



OPEN Predictors of quality of life in professors at public higher education institutions from the RESPIRA cohort: Brazilian prospective longitudinal study

Maria Isabel Triches¹✉, Renata Gonçalves Mendes² & Tatiana de Oliveira Sato¹

Professors in higher education institutions (HEI) are exposed to risk factors for quality of life (QoL). This prospective cohort study aimed to identify the predictors of QoL in a cohort of professors who work 40 h per week in Brazilian public HEI. Nine hundred fifty-four professors composed the sample. They were invited to participate in the electronic survey through advertisements in the media, social networks and emails. Data collection took place from May–December 2022 (baseline), November 2022–August 2023 (6-month follow-up), and May–December 2023 (12-month follow-up). Multiple linear regression identified predictors of QoL among sociodemographic, occupational and health characteristics, daytime sleepiness (Epworth Sleepiness Scale), predisposition to obstructive sleep apnea (Stop-Bang questionnaire), psychosocial risks (COPSOQ II-Br) and physical activity (IPAQ–short form). The QoL was assessed using the WHOQOL-bref. The response rate was 80% at six- and 12-month follow-up. Sociodemographic, occupational and psychosocial factors; health conditions and lifestyle habits were significantly associated with QoL after one year. The number of medical diagnoses was negatively associated with QoL scores in the physical and psychological domains. Family income was positively associated with QoL in the environment domain, and the quantitative work demands was negatively associated with QoL in the social relationships domain. Strategies are needed to improve social relationships, psychological, physical and environmental aspects, such as sleep hygiene techniques, workplace physical activity, health education, occupational stress management programs, and mental healthcare for professors, protecting them from psychosocial risk and decreased QoL.

Keywords Occupational health, Psychosocial impact, Mental health, Sleep, Sleepiness, Physical activity

The WHO definition of Quality of Life (QoL) is based on an individual's self-perception in relation to expectations, standards, goals, and concerns, and is influenced by values and culture¹. QoL involves a multidimensional concept that incorporates the individual's perception of their psychosocial and health status, as well as other aspects of life¹, such as the work environment conditions, which consequently influences professional performance².

Higher education professors perform multiple tasks, including administrative, teaching, and research activities³. In Brazil, teaching is a multifaceted and challenging profession, requiring a combination of pedagogical, social, technological and administrative-bureaucratic responsibilities. Besides this, Brazilian professors face adverse working conditions, such as the devaluation of education and science resulting from public policies with reduction of social support and resources, which affect the mental health of these professionals⁴.

Teaching work has intensified with the increase in effective working hours per week^{5,6}. Consequently, teaching is considered a source of stress, increasing the risk of health problems, such as back pain, hypertension, depression³, and poor sleep⁷. QoL has already been associated with the perception of poor sleep quality by professors⁵. The sleep pattern and QoL of Brazilian higher education professors have also been associated with work overload and compulsive work, which is aggravated by the intensification of work demands⁷.

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A Peruvian study reveals that most college professors had some type of sleep-related problem which required medical attention⁸. One possible explanation is that the continued exposition to work that requires high physical and psychological demands increases the release of cortisol, causing frequent awakenings or sleep disturbances, resulting in poor sleep quality and QoL⁵.

Obstructive Sleep Apnea (OSA) is one of the main sleep disorders and has an estimated prevalence of 33% in Brazilian adults⁹. In addition to the increased risks for cardiovascular and cerebrovascular morbidities, OSA commonly results in excessive sleepiness and QoL impairment¹⁰. Naderi et al.¹¹ found a high prevalence of excessive daytime sleepiness in Iranian professors.

A Brazilian study found that one in three higher education professors suffers from daytime sleepiness¹² and significant associations were found between excessive daytime sleepiness and lower scores in QoL. An individual's QoL may also be related to physical activity (PA)⁵, age, marital status, educational level, and workplace conditions².

The psychosocial aspects of teaching work are also relevant, as stress and burnout impact American professors' productivity, well-being, and QoL¹³. The pressure for productivity has contributed to the exacerbation of psychosocial risk factors for higher education professors. Thus, tensions caused by high psychological and work demands can cause negative consequences for QoL⁵.

Burnout is characterized by emotional exhaustion, depersonalization, and low professional satisfaction, which has already been associated with QoL in a study with professors of *stricto sensu* graduate courses in Brazil⁷. Occupational stress resulting from an imbalance between job demands and worker resources can interfere with interpersonal relationships, job satisfaction, and negatively impact QoL¹⁴. In Spain, professors with job security had better physical and mental health, teaching and research performance¹⁵. Lower mental and physical scores in QoL of university professors predict burnout¹⁶.

In addition to the aforementioned evidence, all these cross-sectional studies highlight the need for further research on professors' well-being, particularly focusing on risk factors and stressors. Another study that investigated factors related to the teaching career and the stress levels among university professors also suggests further research, including variables related to family life, QoL and leisure activities, in larger samples³.

Regular physical activity, good sleep quality, and older age have been associated with a higher QoL among Brazilian professors, while medication use, an unbalanced diet, and lack of leisure time have been associated with lower QoL, indicating that the QoL is influenced by health-related factors¹⁷. In addition to sleep quality, lifestyle habits (such as smoking) and individual factors (such as biological sex), as well as organizational and psychosocial conditions (such as work-family conflict) were predictors of QoL among university professors during the COVID-19 pandemic in Brazil¹⁸. Thus, the QoL of higher education faculty in Brazil is associated with a multifactorial set of variables that reflect the complexity of the teaching profession, encompassing individual, organizational, psychosocial and health-related factors¹⁸.

This study will analyze occupational and psychosocial factors (time working at the current educational institution, accreditation in a graduate program, quantitative work demands, emotional work demands, work-family conflict, stress and burnout symptoms); health conditions and lifestyle habits (number of medical diagnoses, smoking, frequency of alcohol use, physical activity, body mass index, sleep duration, sleep medication, ventilatory therapy for sleeping, STOP-Bang and Epworth scores); and sociodemographic factors (age, sex, marital status, race, educational level, family income, and having preschool-aged children). It is believed that predictors will be present across all categories within the four domains of QoL: physical, psychological, environment, and social relationships.

