



Scoping review of the application of the Postgraduate Hospital Educational Environment Measure (PHEEM) in medical residency

Revisão de escopo da aplicação do Postgraduate Hospital Educational Environment Measure (PHEEM) na residência médica

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ABSTRACT

Introduction: The PHEEM (postgraduate hospital educational environment measure) is a validated and reliable instrument to assess the educational environment in medical residency programs.

Objective: To map the application of the PHEEM questionnaire in medical residency, evaluate the results found, positive and negative aspects and points for improvement.

Method: We performed a scoping review according to the Joanna Briggs institution's methodology. Studies that followed the PCC structure were included, as follows: P (participants) = resident physicians of any specialty; C (concept) = The PHEEM is an instrument used to assess the educational environment in medical residency, through a 40-item questionnaire divided into 3 subscales that include perception of autonomy, teaching and social support. C (context)= studies on PHEEM in medical residency of any specialty. PubMed, EMBASE and the Virtual Health Library databases were the data sources.

Results: We identified 1588 references, and after reading the title and abstract, 50 references were selected for full reading, and 36 studies were included. The studies were carried out in 22 countries, and most revealed a more positive than negative educational environment, albeit with room for improvement. In the subscales, the perception of autonomy was more positive than negative, and the perception of teaching revealed that most programs are moving in the right direction. However, when evaluating social support, the results were divided between an unpleasant environment and an environment with more pros than cons. The main highlighted positive points were low racial and sexual discrimination, possibility of working in a team, adequate level of responsibilities, accessible teachers with good teaching skills, learning opportunities and participation in educational events. The main negative points were lack of adequate food and accommodation during the shifts, excessive workload, lack of feedback from preceptors and lack of protected time for study and the culture of blaming the resident.

Conclusion: The application of PHEEM revealed that in most medical residency programs the educational environment was more positive than negative, albeit with room for improvement. Efforts are needed to improve the educational environment, especially social support, in medical residency programs.

Key words: Internship and Residency; Environment; Education; PHEEM.

RESUMO

Introdução: O Postgraduate Hospital Educational Environment Measure (PHEEM) é um instrumento validado e confiável para avaliar o ambiente educacional nos programas de residência médica.

Objetivo: Este estudo teve como objetivos mapear a aplicação do questionário PHEEM na residência médica e avaliar os resultados, os aspectos positivos e negativos e os pontos passíveis de melhoria.

Método: Trata-se de uma revisão de escopo de acordo com a metodologia do Instituto Joanna Briggs de revisões de escopo. Foram incluídos estudos seguindo a estrutura PCC: P (participantes) = médicos residentes de qualquer especialidade; C (conceito) = o PHEEM é um instrumento utilizado para avaliar o ambiente educacional na residência médica, por meio de um questionário de 40 itens divididos em três subescalas que incluem percepção de autonomia, ensino e suporte social; C (cenário) = pesquisas sobre o PHEEM na residência médica de qualquer especialidade. As bases eletrônicas pesquisadas foram: PubMed, Embase e Biblioteca Virtual em Saúde (BVS).

Resultado: As estratégias de busca rodadas resultaram em 1.588 estudos, 50 foram lidos na íntegra, e incluíram-se 36. Os estudos foram realizados em 22 países, e a maioria revelou um ambiente educacional mais positivo que negativo, entretanto com espaço para melhorias. Nas subescalas, a percepção de autonomia se mostrou mais positiva que negativa, e a percepção de ensino revelou que a maioria dos programas está caminhando na direção certa. Entretanto, na avaliação do suporte social, os resultados foram divididos entre um ambiente não agradável e um ambiente com mais prós do que contras. Os principais pontos positivos destacados foram baixa discriminação racial e sexual, possibilidade de trabalhar em equipe, nível adequado de responsabilidades, professores acessíveis e com boas habilidades de ensino, oportunidades de aprendizado e participação em eventos educacionais. Os principais pontos negativos foram falta de alimentação e acomodação adequadas durante o plantão, carga horária excessiva, falta de feedback por parte dos preceptores, falta de tempo protegido para estudo e cultura de culpar o residente.

Conclusão: A aplicação do PHEEM revelou que, na maioria dos programas de residência médica, o ambiente educacional se mostrou mais positivo que negativo, entretanto com espaço para melhorias. São necessários esforços para a melhoria do ambiente educacional, especialmente do suporte social, nos programas de residência médica.

Palavras-chave: Residência Médica; Ambiente; Educação; PHEEM.

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INTRODUCTION

Medical residency is a type of postgraduate education aimed at physicians, in the form of specialization courses, which takes place in health institutions under the guidance of qualified medical professionals and is considered the gold standard of medical specialization¹.

The educational environment is a complex and dynamic structure with multiple interactions involving the student, teachers, the medical curriculum and the course structure. The educational environment is an important determinant of student and teacher behavior and this environment influences the residents' results, satisfaction and learning success^{2,3}.

The Postgraduate Hospital Educational Environment Measure (PHEEM) is a validated and reliable instrument for evaluating the educational environment during training in medical residency courses⁴. It was developed by Roff et al.⁵ as a 40-item questionnaire divided into three subscales that include perception of autonomy, perception of teaching and perception of social support. Each item is answered and scored according to a Likert scale with five options: Completely agree (4 points), Agree (3 points), Neutral (2 points), Disagree (1 point), Completely disagree (0 point). However, four of the 40 items (numbers 7, 8, 11 and 13) are negative sentences and must be scored in reverse. The result of its application allows evaluating the educational environment of medical residency programs, pointing out the positive points and areas that need to be improved⁶. The maximum score on the scale is 160 points, with the maximum score for the perception of autonomy subscale being 56, the perception of teaching 60 and the perception of social support 44 points. Scores between 0-40 can be interpreted as very bad, 41-80 as having many problems, 81-120 as a more positive than negative environment, but with room for improvement, and 121-160 are considered excellent training environments⁵.

PHEEM is widely adopted in different postgraduate teaching environments internationally^{4,6}. The PHEEM questionnaire was translated and validated into Portuguese by Vieira⁷ and, therefore, can be used as a method to evaluate medical residencies in Brazil. Furthermore, longitudinal monitoring of PHEEM after changes in the medical residency environment can be used to demonstrate improvements in the educational environment^{4,8}.

