



# Stress, anxiety, and cortisol levels in nursing students during clinical practice: a scoping review\*


## Stress, ansiedade e níveis de cortisol em estudantes de enfermagem durante a prática clínica: uma scoping review

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### Keywords

Stress, Physiological;  
Nursing students; Review.

### Abstract

**Introduction:** Nursing students are confronted with clinical demands in clinical practice. Literature points that when compared to other higher education students the stress levels experienced are superior in nursing education.

**Objective:** To map the evidence available on stress and cortisol levels in nursing students during clinical practice.

**Materials and Methods:** A scoping review was performed and quantitative, qualitative, and mixed methods studies in full text, in English, Spanish or Portuguese, published between January 1, 2001 and October 31, 2022 were included. Search was carried out in EBSCOHost, PubMed, SciELO, Mednar, Web of Science, ScienceDirect and Scopus.

**Results:** Sixty-three studies were identified (54 quantitative and 9 qualitative). Studies spanned all academic years, but there is no consensus between stress and the academic year. The main causes of stress were: stress from teachers and nursing staff, students' assignments, workload, and stress related to patient care. There is a lack of studies on the relationship between stress and the cortisol levels.

**Conclusions:** Stress management programs should be implemented during the nursing degree to prepare students for clinical practice. Monitoring of the relationship between biochemical and psychological elements may be useful to evaluate the program's effectiveness.

### Palavras-chave

Estresse Fisiológico;  
Estudantes de enferma-  
gem; Revisão.

### Resumo

**Introdução:** Os estudantes de enfermagem são confrontados com exigências clínicas na prática clínica. A literatura aponta que, quando comparados com outros estudantes do ensino superior, os níveis de stress vivenciados são superiores no ensino de enfermagem.

**Objetivo:** Mapear a evidência disponível sobre os níveis de stress e cortisol em estudantes de enfermagem durante a prática clínica.

**Materiais e Métodos:** Foi realizada uma scoping review e foram incluídos estudos quantitativos, qualitativos e de métodos mistos em texto completo, em inglês, espanhol ou português, publicados entre 01-01-2001 e 31-10-2022. A pesquisa foi efetuada na EBSCOHost, PubMed, SciELO, Mednar, Web of Science, ScienceDirect e Scopus.

**Resultados:** Foram identificados 63 estudos (54 quantitativos e 9 qualitativos). Os estudos abrangeram todos os anos letivos, mas não há consenso entre o stress e o ano letivo. As principais causas de stress foram: o stress causado pelos professores e orientadores, as tarefas dos estudantes, a carga de trabalho e o stress relacionado com os cuidados prestados aos doentes. Há falta de estudos sobre a relação entre o stress e os níveis de cortisol.

**Conclusões:** Devem ser implementados programas de gestão do stress durante o curso de enfermagem para preparar os estudantes para a prática clínica. A monitorização da relação entre elementos bioquímicos e psicológicos pode ser útil para avaliar a eficácia do programa.

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## Introduction

Nursing students are at early stages of their education confronted with clinical demands in the context of clinical practice. Clinical learning is essential to develop a competent nursing given the profession practical nature. Literature underlines that when compared to other higher education students the stress levels experienced are superior in nursing education<sup>1</sup> and considerably increased in the clinical context when compared to the school context.<sup>2</sup> Contributions to this outcome derives from a variety of sources such as the contact with complex patients, the lack of clinical skills or the fear of the unknown.<sup>3,4</sup> Consequently, students are frequently under stress that can have both positive and negative impact. Positive effect includes motivation and excitement which can help students deal with clinical practice demands.<sup>5</sup> On the other hand, negative effects induce physical, emotional, and behavioural responses that results in struggle to achieve educational goals.<sup>6</sup> Additionally, the clinical learning environment appears to be affected by several aspects, such as: the lack of theoretical preparation; effective communication skills; poor faculty self-preparation; unfamiliar setting and insufficient support for students.<sup>7</sup>

Stress can be defined as a phenomenon that is complex and contributes to mental health disorders and chronic health conditions. Therefore, it decreases both the work productivity and the quality of life increasing the cost with medical expenses.<sup>8</sup> On the other hand, anxiety appears as a temporally emotional state that is caused by the perception of potentially harmful situations and therefore it is not a pathological state.<sup>9</sup> Even though both concepts are related and have implications in everyday life, they are distinct. Stress refers to the body's physiological and psychological response to an external critical event. At the same time, anxiety can be described as an emotional response to an identified or anticipated threat. In this sense, stress can be understood as an internal and adaptive response to challenging situations, which, if prolonged, can lead to physiological and psychological dysfunctions. On the other hand, anxiety can be seen as a response to real threats and may become dysfunctional in the face of imaginary situations or perceived threats.<sup>10</sup>

Saliva cortisol levels have been used to evaluate stress as they are increased as a response to stress.<sup>11,12</sup> In nursing students' saliva cortisol levels have been

assessed in a multiplicity of studies such as before evaluations<sup>11</sup>, to assess the effectiveness of yoga interventions<sup>13,14</sup> or music therapy in stress reduction.<sup>15</sup>

