


RESEARCH ARTICLE (ORIGINAL) 

Musculoskeletal symptoms in nursing students: the role of psychosocial factors

Sintomatologia musculoesquelética nos estudantes de enfermagem: o papel dos fatores psicossociais

Sintomatologia musculoesquelética en estudiantes de enfermería: el papel de los factores psicossociales

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Received: 06.06.20

Accepted: 02.10.20

Abstract

Background: Throughout their education, nursing students are exposed to factors that can decrease their quality of life and general health status when associated with musculoskeletal symptoms.

Objective: To identify the psychosocial factors associated with the occurrence of musculoskeletal symptoms in undergraduate nursing students.

Methodology: Cross-sectional study with 253 students from university-level nursing schools. Data were collected between March and April 2018 through a self-administered questionnaire including sociodemographic variables and the Portuguese versions of the Nordic Musculoskeletal Questionnaire (NMQ), the 36-Item Short-Form Survey (SF-36), and the Depression, Anxiety, and Stress Scale (EADS-21).

Results: Anxiety, stress, and depression were identified as variables associated with the occurrence of musculoskeletal symptoms affecting nursing students' health.

Conclusion: There are psychosocial factors associated with musculoskeletal symptoms in nursing students. Understanding these risk factors will allow for the timely planning of prevention strategies and contribute to enhancing the learning process.

Keywords: students, nursing; musculoskeletal system; education, nursing; risk factors; psychosocial impact

Resumo

Enquadramento: Durante todo o curso, os estudantes de enfermagem estão expostos a fatores que podem contribuir para uma diminuição da sua qualidade de vida e do seu estado de saúde em geral, quando associados a sintomatologia musculoesquelética.

Objetivo: Identificar os fatores psicossociais associados à presença de sintomatologia musculoesquelética no estudante do curso de licenciatura em enfermagem.

Metodologia: Estudo transversal, com 253 estudantes de escolas superiores de enfermagem. A recolha de dados foi realizada em março e abril de 2018, através de um questionário autopreenchido incluindo variáveis sociodemográficas, bem como questionários Nórdico Músculo-esquelético (QNM), Questionário Estado de Saúde (SF-36) e a Escalas de Ansiedade Depressão e Stress (EADS-21).

Resultados: A ansiedade, *stress* e depressão foram identificadas como variáveis associadas à presença de sintomatologia musculoesquelética, interferindo na saúde dos estudantes de enfermagem.

Conclusão: Existem fatores psicossociais associados à sintomatologia musculoesquelética nos estudantes de enfermagem. Conhecer estes fatores de risco irá permitir que se possam planear atempadamente estratégias de prevenção e, também, contribuir para a potenciação do processo de aprendizagem.

Palavras-chave: estudantes de enfermagem; sistema musculoesquelético; educação em enfermagem; fatores de risco; impacto psicossocial

Resumen

Marco contextual: Durante todo el curso, los estudiantes de enfermería están expuestos a factores que pueden contribuir a la disminución de su calidad de vida y de su estado de salud en general cuando se asocian con la sintomatología musculoesquelética.

Objetivo: Identificar los factores psicossociales asociados con la presencia de sintomatología musculoesquelética en el estudiante de enfermería.

Metodología: Estudio transversal, con 253 estudiantes de escuelas de enfermería. La recopilación de datos se llevó a cabo en marzo y abril de 2018 mediante un cuestionario autocompletado que incluía variables sociodemográficas, así como los cuestionarios Nórdico Músculo-esquelético (QNM), Cuestionario Estado de Salud (SF-36) y la Escalas de Ansiedad, Depresión y Estrés (EADS-21).

Resultados: La ansiedad, el estrés y la depresión se identificaron como variables asociadas a la presencia de sintomatología musculoesquelética, que interfieren en la salud de los estudiantes de enfermería.

Conclusión: Hay factores psicossociales asociados con la sintomatología musculoesquelética en los estudiantes de enfermería. Conocer estos factores de riesgo permitirá planificar oportunamente las estrategias de prevención y contribuirá también a mejorar el proceso de aprendizaje.