There is no structured and regular assessment of the educational environment in the vast majority of Medical Residency Programs in Brazil. Thus, knowledge and application of the PHEEM questionnaire in medical residency programs can contribute to diagnosing the situation in each program, developing strategies to improve the educational environment

and its sporadic application can evaluate the impact of these changes. Therefore, this study aimed at mapping the application of the PHEEM questionnaire in medical residency programs, reporting the results found, positive and negative aspects and points that need improvement highlighted by the interviewed residents.

METHOD

A scoping review was carried out in accordance with the Joanna Briggs Institute methodology for scoping reviews⁸. The results were reported in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis for Scoping Reviews (PRISMA- Scoping Review)^{9,10}.

This review used the acronym PCC, being: P for "participants"; C for "concept", and C for "context".

Participants

Resident doctors of any specialty were considered participants.

Concept

The PHEEM is an instrument used to evaluate the educational environment during training in medical residency courses⁴, through a 40-item questionnaire divided into three subscales that include perception of autonomy, perception of teaching and perception of social support⁵.

Context

This review considered studies on PHEEM in medical residency in any specialty, in any study setting, including community services and clinical settings (hospital wards, outpatient clinics, emergency room, operating room, etc.), as well as primary care services.

Exclusion criteria

Studies that had undergraduate students as participants were excluded, as well as those that had residents from other areas of health, but not physicians, as participants.

Search strategies

Three search strategies were created adapted to the electronic databases PubMed, Embase and Virtual Health Library (VHL). The descriptors and synonyms related to the terms 'medical residency', 'PHEEM' and 'educational environment' were used. On 08/25/2022 the search strategy was carried out in the PubMed database, and on 08/26/2023 the strategies were carried out in the Embase and BVS databases, in addition to updating the PubMed database. There were no language or publication date restrictions.

Study selection

After the search strategies were carried out, all identified references were transported to RAYYAN, a web application for carrying out systematic reviews. The titles and abstracts were then analyzed by two independent reviewers (P.L.G and A.P.M.M.) to evaluate them according to the inclusion criteria. The full texts of the selected studies were independently assessed in details according to the inclusion criteria by the authors. Reasons for exclusion of full-text studies that did not meet the inclusion criteria were recorded and reported in the review. Disagreements that arose between reviewers at each stage of the study selection process were resolved through discussion, or with a third reviewer.

Data extraction

The following data were extracted from the included studies: country of origin, type of study, residents' specialty, context, assessed outcomes, number of participants, total PHEEM score, autonomy, teaching and social support subscores, more positive points, more negative points, other relevant information and results.

RESULTS

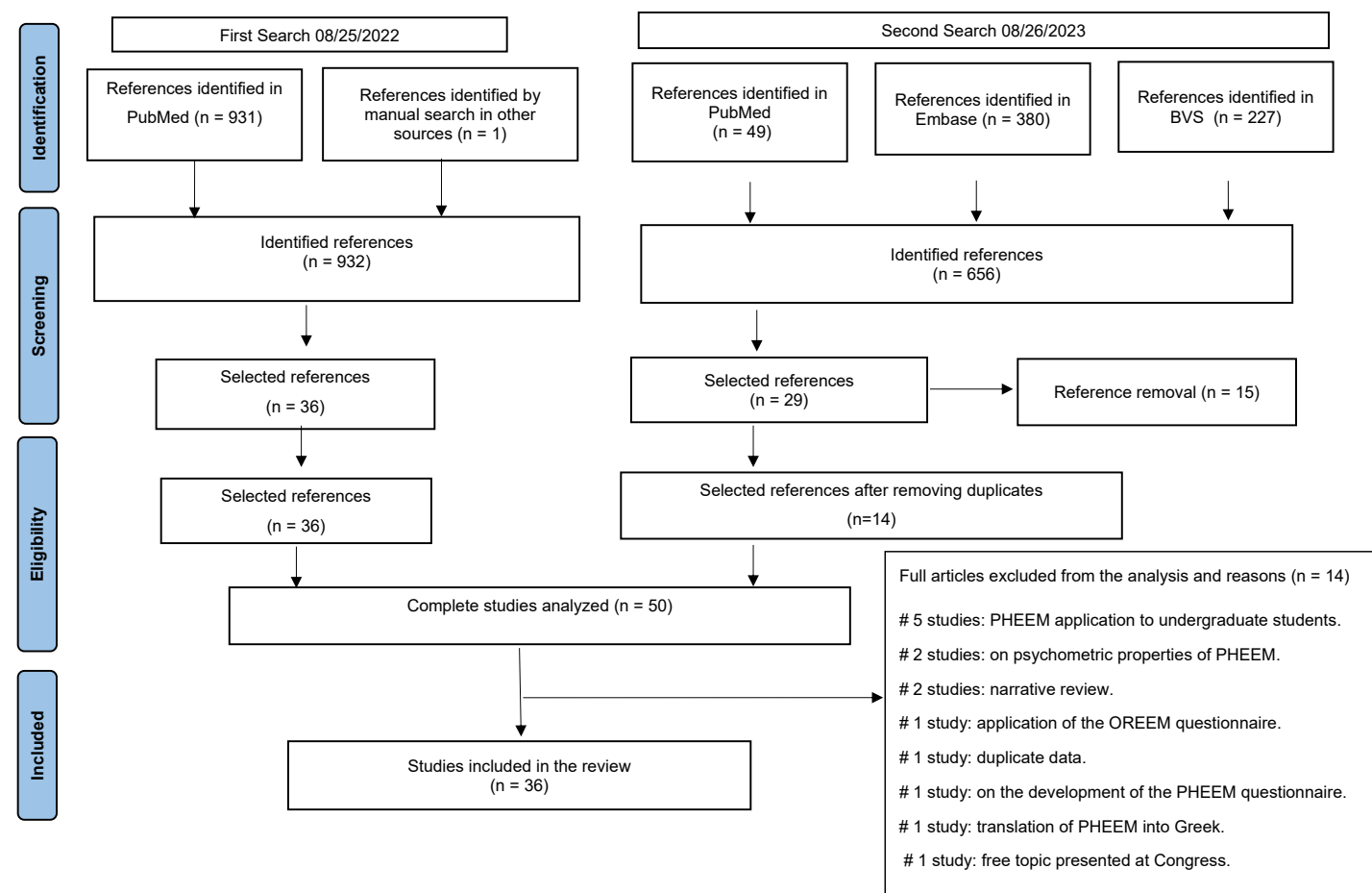
The first search strategy resulted in 931 studies and one study was acquired by manual search⁶. The second search strategy resulted in 656 studies. After reading the titles and abstracts, 50 studies were identified as eligible and were read in full, but 14 studies were excluded^{4,5,11-22} (Figure 1). The excluded studies and the reasons for exclusion are shown in Table 1. Therefore, 36 studies were included in this review^{6-8,23-55}.