Previous literature reviews have been performed that address this topic. The sources of stress in nursing students were systematically reviewed by Pulido-Martos, Augusto-Landa and Lopez-Zafra.<sup>16</sup> The authors concluded that stress was present at the academic level but also at the clinical practice and, in general, there were no changes regarding the year of education. Labrague and colleagues (2017, 2018) performed two different literature reviews. First, they systematically accessed literature to identify the levels of stress and its sources as well as the coping methods used by nursing students.<sup>17</sup> Stress levels ranged from moderate to high and main stressors included "stress through the caring patients, assignments and workloads, and negative interactions with staff and faculty".<sup>17</sup> Following, in 2018 they performed a systematic literature review to appraise and synthesize existing knowledge on stress perceptions and coping styles in Saudi nursing students.<sup>18</sup> Moderate to high stress levels were identified due mainly to heavy workload and patient care. In the same year McCarthy et al.<sup>19</sup> performed an integrative review on nursing and midwifery student's stress and coping during their educational programs. Sources of stress were identified in clinical, academic, financial context and clinical practice with the latter as the predominantly one.

Authors emphasize the need for further research on this topic and it is clear the recent investment in this topic as exposed and detailed above. Although the literature reviews presented address the stress of nursing students in clinical practice, cortisol levels are not mentioned, and reviews are not up to date. Therefore, a scoping review was performed to map the evidence available on stress and cortisol levels in nursing students during clinical practice. As Munn<sup>20</sup> states scoping reviews are particularly useful to scope a body of literature, therefore this type of review was chosen.

## Materials and methods

A scoping review was carried out to map the evidence available about stress and cortisol levels in nursing students during clinical practice. The research question was defined according to PCC<sup>21</sup>: What's the evidence available in literature about stress and cortisol levels (C) in nursing students (P) during clinical practice (C)? (Population: nursing

students; Concept: stress and cortisol levels; Context: clinical practise).

**Protocol and registration.** This research was structured according to the Preferred Reporting Items for Scoping Reviews (PRISMA-ScR)<sup>21</sup> updated in 2020<sup>22</sup> and 2021.<sup>23</sup> The review was registered in the Open Science Framework (OSF) on the 6<sup>th</sup> July 2022 (<https://osf.io/zaq37/>).

**Eligibility criteria.** Studies that addressed stress and cortisol levels in nursing students during clinical practice were considered. As to the type of methodology, to amplify the coverage of existing evidence, quantitative, qualitative, and mixed methods were included. Peer-reviewed empirical studies available in open access and full text, written in English, Spanish or Portuguese and published between January 1, 2001 and October 31, 2022 were included. We chose this time frame given that a preliminary review revealed a shortage of published studies that exclusively addressed stress levels in nursing students in the specific context of clinical practice. Therefore, published studies that considered the entire academic context but made considerations about clinical practice were included. Articles that studied stress in various groups of students were also included as long as it was possible to extract specific data on nursing students. Exclusion criteria included studies that evaluated stress in contexts that were not clinical practice, methodological articles (instrument validation), letters to the editor, editorials, blog articles, advertising, and opinion articles. Literature reviews were also excluded to avoid duplication of results, as these types of studies contain data from original studies which may influence the representativeness of certain studies. Furthermore, an extensive search for reviews on this topic was initially conducted to access the appropriateness of this review.

**Information sources.** According to the PRISMA recommendations for conducting scoping reviews, the research strategy took place in three phases.<sup>24</sup> In phase one, a preliminary search in Medical Literature Analysis and Retrieval System Online (MEDLINE), PubMed, and Cumulative Index to Nursing and Allied Health Literature (CINAHL) was conducted, which allowed the identification of keywords and the structuring of the search equation. The keywords were validated in Medical Subject Headings (MeSH) terms. In phase two, the research was conducted in electronic platform EBSCOhost in the following databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL) [complete]; MEDLINE [complete]; Nursing & Allied

Health Collection [comprehensive]; Cochrane Central Register of Controlled Trials; Cochrane Database of Systematic Reviews; Cochrane Methodology Register; Library, Information Science & Technology Abstracts (LISTA), MedicLatina, Cochrane Clinical Answers, ERIC, Regional Business News, Academic Search Complete and Business Source Complete. PubMed, SciELO, Mednar, Web of Science, ScienceDirect and Scopus were also searched. Grey literature was searched in OpenAIRE. In phase three, the list of references from the selected articles was also searched to locate supplementary significant literature.

The search was performed by all four authors in October 2022.

**Search.** We combined different search terms in the electronic search strategy without field restrictions. Different groupings and combinations were used according to each platform and database characteristics. Full search strategy is available online at OSF (<https://osf.io/zaq37/>).

**Selection of sources of evidence.** 2094 articles were initially selected by title. When it was not clear if the article was appropriate for this study, the abstract was read. Duplicates were removed and inclusion / exclusion criteria were applied. To increase consistency authors worked in groups of two and screened the same publications. Disagreements were resolved through discussion until a consensus was reached. A total of 63 studies were included in the final sample.

**Data charting process.** The authors developed a data chart with the variables to be extracted. The process was initially performed individually by each author and then compared by all authors to analyze the extracted data, decide divergences, and increase accuracy. The final extraction chart was discussed by all authors to reach consensus.