Palabras clave: estudiantes de enfermería; sistema musculoesquelético; educación en enfermería; factores de riesgo; impacto psicossocial



How to cite this article: Firmino, C. I., Sousa, L. M., Rosa, P. J., Marques, M. F., & Simões, M. C. (2021). Musculoskeletal symptoms in nursing students: the role of psychosocial factors. *Revista de Enfermagem Referência*, 5(5), e20085. <https://doi.org/10.12707/RV20085>



Introduction

Entering higher education is a life transition that involves risks and challenges and can be perceived as a moment of crisis due to the need for adaptation to new contexts and societal roles with increased responsibilities at all levels of society. For nursing students (NSs), this responsibility is particularly relevant due to the level of complexity of the nursing program and the emotional impact caused on their *inner self*, which results from the multiple feelings associated with the impact of their care delivery on individuals, the nursing discipline, and society in general (Nogueira & Sequeira, 2017; Prymachuk et al., 2019). As they prepare to assume greater responsibilities, both academically and, later on, professionally, NSs are at a decisive stage in the development of their personality, and they can adopt certain lifestyles that will reduce risks to their health in adulthood (Nogueira & Sequeira, 2017; Soares et al., 2015).

Studies suggest that NSs face several risk factors. The most common risk factors are biomechanical factors (repetition, forceful exertions, patient handling, awkward postures, prolonged and intense computer use together with other electronic devices, and prolonged sitting), psychosocial factors (insecurity, fear, time and emotion management), socio-economical factors (financial management and/or the need to reconcile professional and student activity) and other risk factors such as gender, chronic diseases, and coping with an imposed workload (particularly during their shift-based clinical placements; Kitiş et al., 2017; Morais et al., 2019; Nunes et al., 2016). NSs can perceive life events associated with accomplishing academic objectives and developing personal skills (e.g., time management, financial management, interpersonal relationships) as stressor events. Their intensity and duration over time (even if only some of them) can produce maladaptive stress responses, such as anxiety, depression, and/or musculoskeletal symptoms (MSSs), depending on how the individual perceives stress and copes with it (Ferreira et al., 2015; Firmino et al., 2018; Firmino et al., 2019; Kitiş et al., 2017; Oliveira et al., 2017). In addition to their academic routines, at an early stage of their programs, NSs carry out clinical internships to develop the necessary skills for the nursing profession and cope with academic evaluation-related stress (caused by their teachers or other healthcare professionals) and the pressure to succeed in all course units due to prerequisite course unit requirements (Kitiş et al., 2017; Morais et al., 2019). All these factors combined (or even only some of them) can contribute to the onset of depression, stress, anxiety, and/or MSSs, leading to emotional distress, exhaustion (Ferreira et al., 2015; Firmino et al., 2018; Firmino et al., 2019; Kitiş et al., 2017; Oliveira et al., 2017), and reduced well-being and quality of life among NSs from the beginning of their education, with a direct impact on their health. Moreover, these symptoms can also negatively affect their academic performance or, in extreme cases, make them drop out from their studies (Kitiş et al., 2017). This study aimed to identify

the psychosocial factors associated with the presence of MSSs in NSs.

Background

Well-being and healthy habits reduce the risk factors that have negative effects on health. The prevalence of these factors has been increasing, particularly among young adults, and has grown into a public health issue that has received much attention from researchers (Galvão et al., 2017). Lifestyles are behaviors or habits through which individuals respond to several everyday situations by acquiring knowledge or through a process of socialization, and that are reinterpreted throughout the life cycle in different social situations (Firmino et al., 2019; Galvão et al., 2017). Lifestyles are also characterized by identifiable patterns of behavior that influence the health of higher education students in general and the health of NSs in particular, at a stage when they are shaping their attitudes and behaviors. Anxiety, stress, and depression are major examples of these effects that translate into an emotional state with psychological and physiological aspects which, despite contributing to the normal development of human experience, occur in at least 12% of the higher education population, with a prevalence of depression at 43.1%, anxiety 54.2%, and stress 45.1% (Firmino et al., 2018; Nogueira & Sequeira, 2017).