Included studies

Table 2 summarizes the main characteristics of the studies included in this review.

The 36 studies included in the review were carried out in 22 countries and 5 continents, 16 in Asia, 8 in Europe, 7 in America, 3 in Africa and 2 in Oceania. One study was carried out in 2 countries, the United States and Saudi Arabia²³. Only one study was carried out in Brazil⁷. Thirty studies were published as of 2013. The studies included internal medicine residents, clinical specialties, general surgery and surgical specialties, emergency medicine, family medicine, pediatrics, anesthesiology, intensive care, obstetrics and

Figure 1. Prisma flowchart of included articles.



Legend: PHEEM: Postgraduate Hospital Educational Environment Measure; OREEM : Operating Room Educational Environment Measure, BVS: Biblioteca Virtual em Saúde

Source: Figure created by the authors, adapted from PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

Table 1. Excluded studies and reasons for exclusion.

Study	Year	Reason for exclusion
Algaidi ¹¹	2010	PHEEM applied to undergraduate students
Boor et al. ¹²	2007	Evaluated only psychometric properties
Chan et al. ⁴	2016	Review that evaluated PHEEM in several medical educational settings
Beer et al. ¹³	2021	PHEEM applied to undergraduate students
Gooneratne et al. ¹⁴	2008	PHEEM applied to undergraduate students
Kanashiro et al. ¹⁵	2006	Evaluated educational environment in the operating room with OREEM
Mohamed Cassim ¹⁶	2018	Free Topic in Congress
Naidoo et al. ¹⁷	2017	PHEEM applied to undergraduate students
Ong et al. ¹⁸	2020	Duplicate data (from Ong 2019)
Rammos et al. ¹⁹	2011	Translation of PHEEM into Greek
Riquelme et al. ²⁰	2009	PHEEM applied to undergraduate students
Roff et al. ⁵	2005	Creation of the PHEEM questionnaire
Shokoohi et al. ²¹	2014	Evaluated only psychometric properties
Wall et al. ²²	2009	Review Article

Source: prepared by the authors.

Legend: PHEEM: Postgraduate Hospital Educational Environment Measure; OREEM (Operating Room Educational Environment Measure): measure of the educational environment in a surgical center.

gynecology, and laboratory medicine, among others. The number of participants who answered the questionnaire ranged from 19 to 3,456, with twenty-four studies including more than 100 residents.

In 22 studies^{6,8,23,27-29,31-33,35,37-39,42,45-47,49-53} the mean PHEEM total score was between 81-120, indicating a more positive than negative educational environment, but with room for improvement. In eight studies, carried out in Saudi Arabia^{30,43}, Pakistan^{24,55}, Ethiopia³⁴, Japan⁵⁴, Turkey²⁵ and Greece⁴⁸, the mean total score was 41-80, indicating an educational environment with many problems. None of the studies showed that the educational environment was considered very bad (score below 40) or excellent (score above 120). Six studies^{7,26,36,40,41,44} did not show the total PHEEM score.

Twenty-four studies reported scores on the autonomy, teaching, and social support subscales. In the autonomy subscale, seventeen studies indicated results between 29-42, indicating a more positive than negative perception, whereas seven studies scored between 15-28, indicating a negative perception. No study scored between 0-14 or between 43-56, which would respectively show a very poor or excellent perception. In the teaching subscale, in seventeen studies the results were between 31-45, showing that the program is moving in the right direction, with six showing scores between 16-30, indicating the need for the training of teachers and

preceptors. No study scored between 0-15 or between 46-60, which would reveal, respectively, teachers with low teaching quality or model teachers. In the social support subscale, eleven studies showed results between 12-22, indicating a non-pleasant environment and twelve studies between 23-33 indicating more pros than cons. No study scored between 0-11 or between 34-44, which would indicate a lack of social support or an excellently support environment.

The main positive points highlighted were low racial and sexual discrimination, teamwork, collaboration with other doctors, adequate level of responsibilities, accessible teachers, teachers with good teaching skills, good learning opportunities, opportunity to participate in educational events and a safe environment .

The main problems highlighted when analyzing the PHEEM responses were: food during the shifts in twenty studies; lack of an information manual for residents in twelve studies; accommodation during the shifts in ten studies; excessive workload in nine studies, in addition to lack of protected time for study; lack of feedback from preceptors and a culture of blaming the resident. Although, in several studies, low sexual and racial discrimination was cited as a positive factor, other studies carried out in Saudi Arabia³¹, Morocco²⁸, Pakistan²⁴ and Greece⁴¹ showed sexual and racial discrimination as an important problem in those countries.