Fonseca et al.¹⁴ highlights that this type of study is relevant to identify characteristics in the teaching population which contribute to the planning of public policies aiming to improve the QoL of professors in public institutions. Thus, the objective of this prospective longitudinal study was to identify the QoL predictors in a cohort of professors working in Brazilian public higher education institutions, with an emphasis on sociodemographic, occupational, health, sleep, physical activity, and psychosocial factors. This research seeks to fill gaps in literature by investigating how these predictors impact QoL after 12 months, considering specific aspects of the teaching profession.

A recent study¹⁸ highlights that understanding the predictors of QoL among university professors is essential to guide strategies and intervention priorities for preventing occupational risks, promoting health, and developing a sustainable QoL. By exploring the relationships between individual and institutional characteristics with QoL this study may provide insights into how institutional policies and support strategies can target modifiable QoL factors to improve faculty well-being, contributing to a more comprehensive approach to their health and performance in the academic context.

This study hypothesizes that the QoL of the higher education professors is impacted by occupational and psychosocial factors, health conditions and lifestyle habits, as well as sociodemographic factors. Furthermore, professors with psychosocial risk, poor sleep, lower levels of physical activity, inequalities related to sociodemographic characteristics, and those with health conditions are expected to have a lower QoL, highlighting the role of these variables at the 12-month follow-up. It is also hypothesized that psychosocial risk factors are the main factors associated with QoL in faculty context.

Methods

Study design

This is a prospective cohort study among professors who work 40 h per week exclusively in Brazilian public higher education institutions, called RESPIRA. The RESPIRA cohort is a Brazilian longitudinal study that evaluated health, sleep, and quality of life of full-time professors at public higher education institutions, with a prospective follow-up of 12 months, monitoring participants every 6 months, totaling three assessments. Further details can be found in the cohort baseline article¹⁹. Data was electronically collected, and this study report follows the

recommendations of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)^{20,21} and the Checklist for Reporting Results of Internet E-Surveys (CHERRIES)²².

Sample

Professors were invited mainly through email. Interviews with the regional press, and promotional materials were posted on social media through advertisements and videos with the link to the study's forms. Professors' email addresses were obtained from the institutions' websites, and invitations were sent individually. Professors were informed that the survey was intended for higher education professors who worked 40 h per week exclusively in public educational institutions in Brazil. Those who did not select the option to accept to participate in the survey were directed to the end of the form.

The sample was obtained by convenience, and the inclusion and exclusion criteria were applied when completing the questionnaires. Professors from private institutions; those who did not work 40 h per week exclusively in a public institution and were not affiliated with their current educational institution were excluded. Data collection for this open, voluntary survey took place from May to December 2022 (baseline), November 2022 to August 2023 (6-month follow-up), and May to December 2023 (12-month follow-up).

According to the official data²³, the population of faculty employed in Brazilian public higher education institutions corresponded to a universe of 152,027. The minimum sample size was determined using an online calculator based on the formula for a finite population sample, considering a 95% confidence level, a 5% margin of error, and an expected proportion of 50% for maximum variability. Thus, according to these input variables, the minimum sample size of 384 participants ensures statistical representativeness of the study population.

Instruments

The study included an initial assessment (baseline) and semiannual assessments during the 12-month follow-up period using the Google Forms. At baseline, professors answered sociodemographic, occupational and health questions, STOP-Bang questionnaire (SBQ); Epworth Sleepiness Scale in Brazilian Portuguese (ESS-BR); International Physical Activity Questionnaire–Short Form (IPAQ-SF); WHOQOL-bref and ten questions from the short version in Brazilian Portuguese of the Copenhagen Psychosocial Questionnaire (COPSOQ II-Br) (Fig. 1).

At 6-month follow-up, the participants answered the ESS-BR, SBQ, WHOQOL-bref, as well as an open-ended question about any recent medical diagnosis in the last 6 months and whether their PA level increased, remained or decreased during this period, totaling 45 questions.

At the 12-month follow-up, participants answered the health questionnaire, SBQ, ESS-BR, WHOQOL-bref, IPAQ-SF, as well as the ten selected questions from the COPSOQ II-Br questionnaire, totaling 72 questions. In all forms, participants could monitor their completion using the progress bar, in addition to not losing the answers already selected, through automatic saving, and could review and change their answers using a back button.

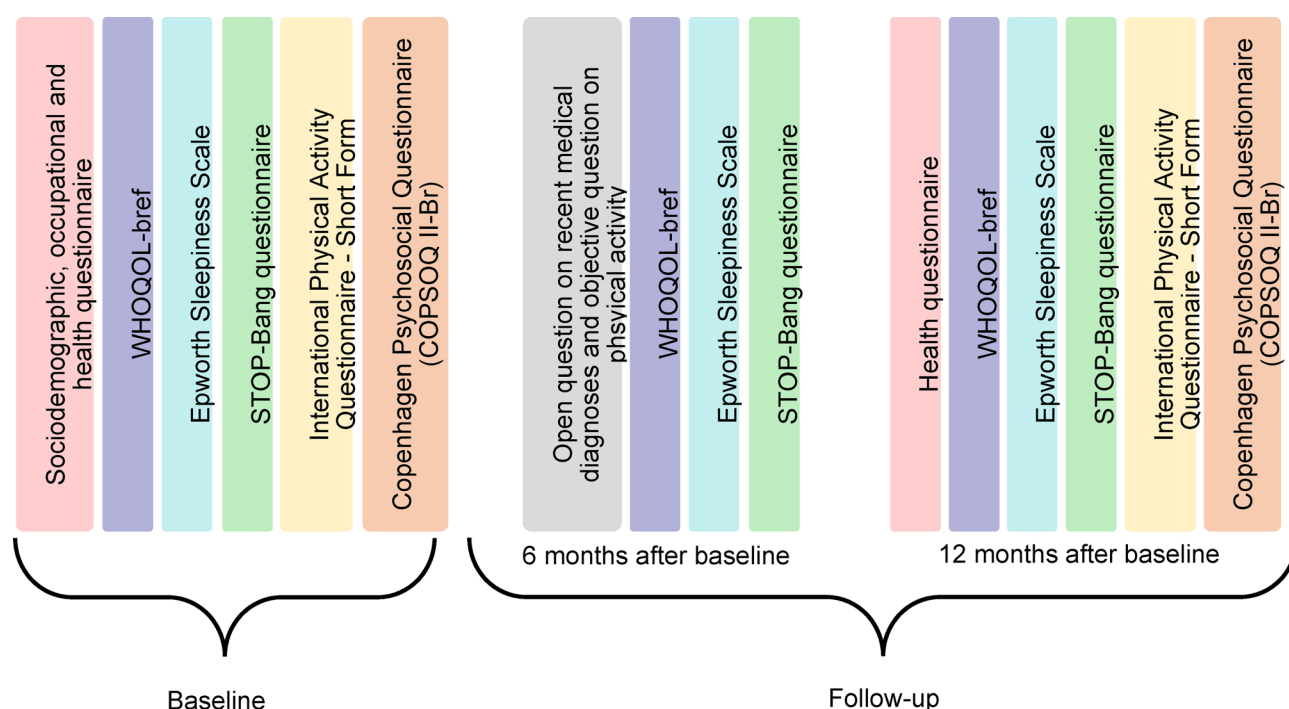


Fig. 1. Timeline for data collection and questionnaires administered in each stage of study.