**Data items.** The data extracted from each article included the following items: authors, year, country, aim, methods (type of study<sup>25</sup>, sample, population, course duration), main findings and instruments used as detailed in table 1 and in table 2. The full extraction table is available at OSF (<https://osf.io/zaq37/>).

**Synthesis of results.** After reading the articles in full, the data were extracted into one main table constructed and validated by all authors. The table included the general characteristics of the studies as described in data items section. Since our main focus was to map the evidence available on stress and cortisol levels in nursing students during clinical practice and having found a great variability in the instruments used in its evaluation, we chose to create a second table summarizing those instruments.

## Results

Selection of sources of evidence. A total of 63 articles from our initial sample of 2094 were included in this review. Reasons for article exclusion included: articles focusing exclusively on related concepts such as depression, burnout, resilience, well-being, quality of life, and coping; studies that analyze specific period of recent COVID pandemic; studies that accessed other student populations (such as medical students); articles focusing on stress associated with clinical simulation settings; and articles related to instrument validation. PRISMA flow chart is presented in Figure 1 to summarize the selection process.

Characteristics of sources of evidence. As explained earlier, we created a table of detailed study characteristics available in the OSF. In addition, we created Table 1 to integrate this manuscript with a summary of each of the selected study characteristics.

Figure 1. PRISMA flow chart for study selection

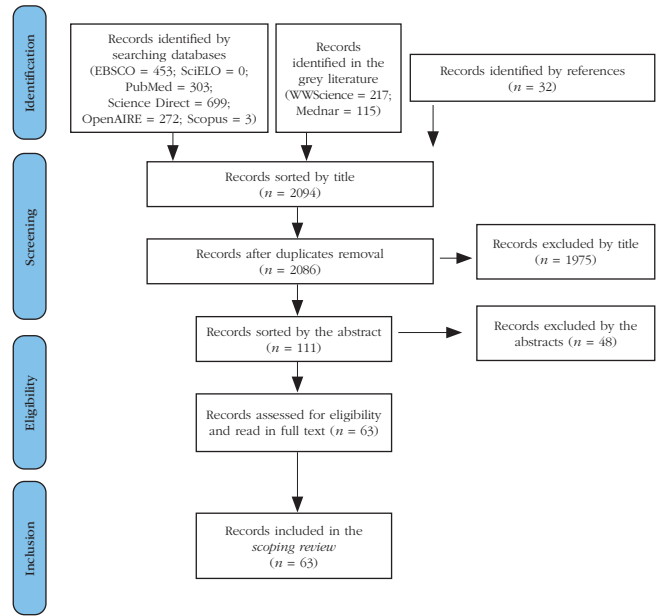


Table 1. Summary of studies characteristics.

Author	Aim	Methodology
(Adjei et al., 2018), Ghana	To explore perceptions, challenges, and how the intra-semester clinical practicum affects the learning process of student nurses.	Qualitative n=33 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 4 years
(Admi et al., 2018), Israel	To investigate the perceptions of stress and satisfaction of undergraduate nursing students during three stages of clinical learning experiences: preclinical, clinical, and advanced clinical.	Quantitative n=339 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 4 years
(Ahmed & Mohammed, 2019), Saudi Arabia	To assess the degree of stress experienced by nursing students at Albaha University, KSA and the coping strategies they subsequently employ.	Quantitative n=125 NS (all academic years) Course duration: 5 years
(Akhu-Zaheya et al., 2015), Jordan	To assess the association between perceived stresses, stress related factors, and students' clinical performance.	Quantitative n=539 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 4 years
(Al-Gamal et al., 2018), Saudi Arabia	To determine the stress level and coping strategies among undergraduate Saudi female nursing students during their clinical education.	Quantitative n=121 NS Course duration: 5 years
(Alsaqri, 2017), Saudi Arabia	To identify the level and types of stress perceived by nursing students in their clinical practice and to identify the coping strategies that students used to relieve their stress.	Quantitative n=200 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> , 5 <sup>th</sup> ) Course duration: 5 years
(Altiok & Üstün, 2013), Turkey	To find out stress sources of second year nursing students.	Qualitative n=15 NS (2 <sup>nd</sup> ) Course duration: 4 years
(Bazrafkan & Kalyani, 2018), Iran	To comprehend the experiences of nursing students in clinical education.	Qualitative n=16 NS (3 <sup>rd</sup> ) Course duration: 4 years