Table 2. Summary of the characteristics of the included studies.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Aalam et al, 2018 ²³	USA and Saudi Arabia	Cross-sectional	Emergency medicine residents.	Adapted PHEEM	3 emergency medicine programs in Saudi Arabia and 3 emergency medicine programs in the USA.	Compare the educational environment between the USA and Saudi Arabian programs.	219	USA: 118.7 SA: 109.9	A: 41.8(USA) X 38.1 (SA) T: 46.5(USA) X 43.1 (SA) S: 30.5(USA) X 28.6 (SA)	USA: feeling like part of the team, clear training instructions, protected study time SA: protected time for study, good collaboration with other doctors, feeling part of the team.	USA: food during shifts, accommodation during shifts, opportunity to continue monitoring the patient. SA: food during shifts, opportunity to continue monitoring the patient, culture of blaming the resident.	US programs score higher overall. Mean scores differ on the autonomy and teaching scales, but not on the social support scale. US programs have more resources like simulation rooms and access to conferences and lectures.
Ahmad et al, 2021 ²⁴	Pakistan	Cross-sectional	Residents of several specialties	Adapted PHEEM	4 tertiary hospitals in Pakistan: 3 public and 1 private	To assess the educational environment in medical residency teaching hospitals in Pakistan.	195	Public Hospitals: 72.6(17.6) Private Hospitals: 61.31(25.03)	A:23.6 (16.2) T: 24.1(16.9) S:19.3(13.2)	Feeling safe in the work environment, good collaboration with the work team.	Sexual discrimination, culture of blaming the resident, lack of time to study.	In private hospitals, the educational environment was considered worse than in public hospitals. It is necessary to improve the educational environment and, especially, eradicate sexual discrimination.
Akdeniz et al, 2015 ²⁵	Turkey	Cross-sectional	Family Medicine Residents	PHEEM, MBI	Department of Family Medicine of Universities: 21 Hospitals of the Ministry of Health: 11	To evaluate the educational environment and burnout in Family Medicine programs.	174	66.0(30.5)	A:26.4(9.4) T:25.7(10.9) S:18.7(7.6)	Not reported.	Not reported.	Perception of autonomy, teaching and social support below average, indicating a need for improvement. Levels of personal satisfaction, depersonalization and emotional exhaustion were within the range considered normal.

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Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Aspergren et al, 2007 ²⁶	Denmark	Cross-sectional	Residents of several specialties (internal medicine, neurology, oncology, pediatrics, surgery, orthopedics, gynecology and obstetrics, and radiology).	Adapted PHEEM	Residents from several departments and specialties.	Translate into Danish and validate PHEEM in the country. A reduced version of PHEEM was used.	342 (159 seniors and 183 juniors)	Not reported.	Not reported. Evaluated the average for each PHEEM item.	Information about the program, appropriate level of responsibilities, feeling part of the work team.	Being called at inappropriate times, lack of information about working hours, food during shifts.	The questionnaire has been validated for use in Denmark.
Bari et al, 2018 ²⁷	Pakistan	Cross-sectional	Residents in pediatrics, pediatric surgery and pediatric diagnosis	PHEEM	Lahore Children's Hospital, Pakistan	To evaluate the residents' perception of the educational environment and compare perceptions between different specialties and years of residency.	160	88.16 (14.18)	A:29.27 (7.09) T: 34.35 (9.66) S:21.58 (6.59)	Adequate level of responsibility, good opportunities to perform hands-on procedures and good collaboration with other doctors.	Food during shifts, inadequate working hours, lack of a working hours contract, lack of an informative manual for residents.	There was no significant difference between specialties and different years of residency. The social support subscale showed a more negative perception as an unpleasant environment.

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Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Berrani et al, 2020 ²⁸	Morocco	Cross-sectional	Residents of different specialties: internal medicine, surgery, pediatrics, anesthesiology, intensive care, gynecology and obstetrics and laboratory medicine	Adapted PHEEM	Six hospitals in Rabat (capital of Morocco)	To evaluate the educational environment of residents in Morocco and compare the perceptions of residents of different specialties.	255	81.4 (21.8)	A:31.9 (8.3) T:33.2 (10.1) S:18.2 (21.8)	Preceptors with good teaching skills, accessible preceptors, faculty encourage resident autonomy.	Accommodation during shifts, food during shifts, not feeling safe in the hospital, sexual discrimination (reported by half of residents) and racial discrimination, culture of blame.	Valid and reliable instrument. Residents in laboratory medicine had higher PHEEM values than those in other specialties, especially those in surgery and gynecology and obstetrics. The main problems are poor infrastructure, inadequate quality of supervision and teaching, and inadequate work regulations.
Bigotte Vieira et al, 2016 ²⁹	Portugal	Cross-sectional	Resident doctors of various specialties	Modified PHEEM	Medical residency for all specialties and regions of Portugal	To evaluate the doctors' satisfaction with residency according to specialty and region of the country.	3456	91.7(24.2)	Not reported	Absence of sexual and racial discrimination, good collaboration with other doctors, opportunity to participate in educational events.	Lack of protected time for study, lack of counseling opportunities for failure situations, lack of adequate accommodation during shifts, little career advice.	Modified PHEEM including questions about satisfaction with coordination and advisor. Endocrinology, Cardiology, Anesthesiology, Family Medicine and Gastroenterology were the specialties with the greatest satisfaction. Greater satisfaction among residents of Azores and Madeira.

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Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Binsaleh et al, 2015 ³⁰	Saudi Arabia	Cross-sectional	Urology residents	PHEEM	Urology residents, different training levels, in several regions of Saudi Arabia and in different sectors of the healthcare system. Only 1 woman.	To investigate associations with level of training, regions of Saudi Arabia, and healthcare system sectors.	38	77.7 (16.5)	A: 26.18 (6.5) T:29.7 (7.7) S: 21.9 (4.3)	Absence of racism, feeling part of the team, opportunity to participate in educational events, accessible teachers.	Food during shifts, lack of clinical protocols and information manuals for residents, lack of contract regarding working hours.	Less than satisfactory educational environment. Differences between different healthcare sectors. Perception did not vary between training level and regions of the country. Need to improve: clinical protocols, working hours, quality of supervision, infrastructure in the hospital environment.
BuAli et al, 2015 ³¹	Saudi Arabia	Cross-sectional	Residents in Pediatrics	PHEEM	Six teaching hospitals in the eastern region of Saudi Arabia	To evaluate the educational environment of the pediatric residency in 6 hospitals.	104 (37 women, 67 men)	100.19 (23.13) Women: 105.39 (22.16) Men: 97.23 (23.48)	A: 34,91(7,83) E: 38,89(9,8) S:26,38(7,04) Women: A: 38.5 (7.98) T: 38.88 (8.14) S: 28 (7.69) Men: A:35.86 (7.75) T: 35.98 (10.75) S:25.38 (6.56)	Collaboration with other residents, feeling part of the team, possibility of participating in educational events, opportunity to perform practical procedures.	Racism, sexual discrimination, working hours, food during shifts, culture of blame, having to perform inappropriate tasks and being called at inappropriate times.	There was no significant difference between genders and year of training. Differences were observed between hospitals. Improvement in social support is required, especially regarding issues of racial and sexual discrimination.