Determinants

The sociodemographic, occupational, and health questionnaire included the following independent variables: sex (male/female), age (years), marital status (with/without partner), race (non-white/white), preschool children aged 0 to 5 years (no/yes), educational level (with/without PhD), family income (above 3 to 6/above 6 to 9/above 9 to 12/above 12 monthly minimum wage (MMW) = R\$ 1,212.00 \cong USD 230), time working at the current educational institution (less than 1/1–5/6–10/11–15/more than 15 years), accreditation in graduate program (no/yes), Body Mass Index (BMI; kg/m²), tobacco use (non-smoker/smoker), frequency of alcohol use (never/less than or equal to 1 time per month/2 to 4 times per month/2 to 3 times per week/equal to or greater than 4 times per week), number of medical diagnoses, sleep duration (hours), amount of sleep medication, ventilatory therapy for sleeping (no/yes).

The questions selected from COPSOQ II-Br included the following dimensions: quantitative work demands; emotional work demands; work-family conflict; burnout and stress symptoms²⁴. These questions are scored using a five-point scale²⁵ and the obtained values were classified as: no risk (safe/attention) or risk^{26,27}.

The ESS-BR assesses the chance of dozing off during eight daily activities^{28,29}. The ESS-BR total score ranges from 0 to 24, with scores above ten suggesting excessive daytime sleepiness³⁰. The SBQ, adapted for Brazil by Fonseca et al.³¹, is the most accurate instrument for detecting mild, moderate, and severe OSA³². The total STOP-Bang score ranges from zero to eight³¹.

PA was investigated using IPAQ-SF, which was proposed by the World Health Organization (WHO) to estimate the PA level, considering physical activities performed at work, home, garden, transportation, leisure, sports and exercise³³. The IPAQ is widely used in studies on the association of PA with health outcomes^{34,35} and allows groups classification with different levels of PA³⁶. In this study, two levels of PA were adopted: sedentary (sedentary, irregularly active A and irregularly active B) and active (active and very active).

Outcomes

The WHOQOL-bref questionnaire was used to assess the QoL in four domains: physical health, psychological, social relationships and environment. This instrument consists of 24 facets, seven in the physical health domain, six in the psychological domain, three in the social relationships domain and eight in the environment domain³⁷. Higher scores represent higher QoL. The Brazilian Portuguese version of this instrument presented internal consistency, test–retest reliability, discriminant validity, concurrent validity and criterion-related validity³⁸.

Statistical analyses

The data were stored in Google Drive and later downloaded as Excel spreadsheets. The identification information was replaced with a unique numerical code assigned to each respondent in ascending order, based on the sequence in which responses were received. In cases where participants submitted the form more than once, only their first response was retained, and subsequent entries were excluded.

The data were organized in the Statistical Package for the Social Sciences (SPSS). The association between the baseline predictors and the outcomes at the 12-month follow-up was investigated using multiple linear regression models for the QoL outcome in its four domains. The confidence intervals (95% CI) and the standardized β coefficients for each independent variable were obtained, and outliers were excluded. The prerequisites of a minimum number of 20 subjects per independent variable, independent residuals by the Durbin-Watson test, normally distributed residuals, homoscedasticity and a linear relationship between the dependent variable and the independent variables were met.

Predictor variables were selected based on the theoretical framework and entered into multivariate models using the stepwise method, which evaluates the statistical contribution of each variable to optimize model fit³⁹. Univariate analysis was not used as a selection criterion to avoid prematurely excluding covariates that might become significant in combination with others and to minimize the risk of estimation bias⁴⁰. Multicollinearity among predictor variables was tested⁴¹, and the highest variance inflation factor (VIF) value was 1.65, indicating no multicollinearity among the independent variables. Since multicollinearity is typically considered present when the VIF exceeds values between 5 and 10⁴², this assumption was met.

In addition to the quantitative variables (age, BMI, number of medical diagnoses, sleep duration, amount of sleeping medication, STOP-Bang and Epworth scores), the following values were assigned to the remaining independent variables in the models: sex (male: 0; female: 1), marital status (without partner: 0; with partner: 1), race (non-white: 0; white: 1), preschool children aged 0 to 5 years (no: 0; yes: 1), educational level (without PhD: 0; with PhD: 1), family income (above 3 to 6 MMW: 0; above 6 to 9 MMW: 1; above 9 to 12 MMW: 2; above 12 MMW: 3), time working at the current educational institution (less than 1 year: 0; 1–5 years: 1; 6–10 years: 2; 11–15 years: 3; more than 15 years: 4), accreditation in graduate program (no: 0; yes: 1), tobacco use (non-smoker: 0; smoker: 1), frequency of alcohol use (never: 0; less than or equal to 1 time per month: 1; 2 to 4 times per month: 2; 2 to 3 times per week: 3; equal to or greater than 4 times per week: 4), ventilatory therapy for sleeping (no: 0; yes: 1); quantitative work demands, emotional work demands, work-family conflict, burnout and stress symptoms (no risk: 0; risk: 1); and physical activity (sedentary: 0; active: 1).

Results

The RESPIRA cohort consists of 954 professors working in Brazilian public higher education institutions, including federal institutions and state and federal universities. All Brazilian states were represented, with the state of São Paulo standing out as the largest contributor, as it has the highest number of public higher education institutions⁴³.

