brought on by COVID-19—including RHW, reduced levels of physical activity (PA), and limited social interaction—appear to have had direct consequences on educators’ physical health and, particularly, their mental health. This increased workload has intensified these effects, with burnout syndrome (BS) emerging as one of the most prominent impacts, highlighting the urgent need for targeted interventions to address the challenges associated with RHW [8].

The blurring of boundaries between personal and professional life triggered by RHW, combined with an increased workload, further intensified these stressors [9]. The lack of social interaction and support from colleagues, which traditionally serve as buffers against work-related stress, led to heightened feelings of isolation and BS [10,11]. Additionally, the adoption of a sedentary lifestyle during this period contributed to declining mental and physical well-being, exacerbating the overall impact of stress on educators [12,13].

These compounded pressures underscore the urgent need to understand and address the unique impacts of RHW on educators’ mental health and job performance during the pandemic. Although distance education was already integrated into the practices of many academic professionals, the pandemic necessitated adaptations to physical spaces, creating a “new classroom” [14]. Educators had to quickly familiarize themselves with digital learning technologies, and these changes have proven to be persistent, with most Higher Education Institutions (HEIs) continuing remote classes (synchronous or asynchronous) [15].

Recognized by the World Health Organization (WHO) as an occupational disease, BS refers to chronic work-related stress (WHO, 2019). It emerges as a response to interpersonal stressors, resulting in exhaustion and/or BS [16]. The multidimensional highlights three central but distinct dimensions: a) emotional exhaustion, which characterized by a lack of energy and enthusiasm; b) depersonalization, that leads to negative and insensitive interactions; c) low personal accomplishment, that reflects a negative self-perception and diminished feelings of competence and success [17–19].

Research indicates that university staff, especially professors, are at a higher risk for emotional disorders, with BS likelihood twice that of other professions, impacting teaching effectiveness and interactions with students, parents, and colleagues [20–23]. Increased working hours related to RHW/digital media teaching have resulted from the need for educators to guide students in navigating this new learning environment while managing domestic demands that have blended with work [24].

Given the critical role educators play in ensuring high-quality education, understanding the factors that impact their motivation to remain in the profession is essential [25]. In higher education, educators face unique demands and responsibilities, especially as they navigate evolving academic landscapes shaped by social and political transformations [26]. Exploring these dynamics is crucial to identifying and addressing the specific stressors they face, providing a strong rationale for investigating factors like BS and well-being that can significantly affect both their professional commitment and the overall quality of education.

The aim of this study is to assess BS levels in university professors following the shift to RHW due to COVID-19 physical and mental well-being measures and to identify key predictors, including both protective and risk factors. The study hypothesizes that the forced transition to RHW during the COVID-19 pandemic has contributed to an increase in BS among university professors.

2. Methods

2.1. Study design

This is a quantitative, descriptive, and cross-sectional study, guided by the STROBE - Strengthening the Reporting of Observational Studies in Epidemiology guidelines [27].

2.2. Participants, inclusion criteria and settings

The study involved 345 university professors from Brazil (see Table 1), including participants of all genders. Inclusion criteria required participants to hold a minimum of pos-graduation as higher education degree, have at least six months of experience as university professors, and to have engaged in RHW during the COVID-19 pandemic. Additionally, all participants were required to sign an Informed Consent Form (ICF) before participating. Exclusion criteria included incomplete questionnaire responses or duplicate submissions.

Following previous and similar studies, the research was conducted virtually, with participants accessing the questionnaires

Table 1

Bio-sociodemographic, clinical health and lifestyle characterization of university professors.