Author	Aim	Methodology
(Bilgiç & Çelikkalp, 2021), Turkey	To examine the clinical stress levels of nursing students during their first clinical practice and their stress coping styles.	Quantitative n=91 NS (1 <sup>st</sup> ) Course duration: 4 years
(Blomberg et al., 2014), Sweden	To describe nursing students' experience of stress during clinical practice and evaluate the risk of stress in relation to the clinical setting characteristics and the organization of the clinical education.	Quantitative N=184 NS (3 <sup>rd</sup> ) Course duration: 3 years
(Bodys-Cupak et al., 2022), Poland	To assess the relationship between perceived stress and psychosocial factors.	Quantitative n=307 NS (all academic years) Course duration: 3 years
(Bradshaw et al., 2018), Ireland	To explore midwifery students' experiences of the internship period.	Qualitative n=13 NS (4 <sup>th</sup> ) Course duration: 4 years
(Chan et al., 2009), China	To examine Hong Kong baccalaureate nursing students' stress and their coping strategies in clinical practice.	Quantitative N=205 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 4 years
(Chen & Hung, 2014), Taiwan	To explore the relationships between perceived stress, coping behaviors, personality traits, and physio–psycho-social responses in a clinical practicum among baccalaureate nursing students.	Quantitative n=101 NS (all academic years) Course duration: 4 years
(Cheung et al., 2016), China	To examine the prevalence of depression, anxiety, and symptoms of stress among baccalaureate nursing students in Hong Kong.	Quantitative n=665 NS (1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 5 years
(Custódio et al., 2009), Portugal	To identify the situations encountered in clinical teaching in nursing which are perceived as stressors.	Quantitative n=1238 NS (all academic years) Course duration: 4 years
(Frögéli et al., 2016), Sweden	To evaluate the effect of a preventive intervention using acceptance and commitment therapy, to target stress during the first semester of nursing training.	Quantitative n=113 NS (1 <sup>st</sup> ) Course duration: 3 years
(Graham et al., 2016), Jamaica	To determine the levels of stress among students in the Jamaican clinical setting and describe the perceived contributing factors to this stress.	Quantitative n=132 NS (all academic years) Course duration: 3 years
(Grant-Smith & Zwaan, 2019), Australia	To explore the impact of participation in unpaid clinical placements on students' financial well-being and stress.	Quantitative n=160 NS Course duration: 3 years
(Hamaideh et al., 2017), Saudi Arabia	To identify levels and types of stressors among nursing students during their clinical training and their coping behavior.	Quantitative n=100 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> , 5 <sup>th</sup> ) Course duration: 5 years
(He et al., 2018), Australia	To examine predictors of psychological well-being among nursing students at an Australian regional university.	Quantitative n=538 NS, other health sciences Course duration: 3 years
(Hwang & Kim, 2022), Republic of Korea	To determine the effects of stress, depression, and anxiety on academic burnout according to the clinical practice experience of nursing students.	Quantitative n=171 NS (all academic years) Course duration: 4 years

Author	Aim	Methodology
(Hwang et al., 2021), Republic of Korea	To describe the stress related to clinical practicum and stress-coping styles during the first clinical practice and to identify the differences in stress according to different coping styles.	Quantitative n=184 NS (1 <sup>st</sup> ) Course duration: 4 years
(Ismaile, 2017), Saudi Arabia	To determine stressor types and degrees during two clinical periods among nursing students.	Quantitative n=55 NS (4 <sup>th</sup> ) Course duration: 5 years
(Kaneko & Momino, 2015), Japan	To identify the structure of stress factors during fundamental clinical training and the relationships between stress factors and coping behaviors in nursing students.	Quantitative n=132 NS (1 <sup>st</sup> ) Course duration: 3 years
(Karaca, 2017), Turkey	To determine nursing students' perceived levels of clinical stress, stress responses and coping behaviors during their clinical practice.	Quantitative n=967 NS (all academic years) Course duration: 4 years
(Khater et al., 2014), Jordan	To assess the stress level, sources of stress and coping strategies used by nursing students in Jordan.	Quantitative n=597 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 4 years
(Kleveland et al., 2015), Norway	To investigate if nurse students' experience of stress differs among clinical practice in nursing homes and medical/surgical wards.	Quantitative n=227 NS (1 <sup>st</sup> , 2 <sup>nd</sup> ) Course duration: 3 years
(Labrague, McEnroe-Petitte, Papathanasiou, Edet, Tsaras, Christos, et al., 2018), Philippines, Greece & Nigeria	To compare perceptions of stress and quality of life among nursing students from three countries.	Quantitative n=547 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) (161 Greek; 153 Philippines; 233 Nigerian) Course duration (all countries): 4 years
(Labrague, McEnroe-Petitte, Papathanasiou, Edet, Tsaras, Leocadio, et al., 2018) Philippines, Greece & Nigeria	This study was conducted to determine the level of stress, its sources, and coping strategies among nursing students after three countries: Greece, the Philippines and Nigeria.	Quantitative n=547 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) (161 Greek; 153 Filipino; 233 Nigerian) Course duration (all countries): 4 years
(Latif & Nor, 2019), Malaysia	To survey the type of stressors and identify the coping strategies used by diploma nursing students during clinical practices.	Quantitative n=346 NS (1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> ) Course duration: 4 years
(Lei et al., 2015), China	To evaluate the stressful effects of clinical learning environments on nursing students and to better understand the importance of reducing anxiety.	Quantitative n=92 NS (all academic years) Course duration: 4 years
(Liu et al., 2015), Macao	To investigate the stress perceived by Macao nursing students in the clinical learning environment.	Quantitative n=203 NS (all academic years) Course duration: 4 years
(Liu et al., 2019), China	To reduce or eliminate the stressors to enhance nursing students' clinical learning experience through implementation of an iterative approach that developed a personalized response to student stress.	Quantitative n=214 NS (all academic years) Course duration: 4 years
(Liu et al., 2022), China	To explore the level of stress, types of stressors, type of coping styles, and factors influencing stress levels and coping styles among nursing students during the initial period of the clinical practicum.	Quantitative n=158 NS (1 <sup>st</sup> ) Course duration: 4 years