Most participants had a PhD (89%), were male (52%), married or in stable union (69.1%), white (71.4%), public servants (97%), lived in the state of São Paulo (24%), had a monthly family income above R\$14,544.00 \cong USD 2,760.00 (49%), and were on average 49.18 (SD = 9.75) years old. Most were accredited in stricto sensu graduate

programs (GPs) (62%), had worked at their current educational institution for more than 15 years (36%), and had children (64%) of which 12.1% were preschool children (≤ 5 years old). Regarding the level of PA, the majority were considered physically active (69.8%), overweight/obese (59%), and spent an average of 7.15 ± 2.72 h per day sitting on weekdays¹⁹.

Furthermore, 74.1% of professors reported at least one medical diagnosis, 33.2% consumed alcoholic beverages 2 to 4 times a month, 95.4% were non-smokers, 21% used sleep medication, 28.5% had excessive daytime sleepiness, 39.6% had intermediate to high risk for predisposition to OSA, 95.8% did not use ventilatory therapy, and the average sleep duration was 6.63 ± 1.12 h. In the QoL assessment, the social relationships domain (61.58%) obtained the lowest score, and the most compromised facets were: participation in and opportunities for recreation/leisure activities [3.24 (SD=0.88)]; sleep and rest [3.20 (SD=1.07)]; and sexual activity [3.16 (SD=1.09)]. Work-related psychosocial risk was identified for symptoms of stress (63.5%); symptoms of burnout (62.5%); emotional work demands (50.9%); work-family conflict (46.1%), and quantitative work demands (19.4%)¹⁹.

During the 6-month follow-up, 767 responses were collected, 4 repeated responses and one retired participant were excluded, and 762 responses were analyzed. During the 12-month follow-up, 761 responses were analyzed, considering the exclusion of one retired participant and 3 repeated responses. The follow-up response rate was approximately 80% at the 6- and 12-month follow-ups (Fig. 2).

Figure 3 presents the results for the four QoL domains at baseline, 6-month, and 12-month assessments, revealing only a modest improvement in scores over time. Among the domains, social relationships persistently showed the lowest scores at all three evaluation points.

Multiple linear regression was applied to identify predictors of each QoL domain (Table 1). The number of medical diagnoses was the most important factor associated with lower QoL in the physical health and psychological domains (Fig. 4). Family income was the most important factor associated with higher QoL in the environment domain, and quantitative work demands was the most important factor associated with lower QoL in the social relationships domain (Fig. 5).

The multiple linear regression analysis resulted in statistically significant models for the four domains of quality of life and the equations describing these relations in each domain were presented in Table 2. The estimated mean value of the outcome variable, when all independent variables are set to zero, represents the intercept. In other words, the intercept value in this study reflects the expected score for each domain of quality of life in professors with null values for all covariates, that is, without exposure to any of the independent variables. The intercept for the physical domain was estimated at 57.836; 51.298 for the psychological domain; 52.143 for the environmental domain; and 67.948 for the social relationship domain.

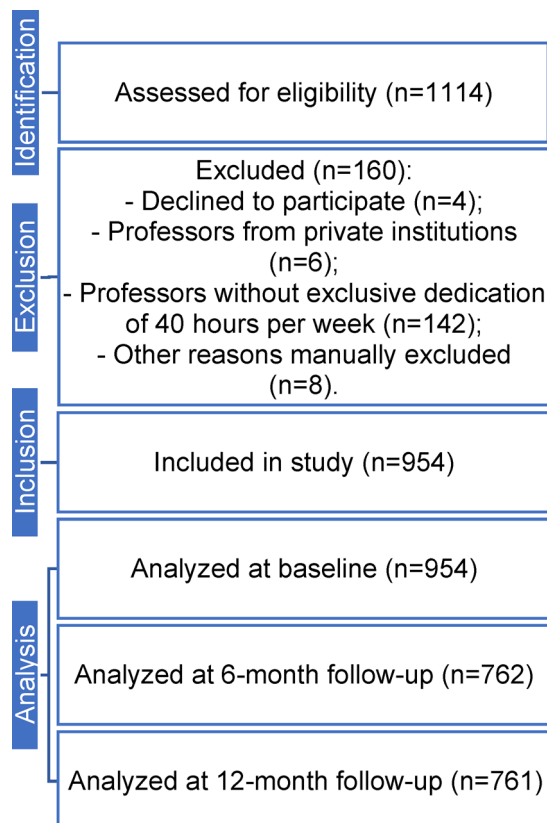


Fig. 2. Flowchart of study participants in accordance with STROBE.