Biosocial and workload status				
	Min	Max	M	SD
Age (years)	24	70	44.4	9.6
Teaching experience (years)	1	41	13.4	9.5
Weekly workload	2	80	32.9	13.5
Number of disciplines	5	11	3.5	2.1
Number of students	5	945	184.1	177.5
	n		%	
Sex				
Female	238		69	
Male	107		31	
Marital status				
Single	93		27	
Married	204		59,1	
Divorced or Separated	43		12,5	
Widower	05		1,4	
Type of residence				
Apartment	198		57,4	
House	138		40	
Farmstead	04		1,2	
Kitchenette or Studio	04		1,2	
Others	01		0,3	
Monthly income				
1 and 2 Minimum wages	12		3,5	
3 and 4 Minimum wages	57		16,5	
5 and 6 Minimum wages	79		22,9	
7 and 8 Minimum wages	73		21,2	
9 and 10 Minimum wages	122		35,4	
Clinical Health and lifestyle status	n		%	
Have chronic illnesses				
Yes	115		33,3	
No	230		66,7	
Take medication				
Yes	162		47	
No	183		53	
Alcohol consumption				
I don't drink	149		43,2	
Drink once a week	106		30,7	
Drink a twice week	57		16,5	
I drink more than three times a week	33		9,6	
Smoker				
Yes	17		4,9	
No	328		95,1	
Weight gain during quarantine				
I didn't lose or gain weight	94		27,2	
Lost between 1 a 5 kg	51		14,8	
Lost more than 5,1 kg	14		4,1	
Gain between 1 a 5 kg	169		49,0	
Gain more than 5,1 kg	17		4,9	
Physical activity				
I didn't practice before the pandemic or now	106		30,7	
I continue practicing physical activity in the same way as before	17		4,9	
I slow down after the pandemic but I keep practicing	67		19,4	
I changed modality post-pandemic and I'm practicing	36		10,4	
I upgrade the pace after the pandemic	23		6,7	
I stopped physical activity after the pandemic	95		27,5	

Notes: M = Average; SD = Standard deviation, Min. = Minimum; Max. = Maximum; n = sample size; % = percentage.

through a widely used online platform link [28,29]. This approach allowed for efficient data collection while adhering to social distancing measures mandated by the COVID-19 pandemic. The participants completed the questionnaires from their respective residences, reflecting the telecommuting nature of their work during the pandemic. The study was conducted in Brazil, reflecting the specific context and circumstances of university professors in the country during the time of data collection.

2.3. Calculation of sample size and enrollment

The sample size of 345 university professors was determined based on a priori power analysis using established methods [30]. Previous recent research on BS among educators conducted in Brazilian populations provided valuable insights into effect sizes (ES) of Cohens d ($d = 0.45$), and variability in relevant outcome measures [31]. Using this ES as a reference, along with a desired level of significance ($\alpha = 0.05$) and statistical power ($1 - \beta = 0.80$), a sample size of 345 participants was calculated to provide adequate power to detect significant associations in the current study.

Enrollment of participants was conducted through targeted recruitment efforts, leveraging academic institutions and professional networks. Email invitations, institutional announcements, and direct communication with department heads were utilized to identify eligible participants. Interested individuals were provided with detailed information about the study and asked to sign an Informed Consent Form (ICF) before participating. Efforts were made to minimize selection bias and maximize generalizability of findings.

2.4. Ethical statement

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki [32], and adhered to ethical guidelines outlined in Resolutions 466/2012 and 510/2016 of the National Health Council [33]. This study was previously approved by the Ethics Committee of São Judas Tadeu University under protocol number CAAE 33527520.0.0000.0089. All participants provided ICF prior to their participation in the study. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without penalty. Confidentiality of participant information was strictly maintained, with data collected and stored securely in compliance with relevant data protection regulations.

2.5. Measurements

This study employed self-reported measures across several domains. Sociodemographic and work-related questions were chosen for their relevance in identifying background and job-specific variables that may influence stress levels. Additionally, questions on PA routine were included given their established role in supporting mental and physical well-being. To assess burnout directly, we utilized the Maslach Burnout Inventory (MBI), a validated tool that measures BS's core dimensions [17].

2.5.1. MBI questionnaire

The Brazilian version of MBI questionnaire, developed by Maslach and Jackson in 1978 served as the primary instrument for assessing BS [34]. The MBI encompasses three subdomains: emotional exhaustion (nine items), depersonalization (five items), and reduced personal accomplishment at work (eight items). The questionnaire consists of 22 closed-ended questions, with response options ranging from 0 to 6 points. Higher scores indicate a greater level of BS and lower overall health and satisfaction [17,34].

2.5.2. Bio-sociodemographic status

This section collected personal information, including biosocial of age, marital status, income, and housing situation. Work-related variables included teaching experience, weekly workload, number of disciplines taught, educational level, number of students, length of service, and type of institution. These variables were selected based on prior research indicating that they can significantly influence mental health and well-being and play a crucial role in shaping burnout experiences among university professors [35,36].