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Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Chew et al, 2022 ⁸	Singapore	Longitudinal	Psychiatry residents	PHEEM, OLBI	Singapore National Psychiatry Program	To evaluate the relationship between burnout and the educational environment among psychiatry residents each year for five years.	93	Initial : 112.3(16.2) After 5 years: 120.3(14.0)	Initial : A:39.2(5.8) T:43.3(6.4) S:29.6(5.1) After 5 years: A:42.0 (5.4) T:47.0(4.8) S:31.4(4.6)	Not reported	Not reported	Perception of the baseline educational environment was inversely proportional to the burnout status. The PHEEM teaching subdomain score increased significantly over time for all residents regardless of the burnout status.
Clapham et al, 2007 ³²	England and Scotland	Cross-sectional	Intensive care residents	PHEEM	Nine intensive care training centers in hospitals in England and Scotland.	To demonstrate the quality of the residents' work environment.	134	103.5 (19.1)	A: 35.7 (7.03) T:38.8 (9.46) S: 28.43 (5.20)	Absence of racism or sexism, good supervision, collaboration with other residents, adequate level of responsibility, feeling like part of the team.	Food and accommodation during shifts, lack of information manual for residents, lack of opportunity for counseling for residents who failed.	There was a significant difference between training level and between centers. No racism or sexual discrimination was reported. Residents satisfied with teaching, work and social support.

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Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Ezomike et al, 2020 ³³	Nigeria	Cross-sectional	Residents of internal medicine, gynecology, pediatrics and surgery.	PHEEM	Nigeria University Hospital.	To evaluate the educational environment and determine if there are differences in subgroups of residents.	160	85.82 (1.02)	A:29.27 (1.05) T:34.80 (0.98) S: 21.55 (1.03)	Collaboration from other residents, absence of sexual discrimination, opportunity to participate in educational events, appropriate level of responsibility.	Food during shifts, accommodation during shifts, lack of counseling opportunities for residents who failed, excessive working hours	The perception of social support is that the environment is not pleasant. Men scored higher than women and gynecology and obstetrics residents scored higher than those from other specialties in the total PHEEM score and in the teaching and social support categories. There was a difference between training levels in the total score and autonomy subscore.
Fisseha et al, 2021 ³⁴	Ethiopia	Cross-sectional	Internal medicine residents	PHEEM	University Hospital in Ethiopia.	To evaluate the educational environment in an internal medicine residency program in Ethiopia.	100 (80 men)	70.87 (19.8)	A:25.9 (7.1) T:27.1 (10.2) S:17.9 (5.1)	Collaboration from other residents, absence of racism and sexual discrimination, feeling physically safe in the hospital environment.	Food and accommodation during shifts, lack of manual and clinical protocols for residents, lack of feedback from teachers, lack of supervision at all times, excessive workload.	The total PHEEM score indicates many problems and the need for changes. Main problems to be improved: excessive workload, inadequate teaching, inadequate physical hospital environment and lack of diagnostic and therapeutic resources. The score was higher for men than for women.

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Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Flaherty et al, 2016 ³⁵	Ireland	Cross-sectional	Residents of various specialties	PHEEM	University Hospitals in Galway, Ireland	To assess the educational environment among residents of different training levels in Ireland.	61	82.88 (18.99)	A: 27.83 T: 31.19 S: 23.75	Absence of sexual and racial discrimination, feeling part of the team, collaboration with other residents, feeling physically safe in the hospital.	Excessive workload, calls at inappropriate times, poor food and accommodation during shifts, lack of protected time for study, lack of feedback from preceptors, culture of blaming the resident.	Deficiencies were identified in several aspects of the educational environment including the need to improve protected study time, feedback, and learning opportunities for doctors in the initial years of training.
Galli et al, 2014 ³⁶	Argentina	Cross-sectional	Residents of Cardiology	PHEEM	31 hospitals (public and private) in the Buenos Aires region	To evaluate the educational environment in Cardiology residency and compare public and private hospitals.	148	Not reported.	Not reported.	Feeling part of the team, opportunity to work as a team, absence of sexual and racial discrimination.	Lack of protected time for study, lack of a manual with instructions about the program, lack of clear rules.	More positive than negative educational environment, but with room for improvement. Private hospitals showed better teaching conditions.
González et al, 2022 ³⁷	Chile	Cross-sectional	Residents from 64 specialties	PHEEM	15 universities in Chile	To evaluate the educational environment of residency programs in different specialties.	1259	100.5	A:36.0 T:38.0 S:26.0	Not described.	Lack of protected time for study, culture of blaming the resident and lack of a routine manual.	The specialties with the highest PHEEM scores were: Ophthalmology (116), Dermatology (113.5) and Anatomopathology (113) and those with the lowest scores were General Surgery (82) and Gynecology, Obstetrics (88.5) and Cardiology (92).