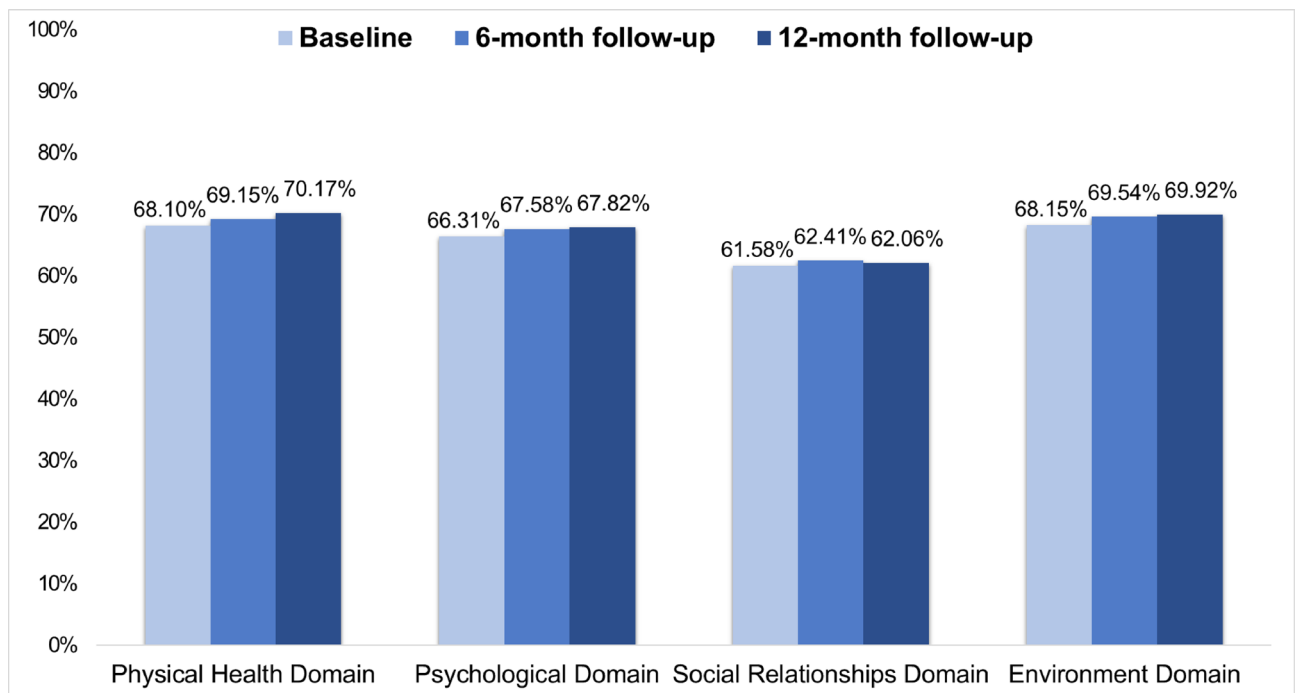


Fig. 3. Quality of life among professors at baseline and 6-month and 12-month follow-up assessments.

The score of QoL in physical health domain was negatively associated with the burnout symptoms and the quantitative work demands, which reduces its intercept (57.836) by 7.6 and 6.8 points, respectively; each additional self-reported medical diagnosis and additional unit of sleep medication reduced the score by 3.0 and 2.7 points, respectively; each 1-point increase in the STOP-Bang and Epworth scores decreased the quality of life by 1 point and 0.3-point, respectively. Conversely, the physical health domain quality of life score was positively associated with each additional hour of sleep and year of age, with increases by 2.0 and 0.25 points, respectively; being accredited in a graduate program increased the physical domain QoL by 2.3 points, and being physically active increased it by 2.1 points.

The score of QoL in psychological domain was negatively associated with self-reported medical diagnoses, reducing the intercept (51.298) by 2.2 points per diagnosis; quantitative work demands, burnout symptoms, stress symptoms, and work-family conflict, with reductions of 7.6, 5.5, 4.3, and 2.2 points, respectively. On the other hand, each additional year of age and hour of sleep increased by 0.2 and 1.5 points, respectively; being accredited in a graduate program increased by 2.3 points; being physically active increased by 4.1 points; family income, with a 1.5-point increase in the score with each increase in income range; and being in a marital relationship with a partner increased by 2.3 points.

The QoL score in the environment domain was positively associated with family income and alcohol consumption, increasing the intercept (52.143) by 3.4 points and 1.8 points with each increase in the income range and frequency of alcohol consumption, respectively; 1.2 points per hour of additional sleep; being white race, accredited in a postgraduate program, female sex, physically active increased by 3.1, 2.3, 2.2, 2.3 points, respectively. In contrast, stress symptoms, burnout symptoms, work-family conflict, and quantitative work demands decreased the environment domain QoL by 4.2, 3.5, 3.2, and 3 points, respectively.

Lastly, the social relationships domain was negatively associated with the quantitative work demands, work-family conflict, emotional work demands, and stress symptoms, reducing the intercept (67.948) by 7.1, 5.0, 4.0, and 4.0 points, respectively. Each additional medical diagnosis decreased it by 1.5 points, each 1-point increase in the STOP-Bang score decreased the intercept by 1 point, and having preschool-aged children decreased it by 4.9 points. Being physically active and being accredited in a graduate program increased the intercept by 4.8 points and 3.5 points, respectively. Alcohol consumption frequency was also associated with an increase in the social relations domain score, with a 1.3-point increase in the intercept for each category increase in alcohol consumption frequency.

Discussion

This study identified predictors of QoL in a cohort of professors from Brazilian public higher education institutions. These findings highlight the relevance of all categories (occupational and psychosocial factors, health conditions and lifestyle habits, and sociodemographic factors) as key determinants of the physical, psychological, environmental, and social relationship aspects of quality of life after one year. The results reflect the complexity of the teaching environment, establishes directionality in the investigated relationships, highlights potential inequalities, and supports theoretical expectations regarding the central role of psychosocial factors as predictors of faculty quality of life. Some of these predictors are modifiable and should be considered in public

Quality of life	12-month follow-up				
	Standardized β	t	P	95% IC	VIF
Predictors of physical health domain					
Number of medical diagnoses	-0.305	-9.175	<0.001	-3.64 to -2.35	1.326
Burnout symptoms	-0.231	-7.081	<0.001	-9.76 to -5.52	1.285
Quantitative work demands	-0.161	-5.140	<0.001	-9.40 to -4.20	1.183
Age	0.148	4.518	<0.001	0.14 to 0.36	1.293
Hours of sleep	0.137	4.443	<0.001	1.13 to 2.91	1.142
STOP- Bang score	-0.102	-3.059	0.002	-1.67 to -0.36	1.342
Amount of sleeping medication	-0.099	-3.221	0.001	-4.36 to -1.06	1.144
Epworth score	-0.082	-2.550	0.011	-0.50 to -0.06	1.248
Accredited in graduate program	0.069	2.357	0.019	0.38 to 4.17	1.028
Physical activity	0.060	2.021	0.044	0.06 to 4.17	1.058
Predictors of psychological domain					
Number of medical diagnoses	-0.229	-7.071	<0.001	-2.83 to -1.60	1.167
Quantitative work demands	-0.182	-5.617	<0.001	-10.31 to -4.97	1.171
Burnout symptoms	-0.168	-4.360	<0.001	-8.04 to -3.05	1.651
Stress symptoms	-0.129	-3.581	<0.001	-6.61 to -1.93	1.438
Age	0.121	3.614	<0.001	0.09 to 0.31	1.260
Physical activity	0.116	3.767	<0.001	1.97 to 6.25	1.057
Hours of sleep	0.099	3.160	0.002	0.55 to 2.37	1.100
Family income	0.081	2.420	0.016	0.28 to 2.68	1.248
Accredited in graduate program	0.069	2.260	0.024	0.30 to 4.26	1.038
Work-family conflict	-0.069	-1.988	0.047	-4.40 to -0.28	1.325
Marital status	0.067	2.100	0.036	0.15 to 4.53	1.126
Predictors of environment domain					
Family income	0.227	6.882	<0.001	2.47 to 4.44	1.107
Stress symptoms	-0.152	-4.086	<0.001	-6.21 to -2.18	1.408
Frequency of alcohol use	0.152	4.717	<0.001	1.03 to 2.51	1.054
Burnout symptoms	-0.128	-3.234	0.001	-5.67 to -1.38	1.601
Work-family conflict	-0.121	-3.364	0.001	-5.13 to -1.35	1.310
Race	0.104	3.172	0.002	1.19 to 5.04	1.104
Hours of sleep	0.099	3.023	0.003	0.43 to 2.01	1.100
Quantitative work demands	-0.085	-2.529	0.012	-5.30 to -0.67	1.163
Accredited in graduate program	0.081	2.525	0.012	0.50 to 3.97	1.054
Sex	0.081	2.523	0.012	0.48 to 3.88	1.061
Physical activity	0.077	2.405	0.016	0.42 to 4.15	1.051
Predictors of social relationships domain					
Quantitative work demands	-0.146	-4.048	<0.001	-10.57 to -3.67	1.142
Work-family conflict	-0.131	-3.328	0.001	-7.82 to -2.02	1.352
Number of medical diagnoses	-0.130	-3.514	<0.001	-2.27 to -0.64	1.193
Physical activity	0.116	3.316	0.001	1.95 to 7.60	1.062
Emotional work demands	-0.107	-2.771	0.006	-6.81 to -1.16	1.290
Stress symptoms	-0.104	-2.764	0.006	-6.87 to -1.16	1.235
Accredited in graduate program	0.092	2.667	0.008	0.93 to 6.11	1.030
STOP-Bang score	-0.088	-2.439	0.015	-1.85 to -0.20	1.143
Preschool-age children	-0.086	-2.463	0.014	-8.75 to -0.99	1.053
Frequency of alcohol use	0.080	2.331	0.020	0.21 to 2.41	1.028