In this study, with a sample of undergraduate nursing students, depression was classified as *mild* in 12.3% of the sample, *moderate* in 13.8%, *severe* in 7.5%, and *extremely severe* in 9.5%. Anxiety was classified as *mild* in 18.2% of the students, *moderate* in 12.3%, *severe* in 9.5%, and *extremely severe* in 14.2%. Stress was classified as *mild* in 14.2% of the students, *moderate* in 11.5%, *severe* in 13%, and *extremely severe* in 6.3% (Firmino et al., 2019; Firmino et al., 2018). MSSs in these NSs is a concern due to their multifactorial nature. MSSs are described and reported as an unpleasant and painful physical sensation that causes a feeling of weight, tingling, fatigue, and muscle tension (Firmino et al., 2019), combining several individual, psychosocial, physical, and biomechanical risks.

These symptoms do not develop due to a specific cause. They result from different interrelated factors, such as academic workload, sleep deprivation, repetition of precise movements during clinical placements, and constant coping with death. These factors can increase stress, anxiety, and depression, which, in turn, can reduce the psychological and physical quality of life of NSs (Kitiş et al., 2017). It is essential to study these factors and strategies for their mitigation because it is impossible to eradicate them. Understanding the psychosocial factors associated with MSSs in NSs is important given their impact on their quality of life and the adoption of appropriate attitudes and adaptative strategies for preventing their occurrence and development during adulthood. Studies that investigate the association between these aspects and NSs are scarce or non-existent, for which reason this study aims to fill this gap.

Research question

What are the psychosocial factors associated with MSSs in NSs?

Methodology

This is a quantitative, cross-sectional, descriptive, and correlational study with a convenience sample of 253 NSs from four nursing schools (two public and two private schools from the Porto and Lisbon and Tagus Valley regions). The inclusion criteria were being enrolled and regularly attending the course units of the schools included in the study, voluntarily participating in the study, and responding to the questionnaire in full. Erasmus students were excluded due to the expected difficulty in adapting to the technical specificities of the Portuguese language regarding this topic.

The Ethics Committees of two nursing schools of the Lisbon and Tagus Valley region approved this study (in February and June 2017).

The questionnaire was sent to the schools via email using Survey Monkey. The coordinators of each year of study then sent the questionnaire to each student via email. The rights and the confidentiality of the answers of all those involved in this study were ensured.

Data were collected between March and April 2018 through a self-administered questionnaire divided into four parts.

The first part addressed sociodemographic aspects (gender, age, marital status, children); lifestyle and health habits (food, commute to school, alcohol and tobacco consumption, computer use), and aspects related to the course itself (choice of course and/or school, change of residence, classes and training, transported materials).

The second part included the Portuguese version of the Nordic Musculoskeletal Questionnaire (NMQ), which was translated and validated for the Portuguese population by Mesquita et al. (2010). The Portuguese version of the questionnaire has an internal consistency of 0.86 using the Kuder-Richardson coefficient of reliability (KR-20). The self-administered questionnaire has 27 dichotomous questions regarding MSSs (Mesquita et al., 2010). It consists of three main questions about nine areas of the body (neck, shoulders, elbows, wrists/hands, upper back, low back, hips/thighs, knees, and ankles/feet); problems (such as pain, discomfort, or numbness), and normal activity (work, housework, hobbies) during the last 12 months. The last question refers to the presence of symptoms in the last seven days (Mesquita et al., 2010).

The third part of the questionnaire included the Portuguese version of the Depression, Anxiety, and Stress Scale (EADS-21), adapted by Pais-Ribeiro et al. (2004). This scale consists of 21 items to measure the three dimensions, each having seven questions. Each item has four possible answers (rated on a Likert-type scale) ranging from 0 (*did not apply to me at all*) to 3 (*applied to me very much*; Pais-Ribeiro et al., 2004). The Portuguese version of the scale has high Cronbach's alphas for the three subscales

(anxiety = 0.74; depression = 0.85; and stress = 0.81) and good psychometric qualities, being a useful measure for research (Pais-Ribeiro et al., 2004).