2.5.2.1. Clinical health and lifestyle screen. This dimension was chosen to capture key lifestyle and health factors among university professors. This dimension includes items on chronic illness, medication use, alcohol consumption frequency, smoking status, and weight changes and PA status during quarantine. These elements were selected based on evidence linking lifestyle behaviors and health conditions to mental health outcomes, such as burnout and stress resilience, especially during the pandemic period [12,37].

2.6. Procedures

Participants were selected through non-probabilistic sampling. Researchers sent invitation letters to teaching professionals via WhatsApp and/or email, outlining the purpose and scope of the study. Upon agreeing to participate, individuals were granted access to the research instrument after electronically signing the Informed Consent Form (ICF). Data collection was conducted exclusively online, from June 5, 2020, to July 16, 2020. During this period, participants completed the questionnaire at their convenience by following the provided link to the online form.

2.7. Data analysis

The Kolmogorov-Smirnov test was employed to determine the normality of the continuous variables. Descriptive statistics were reported as means, standard deviations, minimums, and maximums. Categorical variables were presented as absolute values and percentages. The dependent variables included BS subdomains of "emotional exhaustion," "depersonalization," and "reduced personal accomplishment." For the linear regression analysis, all variables with p-values ≤ 0.20 from the correlation coefficient analysis were selected [38]. These variables were ranked from lowest to highest p-value. A multiple regression modeling process utilizing stepwise forward selection was conducted, with variables added to the model sequentially based on their ranking. Only variables with p-values ≤ 0.05 were retained in the final model, indicating significant predictors of the burnout dimensions. Variables of bio-sociodemographic and clinical health and lifestyle status were included as a co-variate in the regression model. Data were stored and analyzed using SPSS for Windows, version 23.

3. Results

The data in Table 1 reveals that participants have a mean age of 44.4 years, an average teaching experience of 13.4 years, and a weekly workload averaging 32.9 h. Professors teach an average of 3.5 disciplines, and the number of students per professor ranges from 5 to 945, with a mean of 184.1 students. The majority of participants are female, married, and live in apartments. A significant portion of them have a monthly income exceeding five minimum wages.

Table 2
Professional and remote homework characteristics of university professors.

Professional profile	n	%
Area		
Human Sciences	29	8.4
Biological and Health Sciences	264	76.5
Exact Sciences	12	3.5
Agricultural Sciences	37	10.7
Educational level		
Specialization	33	9.6
Master	138	40.1
Doctorate	130	37.7
Post-doctoral	39	11.3
Professorship	05	1.41
Links with educational institutions		
One	258	74.8
Two	71	20.6
Three or more	16	4.62
Institution type		
Public: Federal/State	107	31.2
Private	232	62.2
Community	02	0.6
Public and Private	04	1.2
Remote homework requests	n	%
Was asked about the availability to work in a home office		
Yes	130	37.7
No	215	62.3
Received training on online teaching		
Yes	97	28.1
No	248	71.9
Home office irritation		
I get more irritated working from home than a person	149	43.2
I get more irritated when I work in person than at home	26	7.5
I don't get irritated by the home office mode	170	49.3
Work time		
I work less in the home office than in person	25	7.2
I work more from home office than in person	261	75.5
Home office work the same as in person	59	17.1
Tired of working from home		
I don't get so tired compared to in person	132	38.3
I get tired more easily than in person	213	61.7
Satisfaction with home office		
Satisfied	118	34.2
Neither satisfied nor unsatisfied	159	49.1
Unsatisfied	58	19.7
Sleep during the home office		
I sleep as well as usual	167	48.4
I don't sleep as well as I used to	178	51.6

Only 4.9 % reporting as smokers, and more than half consume alcoholic beverages more than once a week. The majority of professors do not have chronic illnesses, but, half of them use some form of medication. A total of 27.5 % of professors discontinued their PA routines due to the pandemic. A substantial proportion (49 %) reported weight gain during the pandemic (Table 1).