Table 1. Results of multiple linear regression analysis between predictors and quality of life outcomes (n = 761).

policy planning, such as sleep hygiene techniques, workplace physical activity, health education, occupational stress management programs, and other mental healthcare for professors, protecting them from psychosocial risk.

The results suggest marital status, sex, age, race, family income, and preschool-age children may play an important role in shaping professors' perceived QoL. A study that assessed QoL identified higher scores in married individuals⁴⁴. Marital status has already been associated with anxiety/depression, with individuals

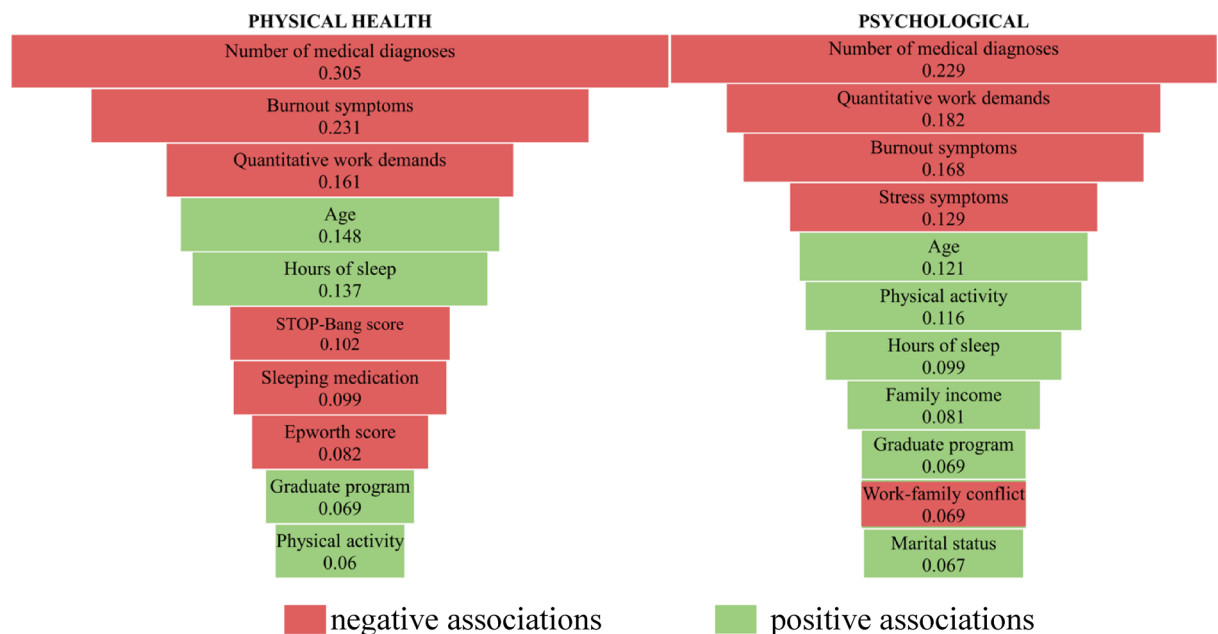


Fig. 4. Standardized beta coefficients of the predictors in the physical and psychological domains of quality of life.