The fourth part of the questionnaire included the 36-Item Short-Form Survey (SF-36). This generic self-reported survey aims to measure perceived health status in both healthy and patient populations. It is a quick, easy-to-use, concise, and psychometrically robust tool translated and adapted to the Portuguese population by Ferreira and Ferreira (2006). It includes 36 closed-ended items that assess eight health domains: Physical Functioning; Role-Physical; Bodily Pain; General Health; Vitality; Social Functioning; Role-Emotional; and Mental Health. The items are grouped into two components: physical and mental (Ferreira & Ferreira, 2006).

A descriptive statistical analysis using absolute frequencies and percentages is presented to describe the academic characteristics of NSs. The musculoskeletal pain variable (presence *vs.* absence) was operationalized through the NMQ. Any participant who did not mention the presence of pain – regardless of the body region – was coded with 0 (*absence*). In contrast, those who mentioned the presence of pain were coded with 1 (*presence*). The association between musculoskeletal pain and the scores of other variables was analyzed using the point-biserial correlation. Finally, a binary logistic regression (musculoskeletal pain as the dependent variable) was performed with the Forward LR method for including variables (Likelihood-Ratio). The potential predictor variables were previously selected through a univariate analysis (*t*-test for quantitative variables and chi-square for qualitative variables with $p < 0.10$) before running the statistical model, as recommended by Katz (2006). The SF-36 pain subscale score was not included in the logistic model as a potential predictor because it assesses the same construct as the dependent variable (musculoskeletal pain). The Hosmer-Lemeshow test was used to assess model fit, the Wald Chi-Squared Test to calculate the significance of the predictor, and the adjusted odds ratio (AOR) to calculate the contribution of the predictor to the presence of musculoskeletal pain (Tabachnick & Fidell, 2013). Considering that the year of university studies is associated with anxiety, particularly the first year, which is a critical period (Nogueira & Sequeira, 2017), the moderating effect of the year of university studies in the association between anxiety and pain was calculated using a hierarchical logistic regression (HLR). All variance inflation factors (VIF) of the predictor variables were lower than 10, indicating the absence of multicollinearity. Before calculating the product term, the predictor variables (anxiety and year of university studies) were centered to prevent multicollinearity (Rosa et al., 2015). The year of university studies was treated as a quantitative variable. The HLR was run using a two-step (blocks) analysis, with 233 cases. Model fit to the data (block) was assessed using the -2 log-likelihood (-2LL) statistic and Nagelkerke R^2 . The -2LL values of each model were compared using the likelihood ratio test (Carvalho et al., 2018). The conditional effects of anxiety at each level of the pain moderator were examined graphically, considering the mean ($SD = 0$) and a standard deviation

below and above the anxiety mean (-1 SD and +1 SD); the same was done for the year of university studies. All statistics were conducted using IBM SPSS Statistics, version 25.0. The significance level was set at 5%.

Results

The 253 NSs who answered to the questionnaire in full were aged 18 to 44 years, 85.80% were women, and 14.42% were men. At the time of this study, the majority of students were single (96.44%) and had no children (96.05%). Regarding the amount of screen time, 46.64% of them spent 2 to 4 hours, 45.45% spent more than 4 hours, and only 18.97% spent less than 2 hours. Regarding the mean number of hours spent sitting, most of them reported sitting for more than 4 hours (65.61%). Using the EADS, anxiety was strongly and positively associated with depression $r(233) = 0.66; p < 0.001$ and stress $r(233) = 0.77; p < 0.001$. However, anxiety had a positive and weak correlation with the presence of pain (NMQ) $r_{pb}(233) = 0.22; p = 0.001$. Anxiety had a significant negative and weak correlation with Role-Physical (SF-36) $r(186) = -0.15; p < 0.048$. Depression had a significant positive and strong correlation with stress $r(233) = 0.72; p < 0.001$ and a weak correlation with the presence of pain (NMQ) $r_{pb}(233) = 0.14; p = 0.027$. Nevertheless, depression had a significant weak correlation with Role-Physical (SF-36) $r(186) = -0.15; p < 0.042$. The EADS stress subscale had a significant positive and weak association with both the pain subscale (SF-36) $r(187) =$