As a see in Table 2, most participants are from the Biological Sciences (76.5 %). A significant proportion holds a Doctorate (37.7 %) and Master's (40 %) degrees. The majority have links with only one educational institution (74.8 %), predominantly in Private institutions (62.2 %). While 37.7 % expressed willingness to RHW, the majority did not. About 28.1 % received training in online teaching.

Table 2 also indicate that 62.3 % were not equipped for RHW, and 71.9 % received no training in online teaching. Nearly half (49.3 %) reported no irritation with remote work, while 43.2 % felt more irritated working from home. A significant majority (75.5 %) experienced an increased workload remotely, and 61.7 % reported greater fatigue compared to in-person work. Satisfaction levels were mixed, with 49.1 % feeling neutral and 34.2 % satisfied. Sleep quality was affected for 51.6 % of respondents, who reported sleeping worse during remote work.

Table 3 shows that the Emotional Exhaustion subdomain has an average score of 26.79 (SD = 12.65). The Depersonalization subdomain has an average score of 5.48 (SD = 3.45). The Low Personal Accomplishment subdomain has an average score of 36.24 (SD = 7.93). The results indicate that the professors surveyed exhibited high levels of emotional exhaustion, low levels of depersonalization, and average levels of low personal accomplishment.

Table 4 presents the results of multiple linear regression analyses exploring factors associated with three dimensions of BS among university professors. The model 1 explained 33 % of the variance in emotional exhaustion. Key risk factors included a heavier weekly workload, dissatisfaction with RHW, fatigue from RHW, absence of consultation for RHW tasks, cessation of PA, and body weight fluctuations. Conversely, protective factors for emotional exhaustion were older age, no irritation with RHW, and maintaining PA. Notably, engaging in PA consistently showed a negative association with emotional exhaustion ($\beta = -5.89$, $p < 0.001$), while PA cessation increased emotional exhaustion ($\beta = 3.86$, $p = 0.01$).

In terms of depersonalization, the model 2 explained 13 % of the variance. Age remained a significant protective factor, while increased BMI, job dissatisfaction, weight fluctuations, and high alcohol consumption exacerbated depersonalization. The consumption of alcohol more than three times per week was strongly associated with higher depersonalization ($\beta = 2.45$, $p = 0.001$). Furthermore, those dissatisfied with RHW reported significantly higher levels of depersonalization ($\beta = 3.38$, $p < 0.001$).

Regarding reduced personal accomplishment, the model 3 accounted for 14 % of the variance. Positive factors included age, employment in private institutions, ongoing physical activity, and a background in Biological and Health Sciences. On the other hand, weight gain and dissatisfaction with RHW were linked to reduced personal accomplishment. Notably, the positive impact of maintaining PA on personal accomplishment was statistically significant ($\beta = 2.22$, $p = 0.025$), whereas weight gain showed a negative association ($\beta = 3.97$, $p < 0.001$). Employment in private institutions also had a slight positive effect on personal accomplishment ($\beta = 1.76$, $p = 0.050$), although the effect was marginal.

4. Discussion

The main findings of this study reveal that RHW during the COVID-19 pandemic resulted in significant chronic stress among university professors, manifesting primarily as emotional exhaustion. Key contributors to this burnout included excessive workloads, dissatisfaction with RHW arrangements, irritability, fatigue, and decreased PA. Furthermore, body composition changes, such as weight fluctuations, were also associated with higher burnout levels.

These findings align with the broader context of higher education in Brazil, where professors face numerous challenges, such as heavy workloads, large class sizes, inadequate resources, and disparities between public and private institutions, which all contribute to the academic stress that impacts both professional efficacy and personal well-being [39]. The COVID-19 pandemic has amplified these challenges, increased stress levels and complicating the transition to remote teaching. The added pressure to achieve academic results, coupled with a broader culture that often undervalues the teaching profession, has contributed to heightened stress and burnout among Brazilian educators, further complicating the academic environment [insirir:33]

In the context of emotional exhaustion, several factors emerged as protective. Professors who were older, did not experience irritation with RHW, and maintained physical activity were less likely to experience high levels of emotional exhaustion. The data from this study corroborate existing literature on the complex role of age in BS. While some studies suggest younger educators are more vulnerable to emotional exhaustion due to unrealistic career expectations and insufficient coping mechanisms [40], others argue that

Table 3
Descriptive statistics of burnout syndrome subdomains among University Professors.