Author	Aim	Methodology
(Melincavage, 2011), USA	To understand student nurses' perception of anxiety in the clinical setting.	Qualitative n=7 NS Course duration: 4 years
(Mohamed & Ahmed, 2012), Saudi Arabia	To investigate the perceived level of stress and sources of stress in undergraduate students enrolled in nursing practicum courses.	Quantitative n=50 NS (3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 5 years
(Moktan & Mehta, 2020), Buthan	To explore how nursing students commonly perceive their clinical experience.	Qualitative n=8-10 NS (1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> ) Course duration: 4 years
(Moon & Jung, 2020), South Korea	To assess the relation between gratitude, clinical practice and stress among nursing students and clinical practice satisfaction.	Quantitative n=171 NS (3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 4 years
(Mosquera et al., 2018), Colombia	To identify the stressors in clinical practices in nursing students and to explore the relationship between stress level and the variables sex and academic semester.	Quantitative n=156 NS (3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 5 years
(Msiska et al., 2019), Malawi	To explore undergraduate nursing students' perceptions of their clinical learning experience, and the reported findings emerged from narratives of their experience.	Qualitative n=70 NS (3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 4 years
(Musso et al., 2008), Chile	To assess the factors derived from the intra-hospitable laboratories that affect the stress appearance in infirmiry students.	Quantitative n=129 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> ) Course duration: 5 years
(Najafi Doulatabad et al., 2015), Iran	To investigate Iranian nursing students' perceptions on the stressors in clinical environment.	Quantitative n=300 NS (all academic years) Course duration: 4 years
(Nebhinani et al., 2020), India	To assess stress and coping strategies among nursing students of Western Rajasthan.	Quantitative n=221 NS (all academic years) Course duration: 4 years
(Nicolás et al., 2013), Spain	To establish what the nursing students' main stress sources are during their practice period, according to their gender, grade, and age.	Quantitative n=45 NS (1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> ) Course duration: 4 years
(Onieva-Zafra et al., 2020), Spain	To investigate the relationship between anxiety, perceived stress, and the coping strategies used by nursing students during their clinical training.	Quantitative n=190 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 4 years
(Pereira et al., 2014), Brazil	To verify the presence of stress among undergraduate nursing students in different stages of hospital practice.	Quantitative n=86 NS (3 <sup>rd</sup> , 4 <sup>th</sup> , 5 <sup>th</sup> ) Course duration: 5 years
(Rafati et al., 2020), Iran	To investigate the stress perceived by Iranian nursing students in the clinical learning environment and its relationship with the characteristics of students.	Quantitative n=422 NS (all academic years) Course duration: 4 years
(Ribeiro et al., 2020), Brazil	To identify the stress level among nursing undergraduates and the associated sociodemographic and academic factors; to compare stress level among college students according to the training phase.	Quantitative n=286 NS (all academic years) Course duration: 5 years

Author	Aim	Methodology
(Rodrigues et al., 2016), Brazil	To assess the risk factors for stress in undergraduate students of nursing in clinical practice in a public university in the Northeast region of Brazil.	Quantitative n=116 NS (3 <sup>rd</sup> , 4 <sup>th</sup> , 5 <sup>th</sup> ) Course duration: 5 years
(Senturk & Dogan, 2018), Turkey	To determine the stress experienced by nursing students during their education, and to raise awareness of educators concerning their own professional behaviors.	Quantitative n=315 NS (all academic years) Course duration: 4 years
(Shaban et al., 2012), Jordan	To identify the level and types of stress perceived by baccalaureate nursing students in Jordan in their initial period of clinical practice and to identify the coping strategies that students used to relieve their stress.	Quantitative n=181 NS (2 <sup>nd</sup> ) Course duration: 4 years
(Sharif & Masoumi, 2005), Iran	To investigate student nurses' experience about their clinical practice.	Qualitative n=90 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 4 years
(Sheu et al., 2002), Taiwan	To identify the degree of stress perceived and types of stressful events, the physio-psychosocial status of nursing students during the practice; their coping behaviors; and the effect of different coping behaviors on their physio-psychosocial health.	Quantitative n=561 NS (2 <sup>nd</sup> ) Course duration: 4 years
(Singh & Chaturvedi, 2019), India	To assess the Level of Stress and Coping Strategies in Academic Performance among first-year nursing students.	Quantitative n=50 NS (1 <sup>st</sup> ) Course duration: 4 years
(Suen et al., 2016), Singapore	To identify the contributing factors of stress and the clinical environment expectations of undergraduate nursing students during their clinical practice.	Quantitative n=285 NS (all academic years) Course duration: 4 years
(Suresh et al., 2013), Ireland	To measure and compare the perceived levels of job-related stress and stressors of newly qualified nurses and fourth-year student nurses in the clinical environment and to explore the participants' views on stress and stressors.	Quantitative n=128 NS (4 <sup>th</sup> ) Course duration: 4 years
(Tambağ, 2021), Turkey	To investigate the relationship between stress and anxiety levels of nursing students during their first clinical practice.	Quantitative n=26 NS (1 <sup>st</sup> ) Course duration: 4 years
(Thomas & Bhattacharya, 2012), India	To assess the change in attitude and perceived stress of students during their first mental health clinical placement.	Quantitative n=100 NS (3 <sup>rd</sup> ) Course duration: 4 years
(Vijayanathan et al., 2016), India	To assess the nursing students' perception about their clinical experience.	Qualitative n=7-10 NS (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> ) Course duration: 4 years
(Wu et al., 2021), Taiwan	To examine factors associated with perceived stress of clinical practice among nursing students with a particular focus on the effect of general health status on stress.	Quantitative n=724 NS (4 <sup>th</sup> , 5 <sup>th</sup> ) Course duration: 5 years
(Yilmaz, 2016), Turkey	To determine the academic and clinical stress, and the ways first-year nursing students cope in their first clinical practice.	Quantitative n=109 NS (1 <sup>st</sup> ) Course duration: 4 years
(Zhao et al., 2015), China	To explore the coping strategy and the effects of self-efficacy of Chinese undergraduate nursing students when they face the stress in clinical practice.	Quantitative n=217 NS (4 <sup>th</sup> ) Course duration: 4 years