$0.17; p < 0.017$ and the presence of pain (NMQ) $r_{pb}(204) = 0.19; p = 0.003$. Regarding the Role-Physical subscale (SF-36), a significant positive and strong correlation was found with the Role-Emotional subscale (SF-36) $r(204) = 0.52; p < 0.001$, a moderate correlation with the Mental Health (SF-36) $r(204) = 0.46; p < 0.001$, and Vitality subscales $r(165) = 0.35; p < 0.001$, and a weak correlation with the Social Functioning (SF-36) $r(165) = 0.52; p < 0.001$ and General Health subscales (SF-36) $r(164) = 0.52; p < 0.001$. The Role-Emotional subscale (SF-36) had a significant positive and strong correlation with the Mental Health subscale (SF-36) $r(204) = 0.66; p < 0.001$ and a significant positive and moderate correlation with Vitality $r(165) = 0.46; p < 0.001$, Social Functioning (SF-36) $r(165) = 0.34; p < 0.001$, and General Health subscales (SF-36) $r(164) = 0.33; p < 0.001$. With regard to the General Health subscale (SF-36), a significant positive and moderate correlation was found with the Mental Health $r(165) = 0.46; p < 0.001$ and Vitality subscales (SF-36) $r(165) = 0.38; p < 0.001$ and a significant positive and weak correlation with the Social Functioning subscale (SF-36) $r(164) = 0.21; p = 0.015$. The scores in the Social Functioning subscale (SF-36) revealed a significant positive and weak correlation with the Mental Health (SF-36) $r(204) = 0.27; p < 0.001$ and Vitality subscales (SF-36) $r(165) = 0.19; p = 0.014$. The Vitality subscale had a significant positive and strong correlation with the Mental Health subscale (SF-36) $r(165) = 0.68; p < 0.001$. No other statistically significant correlations were found. Table 1 shows the bivariate correlation coefficients between the scales and the subscales under analysis.

Table 1

Bivariate correlation coefficients between the scales and the subscales under analysis

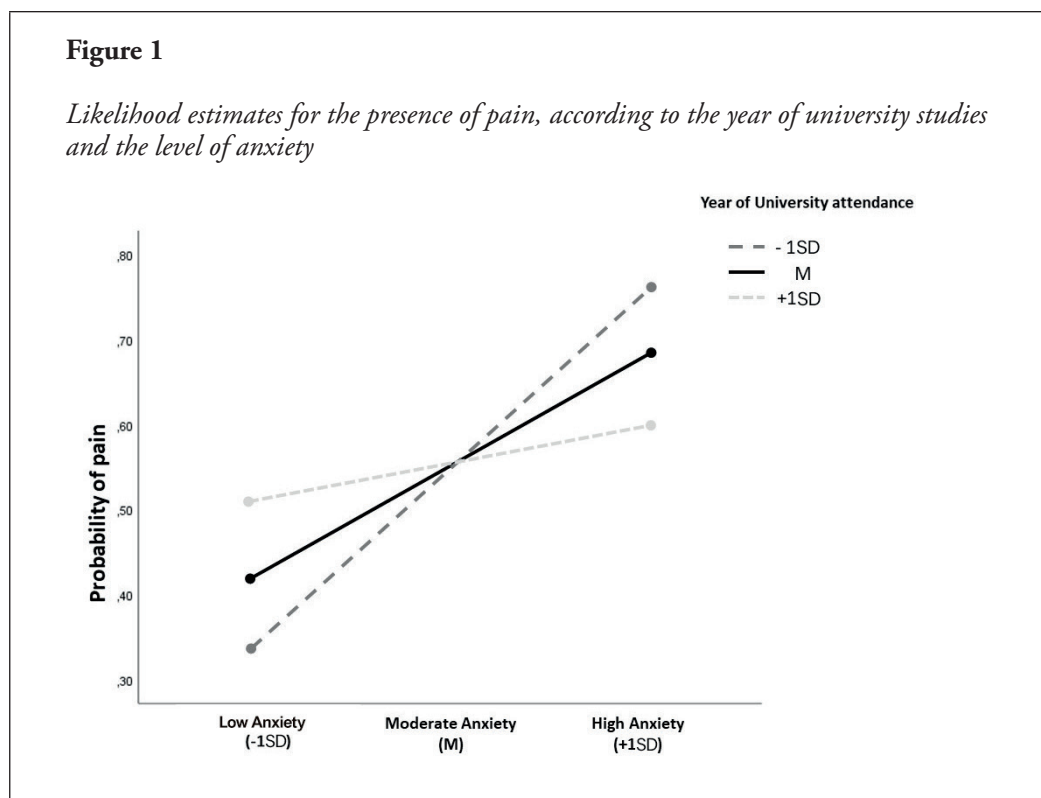
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Positive AF (1)	-													
Negative AF (2)	-.21**	-												
EADS anxiety(3)	.08	-.07	-											
EADS depression(4)	.07	.03	.66***	-										
EADS_stress (5)	.07	-.02	.75***	.72***	-									
SF-36 Physical Functioning (6)	-.03	.03	.05	-.05	.04	-								
SF-36 Role - hysical (7)	.00	-.10	-.15*	-.15*	-.07	.01	-							
SF-36 Role - Emotional (8)	-.07	.04	-.08	-.07	-.06	.00	.52***	-						
SF-36 General Health (9)	-.02	-.05	-.15	-.13	-.05	-.10	.28***	.33***	-					
SF-36 Pain (10)	.04	.07	.07	.06	.17*	.11	.06	-.01	.06	-				
SF-36 Social Functioning (11)	.06	.01	.01	-.08	-.02	-.04	.28***	.34***	.21*	-.05	-			
SF-36. Vitality (12)	.12	-.09	-.11	-.13	-.02	-.06	.35***	.46***	.38***	-.06	.19*	-		
SF-36 Mental Health (13)	.01	-.04	-.10	-.13	-.07	-.09	.46***	.66***	.41***	.03	.27***	.68***	-	
SNMQ_Pain (14) ^a	-.04	.04	.22**	.14*	.19**	.04	.04	.11	-.05	.14	.02	.01	.06	-