	Min.	Max.	Av.	SD
Emotional exhaustion	0	54	26.79	12.65
Depersonalization	0	25	5.48	3.45
Low personal accomplishment	11	48	36.24	7.93

Notes: Min. = Minimum; Max. Maximum; Av. = Average; SD = Standard Deviation; cut-off scores of Emotional exhaustions (≤ 27), Depersonalization (≤ 6), and Low personal accomplishment (≥ 39).

Table 4
Regression analysis of burnout syndrome in university professors.

	β	EP	<i>p</i> -value	95 % IC	
Model 1: Emotional Exhaustion (r ² adjusted = 33 %)					
Constant	27.93	3.82	0.000	20.42	35.45
Age (years)	−0.19	0.05	0.001	−0.31	−0.79
Workload (h/s)	0.10	0.04	0.016	−2.86	2.47
Unsatisfied with RHw work	3.95	1.73	0.024	0.53	7.37
Tired of the RHw	4.72	1.40	0.001	1.95	7.49
Don't get irritated by the RHw	−5.25	1.46	0.000	−8.14	−2.37
I wasn't asked to work in a RHw	4.24	1.27	0.001	1.74	6.74
Physical Activity					
Maintain	−5.89	1.37	0.000	−9.8.60	−3.18
Stopped	3.86	1.50	0,01	−6.81	−0.90
Body mass					
Lost	5,48	1,69	0.001	2,14	8,82
Won	4,27	1,36	0,002	1,58	6,95
Model 2: Depersonalization (r ² adjusted = 13 %)					
Constant	4.05	1.88	0.032	0.35	7.75
Age (years)	−0.08	0.02	0.004	−0.14	−0.27
BMI (k/m ²)	0.09	0.04	0.050	−0.00	0.19
Unsatisfied with RHw	3.38	0.80	P < 0.001	1,80	4,96
Body mass					
Lost	1.82	0.84	0.031	1.71	3.48
Won	1.70	068	0.013	0.36	3.04
Alcohol					
Consumes more than 3 times a week	2.45	1.03	0.001	0.41	4.49
Model 3: Low personal accomplishment (r ² adjusted = 14 %)					
Constant	26.77	2.78	0.000	21.28	32.25
Age (years)	0.16	0.04	0.000	0.81	0.24
Gained body mass	3.97	0.96	0.000	−5.86	−2.08
Unsatisfied with RHw	−3.12	1.16	0.008	−5,42	−0.83
Type of IES - Private	1.76	0.91	0.050	−0.23	3.55
Physical activity					
Maintain	2.22	0.98	0.025	0.28	4.17
Stopped	2.45	1,06	0.021	0.37	4,54
Area of formation					
Biological and Health Sciences	3.60	1,48	0.016	0.69	6.52

Notes: h/week – hours per week; RHw – remote homework; CI – confidence interval; SE – standard error; β – beta coefficient; BMI – body mass index; IES – higher education institution.

older professors, with more experience, may develop resilience to stress over time [41]. Despite these divergent perspectives, it is evident from our data that the pandemic disrupted both professional and personal lives, affecting professors across age groups. Further studies are needed to clarify the relationship between age and burnout, especially in the context of remote teaching.

Maintaining PA routines emerged as a significant protective factor. In line with previous research, the cessation of PA, as well as changes in body weight (either gain or loss), was associated with heightened emotional exhaustion and depersonalization. Our findings align with global studies showing that the pandemic led to a significant reduction in PA among populations worldwide, particularly during lockdowns [41–43]. Regular PA has been recognized as a key element in combating stress and BS, with evidence linking it to reduced burnout levels in educators [44,45]. The high proportion of women in our sample (69 %), who are often responsible for managing both household and work responsibilities, may explain the increased likelihood of sedentary behavior and the negative consequences on physical and mental health [46].

Additionally, the analysis revealed that changes in body mass index (BMI) were significantly associated with both emotional exhaustion and depersonalization. Approximately 54 % of participants reported weight gain, which likely reflects unhealthy lifestyle changes during the pandemic. This increase in BMI is often associated with poor dietary habits and reduced PA, which can exacerbate mental health issues and contribute to the development of BS symptoms, including feelings of detachment and reduced personal accomplishment [47]. Our study's results are consistent with this understanding, as professors who gained weight showed significantly higher levels of depersonalization.