Our review was focused on stress and cortisol levels in a specific population. However, we found only one study that assessed cortisol levels<sup>26</sup>. Stress levels were evaluated in most articles found in this review with different instruments. To facilitate reading we summarized instruments found in quantitative studies as detailed in Table 2.

Results of individual sources of evidence. Each study's global results are compiled and made publicly available at <https://osf.io/zaq37/> in a data chart extraction table. In addition, three tables were

incorporated into this manuscript to summarize key findings.

Synthesis of results. A total of 63 studies were identified in this review. Fifty-four studies employed a quantitative methodology, while nine utilized a qualitative approach. The sample size ranged from 26 to 1238 students and included students from all academic years. Although we looked for articles published in 2001-2022, our final sample consists solely of research published between 2008 and 2022. We found studies published worldwide, but only nine in European nations. Despite focusing on stress

**Table 2.** Summary of instruments that evaluate nursing students' stress in the clinical practice context.

Instruments	Quantitative Studies
ASNS	Pereira et al., 2014
CPSAS	Moon & Jung, 2020
CSQ	Bilgiç & Çelikkalp, 2021; Tambağ, 2021
DASS 21	Cheung et al., 2016
HESA	Musso et al., 2008
IES	Kleiveland et al., 2015
KEZKAK	Mosquera et al., 2018; Musso et al., 2008; Nicolás et al., 2013; Rodrigues et al., 2016
NESS	Senturk & Dogan, 2018; Yilmaz, 2016
NSPCSS	Rafati et al., 2020
NSPSQ	Admi et al., 2018
NSS	Suresh et al., 2013
NSSS	Admi et al., 2018; Liu et al., 2022; Ribeiro et al., 2020
PSS	Ahmed & Mohammed, 2019; Akhu-Zaheya et al., 2015; Al-Gamal et al., 2018; Alsaqri, 2017; Bodys-Cupak et al., 2022; Chan et al., 2009; Chen & Hung, 2014; Frögéli et al., 2016; Ghazawy et al., 2019; Hamaideh et al., 2017; He et al., 2018; Ismaile, 2017; Karaca, 2017; Khater et al., 2014; Labrague, McEnroe-Petitte, Papathanasiou, Edet, Tsaras, Christos, et al., 2018; Labrague, McEnroe-Petitte, Papathanasiou, Edet, Tsaras, Leocadio, et al., 2018; Latif & Nor, 2019; Mohamed & Ahmed, 2012; Onieva-Zafra et al., 2020; Shaban et al., 2012; Sheu et al., 2002; Wu et al., 2021; Zhao et al., 2015
Questionnaire purposely constructed for the study	Kaneko & Momino, 2015; Blomberg et al., 2014; Singh & Chaturvedi, 2019; Graham et al., 2016; Grant-Smith & de Zwaan, 2019; Najafi Doulatabad et al., 2015; Thomas & Bhattacharya, 2012
SAI	Lei et al., 2015
SINS-CN	M. Liu et al., 2015; M. Liu et al., 2019
SNSI	Nebhinani et al., 2020
SNSQ	Suen et al., 2016
SSISCTN	Custódio et al., 2009
STAI	Onieva-Zafra et al., 2020; Hwang & Kim, 2022; Tambağ, 2021
SRCP	Hwang et al., 2021

ASNS- Assessment of Stress Among Nursing Students; CPSAS- Clinical practice stress adapted scale; CSQ- Clinical Stress Questionnaire; DASS 21 - Depression, Anxiety and Stress Scale; HESA-Hamilton Evaluative Scale for Anxiety; IES- Impact of Event Scale; NESS- Nursing Education Stress Scale; NSPCSS- Nursing Students' Perceived Clinical Stressors Scale; NSPSQ- Nursing Students Professional Satisfaction Questionnaire; NSS- Nursing Stress Scale; NSSS- Nursing Students Stress Scale; PSS- Perceived Stress Scale; SAI- State of Anxiety Inventory; SNSI- Student Nurse Stress Index; SNSQ- Stressors in Nursing Students Questionnaire; SSISCTN- Scale of stress-Inducing situations in clinical teaching in nursing; STAI- State-Trait Anxiety Inventory; SRCP- Stress Related to Clinical Practicum

and cortisol levels, we could only locate one study that evaluates cortisol levels.<sup>26</sup> In all other studies, stress was assessed through the use of instruments or qualitative data collection techniques, such as interviews and focus group. In addition, we identified 20 instruments to assess stress and, in some articles, the authors report having developed an instrument specifically for the research.<sup>34,45,49,68,70</sup>

Stress evaluations range from moderate to high.<sup>4,38,47,72-74</sup> The main causes of stress were stress from teachers and nursing staff, students' assignments, workload, and stress related to patient care.