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; ^a = point-biserial correlation.

The univariate analysis also allowed selecting three potential predictive variables for the presence of pain (yes *vs.* no): EADS anxiety, EADS depression, and EADS stress. The remaining variables (sociodemographic and academic) did not meet the conditions for being included in the statistical model, that is, $p > 0.10$. The Forward LR method revealed that only EADS anxiety could predict the presence of pain. The EADS anxiety subscale significantly predicts the presence of pain ($OR = 1.12$, 95%CI [1.05; 1.20] X^2 Wald (1) = 10.80; $p = 0.001$), with the likelihood of pain increasing by 12% for each unit in the EADS anxiety subscale. Considering the potential moderating effect of the year of university studies on the association between anxiety and pain, in the first step of the HLR, only anxiety and year of university studies together were able to significantly predict pain [X^2 Wald (2) = 12.07; $p = 0.002$, -2LL = 307.32, explaining 6.8% of pain variance (Nagelkerke $R^2 = 0.068$)]. The product term (interaction) was added to

the second block [X^2 Wald (3) = 17.63, $p < 0.001$; -2LL = 301.76, explaining 9.7% of pain variance (Nagelkerke $R^2 = 0.097$)]. The G^2 test (1) = 5.56; $p = 0.018$ indicated a significant interaction, demonstrating that the year of university studies moderates the association between anxiety and pain. The simple effects (OR) analysis revealed that, in the first years of university studies, anxiety is associated with a significant increase in the likelihood of pain ($OR = 1.31$; $p = 0.004$). Nevertheless, in intermediate years of university studies, the likelihood of pain decreases ($OR = 1.13$; $p = 0.006$). In the last years of university studies, anxiety was not significantly associated with the presence of pain ($OR = 1.04$; $p = 0.343$).

Figure 1 shows the protective effect of the year of university studies on the association between anxiety and pain, considering that the association between anxiety and the presence of pain decreases as students advance in university.