Work-related dissatisfaction was also a key contributor to emotional exhaustion and depersonalization [22,48]. Professors in our study reported high levels of dissatisfaction with remote work, partly due to the lack of consultation regarding the transition to home office (HO) and the excessive workload (average of 32 h per week). These findings are consistent with previous research that links job dissatisfaction with burnout [8,48,49]. The lack of preparation and training for remote teaching, as reported by 62.3 % of our sample, exacerbated this dissatisfaction [22]. The rapid shift to online teaching, without proper guidance, often led to feelings of inadequacy, guilt, and frustration, further contributing to burnout [40].

In terms of institutional factors, being associated with the field of Biological and Health Sciences served as a protective factor against reduced personal accomplishment. The pandemic elevated the visibility and appreciation of healthcare professionals, which may have positively influenced the sense of professional fulfillment among professors in this field [50]. Professors working in private higher education institutions (HEIs) showed lower levels of burnout, which may be attributed to their institutions' quicker transition to online education and more robust support systems during the pandemic. In contrast, professors in public HEIs faced significant challenges during the pandemic, such as prolonged uncertainty, suspended academic activities, and limited emotional support, which likely contributed to heightened burnout. Public university professors also faced additional stressors due to the political climate, which exacerbated the sense of isolation and uncertainty [20].

We also found a significant relationship with alcohol consumption was found to correlate with depersonalization. Frequent alcohol use (specifically drinking more than three times a week) has been associated with BS, as it may serve as a maladaptive coping mechanism for stress [51]. This suggests that educators facing constant work-related stress may resort to alcohol as a way to escape or alleviate their mental fatigue, which can further exacerbate emotional detachment and BS.

Despite efforts to achieve a diverse sample, it is noteworthy that women represented 69 % of the participants, a figure that aligns with previous studies, who reported that 93 % of their sample consisted of female teachers [52]. This prevalence may reflect the unique challenges faced by female educators, particularly in a RHW setting, where they often balance professional responsibilities with disproportionate domestic and caregiving duties. Gender inequality, which was exacerbated by the pandemic, intensifies this balancing act. Another study found that female educators report greater perceived stress, neuroticism, and physical symptoms such as gastritis and heartburn, despite generally adopting healthier dietary habits. Furthermore, they tend to engage in less PA, which can further increase their risk of BS [53].

4.1. Strengths and limitations

The strengths of this study include its quantitative approach, a well-designed survey, and a relatively large sample size that enhances the generalizability of the findings. The use of multiple regression analyses allowed for the identification of specific factors associated with burnout among university professors during the COVID-19 pandemic. However, the predominance of female participants in the sample may introduce gender bias, potentially limiting the generalizability of the results to male professors. Future research should aim to balance the gender distribution to enhance representativeness. Additionally, the study did not deeply explore the specific dynamics of remote teaching or the contextual factors influencing professors' experiences of BS. A more nuanced analysis of these dynamics could provide valuable insights into how the unique characteristics of remote work contribute to BS.

4.2. Practical applications

The findings of this study underscore the critical importance of addressing BS among educators, especially those working remotely. Practical interventions include limiting daily workloads to manageable levels, promoting regular PA, fostering healthy dietary habits, ensuring sufficient sleep, and addressing substance use as coping mechanisms. These strategies are essential for mitigating stress and supporting educators' well-being in RHW environments. Institutions should consider implementing regular well-being check-ins and support programs, along with clear guidelines for workload expectations, to reduce the strain on faculty members and promote a healthier work-life balance.

4.3. Lessons for the COVID era and beyond

This study highlights the pressing need for targeted, practical measures to improve educators' working conditions, particularly in the context of remote teaching. The findings reveal the importance of reducing burnout through actionable strategies that address workload, professional development, and emotional well-being. Based on recent evidence and the challenges identified, universities should consider implementing the following specific and measurable actions.