The studies identified in this scoping review spanned all academic years, but there doesn't seem to be a consensus regarding a relationship between stress and academic year. The majority of studies that assessed stress identified coping styles, coping strategies, and/or the coping processes.

## Discussion

This scoping review was able to map the existing literature on stress and cortisol levels in nursing students during clinical practice, highlighting gaps in knowledge and areas for future research. Only one study was found that demonstrates the relationship between stress and elevated cortisol levels in nursing students during clinical practice.<sup>26</sup> However, this study assessed stress levels in plasma and not saliva, highlighting the lack of research on this topic.

Our search identified a total of 63 studies, which is a relatively high number and demonstrates the growing interest of the academic and educational community in this issue in this particular population. Stress is a prominent topic in nursing education research and there are stress-reducing interventions that can be implemented by students (relaxation techniques, expressive writing, or other innovative methods such as personal digital assistance devices), and academic institutions (humor interventions, being caring, pairing students, peer mentoring, pre-lab preparation, planning home hospital programs).<sup>27</sup> However, as studies continue to show high levels of stress among nursing students, we can acknowledge that these interventions are not yet being implemented to their full potential and effectiveness by both students and academic institutions.

The studies found are mainly quantitative (n=54), and most of them use scales already validated by other authors. The ratio of quantitative to qualitative studies found suggests that this is an area of interest to researchers. The PSS is the most used

instrument (n=23), allowing the comparison of data, and reinforcing the consistency and liability of the results. However, we need to consider the impact of curriculum differences on the results despite applying the same scale.

It is interesting to note that despite the existence of a wide range of qualitative data collection techniques, the studies analyzed only use interviews<sup>28-31</sup> or focus groups<sup>32-36</sup> to evaluate stress among nursing students. This may be due to the need to explore issues that may not be fully understood or captured by other data collection methods. In particular, interviews allow researchers to explore a participant's experience in depth.

We found a small number of instruments that were specifically designed for the study (n=7). While it is important to have instruments that allow for comparability of results, it is also necessary to use instruments that are adapted to specific cultural and social circumstances to assess the unique characteristics of each context and population.

As previously mentioned, we only found nine studies undertaken in European countries<sup>33,37-44</sup>. Additionally, two studies compare European, Asiatic and African countries.<sup>45,46</sup> The variability of countries in which the studies were carried out reveals a global concern with stress in nursing students and with the impact that this may have not only on their personal and professional development, but also on the quality of care provided.

It is important to mention that nursing education can differ from country to country, namely regarding the degree duration, and in the organization of clinical practice throughout the course. However, in both Labrague<sup>46</sup> studies, the duration and structure of the courses is similar.

Almost all studies identify the academic years in which the study was carried out, with the exception of 4 studies.<sup>30,47-49</sup> Of the remaining 59 students, 16 included students from all academic years.<sup>26,38,39,50-62</sup> The comparison between all academic years allows a more integrated comprehension of the evolution of stress throughout the student's academic journey. Nevertheless, studies are not consensual regarding the relation between stress and academic year. Liu<sup>56</sup> states that sophomore students have lower stress levels than the other ones. Custódio<sup>39</sup> refers that freshmen are the ones with the lowest perception level of stress-inducing situations. On the other hand, Sharif<sup>35</sup> mention that sophomore students have higher stress levels than junior and senior students. This inconsistency in the results may be related

to the following: the nursing degree duration; the stage in which the clinical practice takes place; the context/ unit; and the clinical practice aim.

We found 11 studies that exclude first year students and only consider all the other years.<sup>28,35,36,45,46,63-68</sup> Only 8 studies evaluate stress in first year students.<sup>40,69-75</sup> When analyzing these results, once more we have to take into account the nursing degree duration and in which year the first clinical practice takes place. In some cases, it does not begin until the second or even the last year of the course, which may explain the lower number of studies found. However, the first exposure to the clinical context may be the one in which students are more vulnerable. Despite the previous academic preparation, their knowledge and competencies are still in an early stage, and they may feel an inadequacy in providing care. Also, the clinical environment may not be pleasant and enjoyable for students with no previous contact with healthcare units. Therefore, there is a need for further research on students who are having their first contact with clinical practice, so that strategies to help them cope with stress can be developed early.

On the other hand, according to our academic experience, senior students seem to be subject to higher levels of stress for several reasons: they are expected to demonstrate more differentiated skills, competencies, and autonomy; soon they will be on their own and fully responsible for providing care without professors and tutors' support. Having this in mind it is interesting to note that we only found 3 studies assessing students stress in the final year.<sup>2,33,37</sup> Also, given the unique characteristics of each training phase, we anticipated to have found studies that compared stress levels between the first and the last contact with the clinical practice context.

As expected, studies confirm the variations on stress levels from moderate<sup>50,59,75-77</sup> to high<sup>41,42,44,61,65,67,74,78</sup>, depending on the context and year of clinical practice.