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Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Goughet al, 2010 ³⁸	Australia	Cross-sectional	R1, R2, and R3 Residents	PHEEM	9 hospitals	To test PHEEM acceptability.	429	110	Not reported.	Available teachers, safe environment and teamwork.	Food during shifts, lack of feedback, little career guidance.	8 hospitals: more positive than negative environment, and 1 hospital: excellent environment.
Goul-ding et al, 2016 ³⁹	United Kingdom	Cross-sectional	Dermatology Residents	Modified PHEEM	Hospitals located in one region of the United Kingdom (West Midlands)	To evaluate the educational environment in the Dermatology residency.	19	96.5 / maximum score of 152	A: 35.8/56 T:39.4/60 S:21.3/36	Possibility of participating in educational events, safety in the workplace, teachers with good teaching skills	Accommodation and food during shifts, lack of feedback from teachers, few opportunities for counseling in case of poor performance.	Questions about sexual and racial discrimination were excluded.
Herrera et al.2012 ⁶	Chile	Cross-sectional	Residents from several specialties (35 programs)	PHEEM	Several clinical, surgical and pediatric specialties.	To compare scores by gender, university, nationality.	318	105.09 (22.46)	A: 36.54 (8.26) T:39.76 (10.11) S:28.79 (5.98)	Low discrimination, good preceptors, safe environment.	Lack of time to study, little academic advice, lack of information about working hours.	There was no difference between gender and university of origin. Foreigners rated the educational environment better than Chileans.
Jalili et al, 2014 ⁴⁰	Iran	Cross-sectional	Emergency medicine residents	PHEEM	Three emergency medicine programs	Applicability of the Persian version of the questionnaire.	89	Did not evaluate the total average	Evaluated average per item. Average score per item 2.24 (0.06) A: 2.4(0.58) T: 2.57(0.35) S:2.21 (0.67)	Working hours contract, accessible teachers, teamwork.	Lack of information manual, accommodation during shifts, career guidance.	Persian version with 37 questions and not 40. Reliable method for emergency medicine programs. No differences between genders and training levels.

Continue...

Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Karatanos et al, 2015 ⁴¹	Greece	Cross-sectional	Residents of several specialties.	Modified PHEEM	Western Greece Hospitals	To evaluate the educational environment in hospitals in different specialties.	731	Not described.	Not described.	Teamwork, accessible teachers, encouragement to learn alone	Racism and sexual discrimination, lack of feedback, lack of information manual, lack of support for residents with poor performance.	Modified PHEEM with the inclusion of 10 extra closed questions and one open question. Resident doctors are not satisfied with the educational environment of Greek hospitals.
Khan et al, 2017 ⁴²	Pakistan	Cross-sectional	Residents of Internal Medicine, Pediatrics, Gynecology and Obstetrics, General Surgery.	PHEEM	Mirpur City Teaching Hospital, Pakistan	Evaluate the educational environment of medical residency programs.	82	90.7(15.6)	A: 30.2(5.9) T:38.9(7.1) S:21.6(5.8)	Not described .	Not described.	Higher scores in the teaching and autonomy subscores. The specialty with the highest score was Internal Medicine followed by Pediatrics.
Khoja, 2015 ⁴³	Saudi Arabia	Cross-sectional	Family medicine residents	PHEEM	Family medicine residents from 4 centers	Assess the educational environment and differences between genders, training level and hospital center.	91	67.1 (20.1)	A: 24.2(7.1) T: 25.31(8.9) S:17.59 (5.6)	Safe environment, without racial discrimination, teachers encourage independence.	Accommodation and food during shifts, lack of career guidance, excessive workload.	Very low overall score. There was a difference between the centers. More advanced residents have higher scores. There was no significant difference between genders.
Koutso-giannou et al, 2015 ⁴⁴	Greece	Cross-sectional	Residents of various specialties	PHEEM	Residents of 83 hospitals and 41 city halls	Validation of the instrument, Greek version with 6 response degrees.	731	Not assessed	Not assessed	Absence of racial and sexual discrimination, good collaboration between doctors, accessible teachers.	Lack of career guidance, lack of information manual for residents, poor feedback.	Greek version is valid, reliable and sensitive for evaluating educational environment.

Continue...

Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Llera et al, 2014 ⁴⁵	Argentina	Cross-sectional	Residents in pediatrics, internal medicine, family medicine, cardiology, intensive care	PHEEM E MBI	Residents of 5 medical residency programs	Correlates the educational environment and burnout	92	106.8 (13.98)	A:36.57 (5.69) T:39.79 (6.19) S:30.48 (2.48)	Not reported.	Not reported.	19.6% burnout. Negative correlation between the educational environment and exhaustion and depersonalization. Positive correlation between educational environment and personal fulfillment. Correlation between burnout and PHEEM autonomy subscore
Mahen-dran et al, 2013 ⁴⁶	Singapore	Cross-sectional	Psychiatry residents	PHEEM	Two residency models: British and American	To compare the PHEEM results in the 2 residency models	60	109.30	Worst scores on the teaching subscale	Absence of racial and sexual discrimination, protected study time, absence of inappropriate tasks	Lack of clear expectations, lack of teaching skills by teachers, few learning opportunities.	There was no difference in PHEEM between the 2 residency models. Worst scores on the teaching subscale
Ong et al, 2019 ⁴⁷	Singapore	Cross-sectional	Internal medicine residents	PHEEM	Internal Medicine Program	To assess educational environment, compare results by gender and training level, and evaluate areas for improvement.	136	112.2 (16.7)	A: 38.5(6.18) T: 42.79 (6.49) S:30.93(5.07)	No racial and sexual discrimination, feeling of belonging to the team, good collaboration with co-workers.	Excessive workload, little contact with teachers and lack of feedback, lack of adequate food during shifts.	There was no difference between genders and training levels.

Continue...

Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Papaefstathiou et al, 2019 ⁴⁸	Greece	Cross-sectional	Resident doctors (surgery, internal medicine and laboratory)	Greek version of PHEEM, CBI, JSM	Several hospitals in Greece.	To evaluate the relationship between the educational environment and professional stress with the development of burnout.	269	46.26 (14.54)	A: 42.09 (16.36) T: 46.8 (19.51) S: 49.59 (14.33)	Not reported	Not reported	Different scoring in the Greek version of PHEEM (0-100): 0-25: very negative; 26-40: negative; 41-50: more negative points; 51-60: more positive points; 61-75: positive; 76-100: very positive Educational environment has more negative points than positive points in total and in the 3 subscales. The total PHEEM score and the 3 subscales correlated negatively with burnout (CBI). Positive correlation between stress level and burnout and personal exhaustion.
Pinnock et al, 2009 ⁴⁹	New Zealand	Cross-sectional	Pediatrics residents	PHEEM	Pediatrics residents attending early and advanced residency years.	To evaluate the educational environment of pediatric residency in New Zealand.	53	Early years: 106.3 (18.3) Advanced years: 114.2 (17.8)	Early years: A: 37.4(6.3) T: 39.6(8.7) S: 29.4(5.7) Advanced years: A: 39.5(5.7) T: 44.1(8.1) S: 30.5(5.5)	Feeling part of the team, teachers with good teaching and communication skills, absence of racism and racial discrimination, adequate levels of responsibility.	Accommodation during shifts, few opportunities for counseling for residents with difficulties, lack of information manual and guidance.	Residents in more advanced years evaluated the educational environment better than residents in the early years.