Discussion

This study aimed to identify the psychosocial factors associated with MSSs in NSs. Anxiety, stress, and depression were identified as variables associated with the presence of MSSs. Studies have associated these variables with being away from family, decreased leisure activities, and sleep deprivation (Firmino et al., 2019; Kitiş et al., 2017; Morais et al., 2019). Most students have to cope with the higher education demands on a daily basis (application of scientific and technical knowledge; contact with specialized professionals, both in the areas of education and clinical practice; practical and theoretical assessment; use of technological and computer tools). These demands can increase distance in a family, reduce the number of social

activities and the time available for leisure activities, cause sleep deprivation, less-than-ergonomic postures, muscle tension, movement repetition, and competition among colleagues (Firmino et al., 2019; Nunes et al., 2016). Other studies also mention the unpredictability to which students are exposed as another factor of anxiety and stress (because they may have to make choices and interventions that require a high level of technical and scientific skills or imply the maintenance of their academic internship), putting them in a situation of vulnerability, and leading to inappropriate postures, excessive academic workload, shift-based clinical placements, and movement repetition, which are factors associated with the likelihood of emotional suffering and pain (Firmino et al., 2019; Morais et al., 2019; Nunes et al., 2016). Pain associated with

the variables of anxiety, stress, and depression can result from the NSs' exposure to psychosocial factors and the lack of time to engage in leisure or rest activities (both with behavioral and psychological effects), causing the somatization of physical symptoms and muscle tension that lead to musculoskeletal pain, which is one of the factors responsible for the development of MSSs (Firmino et al., 2019; Morais et al., 2019; Nunes et al., 2016). In the consulted literature, other studies corroborate the association made in this study between the first years at university and anxiety and pain, in which, on average, 25% of students had severe depressive symptoms, and 54% of them had minor psychiatric disorders (Pinheiro et al., 2020; Wang et al., 2019). This association can result from a higher incidence in the first semesters, with higher anxiety levels in younger students due to clinical placements, new learning experiences, and interaction with teachers. Nevertheless, these difficulties are overcome through the knowledge and skills acquired during the following years of study (Pinheiro et al., 2020; Wang et al., 2019).

This study also found relevant findings concerning associations between role-physical, role-emotional, mental health, and vitality. These results are in line with those of previous studies on NSs' quality of life that found that role-physical is strongly correlated with several domains because it includes questions about activities of daily living, vitality, energy, and motivation (Ferreira et al., 2015; Firmino et al., 2018; Kitiş et al., 2017; Morais et al., 2019).

In Portugal, the undergraduate nursing degree is currently being offered in polytechnic higher education in public and private institutions. These institutions are strategic educational environments that should promote initiatives right from the beginning of the degree, following a positive health perspective, with the purpose of strengthening the individual, social, and cultural factors of each student and increasing their health potential. We are training the future professionals of this area, and, in turn, they will disseminate these interventions in several social areas, as it is part of their responsibilities as future nurses (Ferreira et al., 2015; Firmino et al., 2018; Pryjmachuk et al., 2019). A limitation of this study was that it was carried out exclusively with NSs, which prevented understanding and comparing MSSs in other health students and/or students from other grade levels. It would be important to determine the number of hours of clinical placement already attended by students to understand the influence of clinical placements on the onset of MSSs.

Conclusion

This study aimed to identify the psychosocial factors associated with the presence of MSSs in NSs. The results show that, of the various psychosocial factors under analysis, that is, anxiety, depression, stress, and quality of life, pain was positively associated with anxiety, depression, and stress. However, only anxiety predicted pain. Moreover, this study revealed other important associations for un-

derstanding this issue, namely the significant correlations between role-physical and role-emotional, and between mental health and vitality, as well as the strong associations between depression, anxiety, and stress. Identifying the multiple factors associated with MSSs can be a strategic tool for all those involved in NSs' learning process. Nursing schools seem to have a key role in developing actions and interventions directed at MSSs, designing strategic approaches to cope with the multicausal factors, and contributing to the anticipation of this issue, either by organizing workshops and seminars (as these are considered learning spaces based on personal experiences), or including them in course units of differentiated approaches (given their impact at an individual, group, and even societal level). Due to this worrying situation and the scarcity of studies in this population in Portugal, a follow-up of NSs is recommended to clarify the results found here through studies using biofeedback techniques in laboratory or prospective, randomized, and epidemiological studies. A specific research tool for this student population should be developed to facilitate data comparison and the implementation of MSSs prevention programs, using the knowledge of faculty members of all nursing specialties (e.g., occupational nursing, rehabilitation, mental health).

Author contributions

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