A great variability of causes of stress during clinical practice was identified in our research. The most common were: stress from teachers and nursing staff<sup>29,47,52,54,57,64-66,68,71,78,79</sup>; students assignments<sup>2,33,47,64,66-68,77,80</sup>; stress related to patient care<sup>29,31,47,64-66,78,79,81</sup>; and workload.<sup>2,44,47,54,67,68,76,80</sup>

It is interesting to note that the relationship between teachers and nursing staff is reported as one of the main sources of stress. It can be due to unclear learning objectives, expectations for the specific clinical setting or even ineffective communication strategies. This shows the need

for a quick intervention, as academy and health institutions are the main responsible for improving students experience during clinical practice.

Stress related to students' assignments and workload may be connected. Clinical practice is followed by several evaluation moments, and students are required to complement their clinical learning with scientific evidence through theoretical work. The conciliation of such amount of work could be the origin of such a great source of stress.

The stress related to patient care is also commonly mentioned. It can be interpreted as a major dimension of stress, associated with a set of more specific situations such as: patient safety, practical procedures, lack of knowledge, communication, etc.


Other causes include: lack of professional knowledge and skills<sup>35,57,65,71,76,81</sup>; clinical setting characteristics<sup>33,57,70,72,77</sup>; fear of harming patients<sup>42,52,57,82</sup>; peer relationships<sup>44,71,78</sup>; relationship with patients, families and healthcare staff<sup>71</sup>; maintaining a work life balance<sup>33,78</sup>; financial constraints<sup>48,52</sup>; nature and content of the work<sup>72,76</sup>; fear from unknown cases<sup>42,57</sup>; fear of making mistakes<sup>57,82</sup>; receiving contradictory orders<sup>82</sup>; daily planning in clinical practice<sup>71</sup>; inconsistency between clinical and theoretical learning<sup>57</sup>; practical work burden<sup>70</sup>; reflecting on patient care experiences<sup>71</sup>; giving non-oral medicines, encounter with mortality, care of infected patients, discrimination between nursing students and other fields, and lack of confidence<sup>57</sup>; general academic concerns<sup>58</sup>; unmet clinical learning needs<sup>44</sup>; organization of supervision, number of students in clinical placement<sup>37</sup>; stress from clinical evaluation<sup>31</sup>; inadequate preparation for clinical practice<sup>63</sup>; and inadequate planning.<sup>32</sup>

With our research, we expected to have found evidence on the relationship between stress and cortisol levels. However, only one study reports changes in body's hormone levels and immune function induced by stress during students' clinical practice. It concludes that plasma cortisol might be a good indicator for the acute stress.<sup>26</sup> Even though, the authors did not monitor cortisol levels before and after clinical practice which could clarify if there are fluctuations in stress levels and related factors.

Limitations. The great variability in the academic degree duration and clinical practice organization limits the discussion of the findings. Additionally, the variability of instruments found to assess stress makes it difficult to compare results. Some studies refer to the sources of stress as dimensions, and others explore them as specific items, which leads

to a high number of stressors, interfering in studies comparison. Another limitation may be the inclusion of students from all years of the nursing course without focusing on a single year or clinical practice context. Although this approach allows us to have a broader view of stress levels throughout the course, it may mask specificities between years and contexts, such as moments of stress at critical stages of the course. Future studies could use this strategy to identify patterns and develop targeted interventions.

## Conclusions

The scoping review presented in this manuscript aimed to map the existing literature on stress and cortisol levels in nursing students during clinical practice. Through a comprehensive literature search, we identified a range of studies that have explored this topic, including both quantitative and qualitative research. A variability of instruments used to assess stress in nursing students was found, with predominance of the PSS. Most causes of stress from the clinical practice were factors related to stress from teachers and nursing staff, students' assignments, workload, lack of professional knowledge and skills, and clinical setting characteristics. Several studies were found on the specific factors that contribute to stress according to the academic year and the clinical context. There is a lack of evidence between stress and the body physiological response, namely the cortisol levels. Overall, this scoping review provides a comprehensive overview of the existing literature on stress in nursing students during clinical practice and highlights key areas for future research. The implementation of stress management programs during the nursing degree is recommended. Simultaneous monitoring of the relationship between biochemical and psychological elements may be useful to prove the program's effectiveness. By identifying these gaps in the existing literature, we hope to inspire nursing professors, clinical tutors, and academic decision makers to adapt nursing curricula. 

## Conflicts of interest

The authors declare no conflict of interest.

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### Contributos dos autores | Author's roles

Contributo Role	Autor 1 Author 1	Autor 2 Author 2	Autor 3 Author 3	Autor 4 Author 4
Conceptualização   <i>Conceptualization</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Gestão dos dados   <i>Data curation</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Análise dos dados   <i>Formal Analysis</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Aquisição de financiamento   <i>Funding acquisition</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Investigação   <i>Investigation</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Metdologia   <i>Methodology</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Gestão do projeto   <i>Project administration</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gestão de recursos   <i>Resources</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Software	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Supervisão   <i>Supervision</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Validação   <i>Validation</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Visualização   <i>Visualization</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Escrita – 1.ª versão   <i>Writing – original draft</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Escrita – revisão e edição   <i>Writing – review &amp; editing</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>