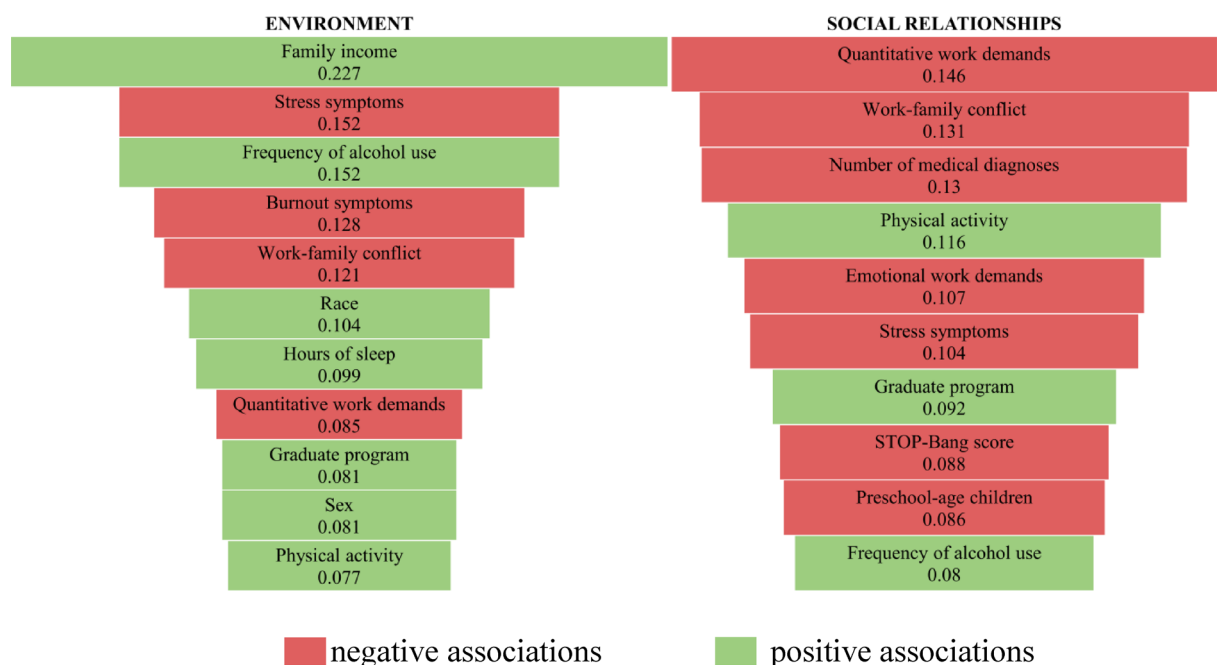


Fig. 5. Standardized beta coefficients of the predictors in the environment and social relations domains of quality of life.

without a spouse being 58% more likely to report them compared to married individuals⁴⁵. In our study, marital status was positively associated with QoL in the psychological domain, which can be attributed to the emotional support, stability, and/or security that marriage/stable union can offer.

Regarding gender, men and women may attribute different meanings or importance to certain aspects of life when evaluating their QoL⁴⁶, and female professors may evaluate issues about their environment more satisfactorily, such as living conditions, access to health services or daily information. In our study, female professors improved their QoL after one year in the environment domain.

Recent research on QoL provided interesting insights into the priority that women place on environmental QoL, which increases with age. Regression analysis also revealed the impact of environmental QoL on overall

Quality of life domain	Equation
Physical health: [F (10, 688) = 51.551; p < 0.001; R ² = 0.428]	57.836 - 7.641*(BS) - 2.996*(MD) - 6.799*(QWD) + 2.017*(HS) + 0.248*(AG) - 1.019*(SBS) - 2.710*(SM) - 0.283*(ES) + 2.276*(AGP) + 2.118*(PA)
Psychological: [F (11, 688) = 38.851; p < 0.001; R ² = 0.383]	51.298 - 2.218*(MD) - 7.639*(QWD) - 5.543*(BS) - 4.267*(SS) + 0.204*(AG) + 4.107*(PA) + 1.460*(HS) + 1.482*(FI) + 2.281*(AGP) - 2.215*(WFC) + 2.343*(MS)
Environment: [F (11, 689) = 30.121; p < 0.001; R ² = 0.325]	52.143 + 3.455*(FI) - 4.197*(SS) + 1.772*(AF) - 3.526*(BS) - 3.242*(WFC) + 3.115*(RC) + 1.216*(HS) - 2.983*(QWD) + 2.34*(AGP) + 2.180*(SX) + 2.283*(PA)
Social relationships: [F (10, 689) = 18.310; p < 0.001; R ² = 0.210]	67.948 - 7.121*(QWD) - 4.921*(WFC) - 1.457*(MD) + 4.772*(PA) - 3.984*(EWD) - 4.015*(SS) + 3.520*(AGP) - 1.023*(SBS) - 4.870*(PAC) + 1.310*(AF)

Table 2. Equations of multiple linear regression analysis between predictors and quality of life outcomes (n = 761). BS: Burnout symptoms; MD: number of medical diagnoses; QWD: quantitative work demands; HS: hours of sleep; AG: age; SBS: STOP-Bang score; SM: amount of sleeping medication; ES: Epworth score; AGP: accredited in graduate programs; PA: physical activity; SS: stress symptoms; FI: family income; WFC: work-family conflict; MS: marital status; AF: frequency of alcohol use; RC: race; SX: sex; EWD: emotional work demands; PAC: preschool-age children.

quality of life and global health, with environmental QoL explaining 46% of women’s overall QoL and health, especially through the facet of the home environment⁴⁷.

The white race presented better QoL in the environmental domain. Racial origin can influence access to resources, in addition to experiences of discrimination, affecting the well-being and life satisfaction. In this sense, socioeconomic status is directly associated with higher QoL in black adults and social support acts as a partial mediator in the relationship between socioeconomic status and QoL in the black community⁴⁸.

In our study, age was positively associated with QoL in the physical and psychological domains, so that increasing age presents better QoL results in the 12th month. In a large-scale study with adults QoL also increased with advancing age in all domains, except the physical⁴⁷. A possible reason could be that younger professors are less experienced and may be learning to deal with the high work demands and developing their skills in an environment with pressure for productivity, stress and burnout risks^{49,50}. A study indicates higher burnout scores in younger Italian professors, with decreasing age ($\beta = -0.263$; $p = 0.001$) being a predictor of personal exhaustion and fewer years of work ($\beta = -0.269$; $p \leq 0.001$) being a predictor of professional exhaustion¹⁶.

Family income and the presence of preschool-age children was also associated with QoL. Professors with lower income presented lower personal fulfillment⁵¹. In addition, higher income may be associated with more access to information and education, medical care, housing and transportation conditions, leisure opportunities and other resources that can improve QoL⁴⁶.

On the other hand, the presence of young children in the household may impact perceived QoL, as there are additional responsibilities and sources of stress. Parents play an intense role in child development, and parental stress can affect well-being⁵². Furthermore, the perception of poor sleep quality in Brazilian professors has been associated with having children, which may also negatively influence QoL⁵ and hinder work commitments, while work-family conflict was already associated with burnout in Chinese university professors⁵³.

The number of medical diagnoses was negatively associated with physical, psychological and social relationships domains. The presence of any chronic disease results in significantly lower physical, mental and social scores⁵⁴, being considered a negative predictor of QoL⁵⁵. University staff in Malaysia without medical illness were more likely to have a good quality of life⁵⁶. Interventions targeting health conditions may notably enhance physical and psychological QoL domains. Despite uncertainties regarding their modifiability, encouraging professors to adopt healthier habits and engage in regular health monitoring could yield positive outcomes.