Continue...

Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Posada Uribe et al, 2021 ⁵⁰	Colombia	Cross-sectional	Residents of clinical and surgical specialties	PHEEM and WEMWBS	Residents of clinical and surgical specialties	To determine the relationship between the educational environment and well-being	131	107.96 (18.88)	Not reported.	Not described	Not described	Positive correlation between educational environment and assessment of well-being through two scales.
Puranitee et al, 2019 ⁵¹	Thailand	Cross-sectional	Pediatrics residents	PHEEM, MSI, WRQoL	Department of Pediatrics at a hospital in Bangkok	To evaluate the association between burnout and the educational environment and work-related quality of life	41	112.7 (11.2)	It does not describe the average. A: 88% - positive perception T: 51% more positive than negative points, but needs improvement (scores between 31-45) S: 85% more positive than negative points	Not described.	Food during the shifts (mentioned as the item with the lowest PHEEM score)	Emotional exhaustion and educational environment correlate with quality of life at work. Positive correlation between educational environment and quality of life in the workplace. Considers that PHEEM may not be the appropriate instrument to assess the educational environment in Thailand.
Sandhu et al, 2018 ⁵²	Pakistan	Cross-sectional	Resident doctors from different specialties (internal medicine, general surgery, gynecology and pediatrics)	PHEEM	Hospital in the city of Lahore, Pakistan.	To determine the quality of residents' educational environment.	87	90.49 (15.4)	A: 30.16 (5.85) T: 38.87 (7.03) S: 21.45 (5.75)	Adequate level of responsibility, teachers with excellent communication and teaching skills, collaboration with other residents, team feeling	Non-compliance with working hours (highlighted as the lowest scoring item), food during shifts, accommodation during shifts, lack of time reserved for study.	Highest score for the neurology department and lowest score for anesthesiology. 71.3% of residents classified the work environment as "more positive than negative, but with room for improvement".

Continue...

Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Sheikh et al, 2017 ⁵³	Pakistan	Cross-sectional	Resident doctors	PHEEM	One public hospital and 6 private hospitals in Karachi, Pakistan	To evaluate the educational environment of residency programs and identify differences between public and private sectors of tertiary hospitals.	302	93.96 (20.79)	A: 32.83(7.34) T: 37.27(9.43) S: 23.97(6.76)	Good collaboration from other residents, teachers with good teaching skills, adequate level of responsibility.	Food during shifts, access to a document listing the skills expected of residents, calls at inappropriate times.	Total PHEEM score was significantly higher in private hospitals than in public ones. Slightly modified version to better meet regional issues, for example appropriate workload (there is no national regulation).
Shimizu et al, 2013 ⁵⁴	Japan	Cross-sectional	Resident doctors	PHEEM and GM- ITE	21 teaching hospitals in Japan	To evaluate the relationship between the educational environment and the residents' medical knowledge assessed by an exam at the end of residency.	206	57.6(5.4)	Not reported	Not reported	Not reported	Medical knowledge was significantly associated with the educational environment of hospitals. The presence of an internal medicine department and a rural location were associated with a higher score.

Continue...

Quadro 2. Continuation.

Author, year	Country	Study design	Participants	Concept	Context	Assessed outcomes	Number	Average PHEEM Total Score (SD)	Subscores (SD) Autonomy (A), Teaching (T) and Social (S)	Positive points	Negative points	Other information and results
Vieira,2008 ⁷	Brazil	Cross-sectional	Residents of internal medicine, anesthesiology and general surgery (HC) and various specialties (HGCR).	PHEEM	Hospital das Clínicas de São Paulo and Hospital Governador Celso Ramos (Florianópolis)	To validate the use of PHEEM translated into Portuguese and evaluate the reliability of its use.	306	Not assessed	A: 33.9 (8.6) T: 35.0 (10) S: 26.6 (6.0)	Absence of racism and sexual discrimination, adequate level of responsibility, accessible teachers, opportunity to practice procedures.	Food during shifts, non-compliance with workload, absence of specific periods for studying, lack of feedback from teachers, lack of culture of not blaming the resident.	Highlighted the importance of improvements in the main factors related to the perception of teaching (feedback, study period). Use of PHEEM is reliable to assess educational environment. Greater autonomy for internal medicine residents. Higher score in the perception of teaching by the anesthesiology residents. It perceived similar social support in the three areas.
Waheed et al, 2019 ⁵⁵	Pakistan	Cross-sectional	Gynecology and obstetrics residents	PHEEM	All gynecology and obstetrics residency programs in Lahore (11 institutions – 5 private and 6 public ones).	To determine the quality of the educational environment for GO residents.	368 (only 4 men)	63.68 (29.6)	A: 23.94 (10.28) T: 20.16 (11.9) S: 18.42 (8.04)	They feel satisfied with their work, adequate working hours, food during the shift.	Teachers lack communication skills, little collaboration from other residents, and lack of clinical supervision at all times.	The majority of residents classified the educational environment as having “many problems”, highlighting the need for improvements. Higher PHEEM scores in public hospital residents.

Source: prepared by the authors

Legend : CBI Copenhagen Burnout Inventory; GM- ITE General Medicine Internal Training Examination; JSM-G ; Job Stress Measure Greek version; MBI Maslach Burnout Inventory; OLBi: Oldenburg Burnout Inventory; WEMWBS: Warwick Edinburgh Mental Wellbeing Scale; WRQoL work related quality of life scale.