- a) Training Programs: Provide ongoing training in digital tools and teaching strategies such as Technological Pedagogical Content Knowledge (TPACK model) to enhance educators' confidence and effectiveness in remote teaching [54];
- b) Adoption of Interactive and Collaborative Technologies: encourage institutions to incorporate adaptive tools to enhance remote teaching, reduce cognitive load, and boost engagement [55]. Adaptive scaffolding, for example, provides tailored support based on individual needs [56], while gamification uses game-like elements to increase motivation and participation [57]. Together, these strategies can ease educators' workloads and improve the online learning experience [58];
- c) Wellness Programs: Institutions should prioritize educators' well-being by offering emotional coaching, psychological services, and peer support. Programs like "Well-being in Learning Environments (WBLE)," both online and in-person, can foster resilience and reduce burnout [59].
- d) Hybrid and Blended Models: Universities should develop clear policies to facilitate a hybrid teaching framework, blending in-person and remote instruction [60]. This approach offers flexibility for educators and students while reducing the stress of abrupt transitions [61].
- e) Regular Monitoring: Implementing ongoing check-ins and assessments of faculty well-being is crucial for responsive and data-informed interventions. Regular surveys and interviews can capture qualitative and quantitative insights into educators'

physical, mental, and emotional states [62]. Additionally, evaluating the effectiveness of remote teaching practices and satisfaction levels among faculty ensures adjustments align with their evolving needs [63].

4.4. Conclusion

This study found that burnout symptoms, particularly emotional exhaustion and depersonalization, were prevalent among educators working remotely during the COVID-19 pandemic. Several factors, including changes in body mass index, the cessation of PA, and increased workloads, were found to correlate with higher levels of burnout. Professors reported feeling irritated and fatigued due to the remote work setup, with many expressing dissatisfactions due to the lack of preparation and consultation regarding the transition to remote teaching. Protective factors against emotional exhaustion and depersonalization included older age, the absence of irritation with remote work, and regular physical activity. These findings suggest the need for targeted interventions, including workload management, PA promotion, and emotional support programs, to mitigate burnout and enhance educators' well-being in both current and future remote work contexts.

CRedit authorship contribution statement

Angelica Castilho Alonso: Writing – review & editing, Writing – original draft, Visualization, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Alan Oliveira Máximo de Carvalho:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Juliana Sanches Lira:** Writing – original draft, Methodology, Investigation, Data curation. **Vitória Camargo Paixão:** Methodology, Investigation, Formal analysis, Conceptualization. **Rafael Diego Modenes:** Methodology, Investigation, Data curation, Conceptualization. **Rita de Cássia Ernandes:** Writing – original draft, Resources, Investigation, Conceptualization. **Vanderlei Carneiro da Silva:** Project administration, Methodology, Investigation, Conceptualization. **Gerson Scherrer Júnior:** Visualization, Resources, Methodology, Investigation, Conceptualization. **Kleyton Góes Passos:** Writing – original draft, Methodology, Investigation, Conceptualization. **Matheus Henrique dos Santos Lino:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Conceptualization. **Sofia Silva:** Writing – original draft, Validation, Methodology, Funding acquisition. **Sônia Brito-Costa:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Funding acquisition, Conceptualization. **Guilherme Eustáquio Furtado:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Funding acquisition, Conceptualization. **Guilherme Carlos Brech:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization.

Ethical statement

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki [32], and adhered to ethical guidelines outlined in Resolutions 466/2012 and 510/2016 of the National Health Council [33]. This study was previously approved by the Ethics Committee of São Judas Tadeu University under protocol number CAAE 33527520.0.0000.0089. All participants provided ICF prior to their participation in the study. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without penalty. Confidentiality of participant information was strictly maintained, with data collected and stored securely in compliance with relevant data protection regulations.

Data availability statement

Data will be made available on request. For requesting data, please write to the corresponding author.

Declaration of competing interest

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

Acknowledgments

The students and researchers are grateful to the professors of the higher education institution and other individuals who collaborated to assist in the research. G.E.F. thanks the National funding by FCT- Foundation for Science and Technology, P.I., through the institutional scientific employment program-contract (CEECINST/00077/2021). S.B.C., and S.S. thanks to FCT - Fundação para a Ciência e a Tecnologia, I.P., under the scope of the project UIDB/05198/2020 (Centre for Research and Innovation in Education, inED)". <https://doi.org/10.54499/UIDB/05198/2020>.

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