Physical activity appeared with positive associations in all four domains of QoL, with individuals who were active at the beginning of the study presenting higher QoL compared to sedentary individuals. Li and Kou⁵⁷ found that lower levels of PA were associated with higher stress among Chinese university faculty. Faculty members in China with higher hobby involvement had significantly lower scores for emotional exhaustion, low personal accomplishment, and depersonalization compared to professors with few hobbies, who had higher burnout⁵¹. Meira et al.⁵⁸ also found that PA resulted in significantly higher scores across all QoL domains in Brazilian professors.

The frequency of alcohol consumption showed positive associations with QoL in the social relationships and environment domain. We believe that this result may be related to greater participation in leisure opportunities, in addition to satisfaction with personal relationships and support received from friends outside the work environment. Because it is considered important for socialization, increased alcohol intake has already been correlated with higher scores in the social relationships domain. However, this finding deserves attention, as it is a stress coping strategy that can have negative implications for health⁵⁹.

Regarding occupational aspects, accreditation in GPs was positively associated with all domains of QoL, that is, those accredited presenting better QoL in the 12th month. This result may be related to the satisfaction of professors accredited in GPs with their working conditions, academic production, career progression and salary. In addition, teaching is linked to the feeling of enjoying what one does, recognition, contribution to the production of knowledge, and transformation of social reality⁶⁰.

However, caution is needed in its interpretation, since the various activities are carried out in short periods of time and with high productivity demands. This high quantitative demand can cause excessive work. Vedoado et al.⁶¹ found that professors working in graduate programs at Brazilian public universities who worked compulsively were less likely to have high physical health, psychological, social relationships, and environmental QoL.

Furthermore, psychosocial factors were negatively associated with QoL domains. Burnout symptoms and quantitative work demands were two important factors associated with the physical health domain. Stress symptoms, burnout symptoms, and quantitative work demands were important factors associated with the psychological domain, in addition to work-family conflict. In the environmental domain, stress symptoms were the second most important factor, and burnout symptoms, work-family conflict, and quantitative work demands also showed significant associations. Finally, the two main factors associated with the social relationships domain were quantitative work demands, work-family conflict, in addition to emotional work demands and stress symptoms. According to a Peruvian study, excessive workload affects social functioning and is associated with increased physical discomfort among university professors, affecting interpersonal relationships and activities⁶².

Burnout and stress have a direct negative effect on professors' QoL⁵¹. Stress has already been negatively associated with health-related quality of life among Jordanian university professors⁶³. Meira et al.⁵⁸ identified in their cross-sectional study a negative correlation between perceived stress and all domains of QoL among professors in Brazil. In this study, in addition to perceived stress, sleep duration and medication intake due to work explained the variance in QoL in the scores of the physical health, psychological, social relationships and environment domains by 50%, 58%, 27% and 40%, respectively⁵⁸.

The amount of sleeping medication, the Epworth score, and the STOP Bang score were negatively associated with QoL at 12th month in the physical health domain. Regarding the last two factors, a study in adults recently diagnosed with OSA showed a significantly lower mean QoL score in the physical domain compared to normative population data, elucidating the impairment related to their physical functioning⁶⁴.

The STOP Bang score was also negatively associated with the social relationships domain, while sleep duration was positively associated with the physical health, psychological and environmental domains. These results point to the importance of sleep in the professors' QoL, with more hours of sleep improving QoL. Sleep has already been associated with higher QoL in the university environment in several studies with students^{55,59,65,66}. A recent study of 1560 Spanish university professors also found that sleep problems were negatively associated with a lower quality of life, and professors with good sleep quality had significantly higher scores on four dimensions of quality of life⁶⁷, corroborating our findings.

Limitations, perspectives and strengths

This study is limited by the use of self-reported measures, which may be subject to recall or reporting bias, and by the convenience sampling strategy, which may restrict the generalizability of findings. In addition, residual confounding cannot be ruled out despite the regression modeling applied. Furthermore, participants' interpretation of the QoL questions may have changed over time due to evolving personal or contextual factors, potentially affecting the comparability of responses across the three moments evaluated.

As QoL is influenced by multiple factors, it is expected to change over time, especially in response to significant environmental or psychosocial changes, such as emergency remote teaching during the COVID-19 pandemic. Despite the expectation of a significant improvement in QoL after the end of remote learning, our results showed only a modest increase over the follow-up period. It appears that the negative impacts of the pandemic on professors' QoL may be more persistent, and that the return to in-person teaching did not immediately increase the QoL.

In addition to meeting the assumptions of regression analysis and excluding outliers to avoid bias in the estimates, the stepwise method was adopted for variable selection, aiming to retain only statistically significant predictors and optimize model fit for each QoL domain separately. Most models showed moderate explanatory power (R^2), which is consistent with the multifactorial complexity of QoL. Considering the modest explanatory power ($R^2 = 21\%$) observed for the social relationships domain, future studies should investigate additional unmeasured psychosocial variables such as perceived social support, quality of workplace interactions, and exposure to offensive behaviors in educational environments, which may strongly influence individuals' social QoL domain.

The study presents a sample with participation of professors from all regions of the country, increasing the representativeness of the sample. Besides, the longitudinal design of the study and response rate in the follow-ups of 80% preserved the representativeness of the sample. New studies with longitudinal data are suggested to identify predictors of sleepiness, symptoms of burnout, stress and other psychosocial work aspects.

Conclusions

Professors from public higher education institutions in Brazil have lower QoL in the social relations domain. The findings suggest the need for improvements in social relationships, psychological, physical health, and environmental aspects. In addition, sociodemographic and occupational characteristics, health-related factors, and sleep were significantly associated with QoL after 1 year. In addition to managing occupational risks, it is necessary to consider developing strategies to improve professors' QoL, focusing on modifiable factors, such as sleep hygiene techniques, workplace physical activity, health education, occupational stress management programs, and other mental healthcare for professors, protecting them from psychosocial risk and decreased QoL.

Data availability

The datasets used and/or analyzed during the current study available from the corresponding author upon reasonable request.

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Author contributions

MIT, RGM and TOS have made substantial contributions to the conception, design of the work, analysis and interpretation of data. MIT: collected data and drafted the work. RGM e TOS reviewed the manuscript. All authors approved the final version of the manuscript.

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Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

The RESPIRA cohort study received approval from the Human Research Ethics Committee of Universidade Federal de São Carlos (UFSCar) (process number: 56582322.7.0000.5504) and was conducted in accordance with current ethical standards and resolutions in Brazil. Informed Consent was obtained from all individual participants included in the study.

Additional information

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