Some studies point out differences between specialties. Vieira⁷ evaluated residents from different specialties and observed higher scores on the autonomy scale among internal medicine residents and a greater perception of teaching in anesthesiology residents. Sandhu et al.⁵² observed higher PHEEM scores in the questionnaires answered by neurology residents and lower scores among anesthesiology residents. In the study by Berrani et al.²⁸, laboratory medicine residents had higher PHEEM values than residents from other specialties. Ezomilke et al.³³ showed that gynecology and obstetrics residents scored higher than those in pediatrics and surgery in the total PHEEM score and in the teaching and social support categories. Bigotte Vieira et al.²⁹ showed that residents in endocrinology, cardiology, anesthesiology, family medicine and gastroenterology were more satisfied with the educational environment than those from other specialties. And recently, in the study by González et al.³⁷, the specialties with the highest scores in the total PHEEM score were ophthalmology, dermatology, pathological anatomy, while general surgery, gynecology and obstetrics and cardiology had the lowest scores.

Three studies evaluated the relationship between educational environment and burnout. Llera et al.⁴⁵ showed a negative correlation between the educational environment, exhaustion and depersonalization and a positive correlation between the educational environment and personal fulfillment. Papaefstathiou et al.⁴⁸ demonstrated that the total PHEEM score was negatively correlated with burnout. The perception of the educational environment was inversely proportional to the burnout status among psychiatry residents in the study by Chew et al.⁸. Other studies showed a positive correlation between the resident's well-being and the educational environment⁵⁰ and a correlation between emotional exhaustion and the educational environment with quality of life at work⁵¹.

One study⁵⁴ showed that medical knowledge, assessed through IGM-ITE (General Medicine Internal Training Examination) at the end of the residency, was significantly associated with the educational environment. Higher PHEEM scores were associated with better results on IGM-ITE exams.

DISCUSSION

The PHEEM is a reliable instrument for evaluating the educational environment in medical residency programs and has been validated in different parts of the world. This review assessed the use of PHEEM in medical residency programs of different specialties, in several countries, evaluating the total score and subscores of PHEEM and mainly highlighting the positive and negative points assessed with the aim of identifying aspects requiring improvement in the educational environment of the residency programs.

Most studies disclosed an educational environment in medical residency programs that was more positive than negative, although there was room for improvement. When evaluating the subscales, the perception of autonomy was more positive than negative and the perception of teaching revealed that the majority of programs are moving in the right direction. However, when evaluating social support, studies showed results divided between an environment that was not pleasant and an environment that had more pros than cons.

The main positive points reported in the autonomy subscale were feeling part of the work team and adequate level of responsibility during training; in the teaching subscale, available and accessible teachers stand out, as well as teachers with good teaching skills, good learning opportunities, opportunity to participate in educational events; in the social support subscale, low racial and sexual discrimination, collaboration with other doctors and a safe environment were reported. Most of the problems highlighted in the studies were related to social support, with the lack of adequate food during shifts being the main problem in most studies, regardless of the country or region, followed by inadequate accommodation and a culture of blaming the resident. In a study carried out in Morocco²⁸, sexual discrimination was considered a problem by half of the residents, associated with racial discrimination, problems also observed in Saudi Arabia³¹, Pakistan²⁴ and Greece⁴¹, demonstrating that regional and cultural factors influence the educational environment, especially regarding social support of medical residency programs. In the perception of autonomy subscale, the main negative points were lack of an information manual and clinical protocols for residents, excessive workload, and being called at inappropriate times, while in the teaching subscale, the main problems highlighted were lack of protected time for study and lack of feedback from preceptors.

Medical residency programs have realities that vary greatly from one country to another and even from one region to another within the same country. There is a scarcity of studies evaluating the educational environment in medical residency programs in Brazil. Only one study⁷, carried out more than a decade ago, demonstrated the reliability of the PHEEM translated into Portuguese, evaluating the educational environment in medical residency programs at Hospital das Clínicas in São Paulo and in a hospital in Florianópolis. The obtained scores revealed a more positive than negative perception of autonomy, a perception of teaching moving in the right direction and a perception of more pros than cons regarding social support. The most positive points were the absence of racism and sexual discrimination, an adequate level of responsibility, accessible teachers and opportunities to practice procedures. The points considered to be the most

problematic ones were food during shifts, excessive working hours, lack of time reserved for study, lack of feedback from teachers and a culture of blaming the resident.

Analysis of the PHEEM results allows us to point out some points for improvement. Excessive workload is a frequent problem in residency programs. In Brazil, the National Medical Residency Commission regulates the maximum weekly working hours of 60 hours of work, post-shift rest and at least one day off per week (CNRM, Law n. 6,932, 07/07/1981)⁵⁶. Additionally, protected study time must be reserved during the residents' standard week. Feedback is essential in the teaching-learning process. Preceptors must be trained and encouraged to provide feedback to residents during residency activities. The development and implementation of manuals for residents and clinical protocols can improve the residents' perception of autonomy.

Issues related to food and accommodation during shifts are among the negative aspects most often cited by residents from all different programs in different countries and must be discussed and resolved together with the hospital administration.

This review has some limitations. Some studies did not provide the total PHEEM score, others did not provide subscale scores, and some did not show the score for each item on the scale. Regional and cultural differences in the educational environment make it difficult to generalize results.

CONCLUSION

The use of the PHEEM questionnaire showed that in most medical residency programs the educational environment was more positive than negative, however with room for improvement. The highlighted positive points were low racial and sexual discrimination, possibility of working as a team and collaboration with other doctors, adequate level of responsibilities, accessible teachers with good teaching skills, good learning opportunities and participation in educational events. The main indicated negative points were lack of adequate food and accommodation during the shifts, followed by excessive workload, lack of feedback from preceptors and lack of protected time for study, in addition to the culture of blaming the resident. Therefore, improving the educational environment in medical residency must involve efforts especially related to improving social support, aiming to improve the learning capacity and preserve the mental health of resident doctors.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

AUTHORS' CONTRIBUTION

Patricia Lofêgo Gonçalves: contributed to the project design,

development of the research question, bibliographic search, database search, analysis and interpretation of data, discussion of the results, drafting and final writing of the manuscript. Ana Paula Moscon Marçal: contributed to conception and development of the project and research question, bibliographic search, database search, analysis of data. Renata de Almeida França: contributed to project development, bibliographic search, analysis of data. Vania dos Santos Nunes Nogueira: contributed to study conception and planning, development of the project and research question, database search, advisor of all phases of the research, final review of the manuscript.

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