



## Contributions of nursing students during their clinical practice in primary care: Adaptation and validation of a scale

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### ABSTRACT

**Aim:** To adapt the 'Nursing Student Contributions to Clinical Settings' scale (CEECC, Spanish acronym), designed for specialized care and to evaluate the validity and reliability of a measure in the primary health care setting. Additionally, a description of the contributions of nursing students to primary health care in Spain is presented, based on the perception of preceptor nurses.

**Methods:** A multicenter cross-sectional study was conducted in Spain, involving a committee of nursing experts who participated in a Delphi panel (n = 5) and cognitive interviews (n = 5) and a sample of nursing preceptors (n = 300) from 57 primary health care centers (2019–2020). The CEECC was reviewed by experts for the conceptual semantic adequacy of the 24 items for its application in primary health care. Nurse preceptors' responses to the CEECC scale were used to study the validity and reliability of the measure, including factor analysis, convergent validity with the Health Sciences-Evidence Based Practice scale and a matched test-retest over a three-week interval.

**Results:** According to the consensus of experts, the CEECC scale is valid for primary health care with minimal modifications (change "patient" to "user"). Based on the analysis of responses to the scale, the corrected item-total correlations of the 24 items were  $\geq 0.40$  and were grouped into a single factor, explaining 46.3% of the variance. The Cronbach's alpha value was 0.95. Regarding convergent validity, there was a positive correlation between the CEECC scale and the score of the Health Sciences-Evidence Based Practice scale (Pearson's coefficient = 0.33;  $p < 0.001$ ). The overall intraclass correlation coefficient was 0.91. Finally, the mean CEECC score was 61.9 points (range 0–96). The two most positive contributions were 'Nursing students enable nursing professionals to perform their teaching role' and 'Nursing students become future professionals who know the healthcare facility'.

**Conclusions:** The CEECC scale provides a valid and reliable measure of nursing students' contributions to primary health care. Nursing students' contributions to Spanish primary health care were positive, especially towards the nursing profession and healthcare organizations.

### 1. Introduction

Primary health care (PHC) has been considered the cornerstone of

health systems; however, since 2020, it has been in an extremely tumultuous situation (Organisation for Economic Co-operation and Development, 2021). In most countries, the COVID-19 pandemic forced

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modifications affecting work environments, clinical flow charts and protocols, such as the abrupt expansion of telecare (Khoong et al., 2022). Moreover, there was an increase in the demand for PHC, together with a diversion of resources for scaling-up of hospital capacities (Organisation of Economic Co-operation and Development, 2021). As a result, the endemic weaknesses of the PHC model became visible (Ares-Blanco et al., 2021; Jiménez Carrillo et al., 2022; Lauriola et al., 2021; Lim et al., 2021; Mughal et al., 2021). Undoubtedly, one of the most worrying issues is related to the growing difficulty in providing health staff to PHC, which responds to a global dynamic (Association of American Medical Colleges, 2020; Aston, 2018). However, this failure has also brought a unique opportunity for transformative changes (Barış et al., 2021). For example, in Spain, the approval of a Primary and Community Care Action Plan for the years 2022 and 2023, with specific objectives and a targeted budget, suggests a redefinition of the PHC model (Ministerio de Sanidad, 2021).

The success of PHC remodeling will largely yield on a process of calm reflection where all stakeholders are considered. Political decision-makers should listen to the voice of both healthcare providers and users, including managers and health workers, scientific societies, patient organizations and representatives of civil society. Moreover, the role of health science students should be considered in the gestation of the new PHC (Duran-Niño et al., 2021), because they are the foundation for the health system of the future and because they spend long hours receiving training in PHC settings. In fact, PHC centers play a decisive role in the undergraduate training of health science students and in the training of health specialists, for at least two reasons. Firstly, because the teaching function is inherent to professional development in PHC; and, secondly, because it is necessary for graduates who will be incorporated into PHC to be competent in the professional functions (Calma et al., 2019).

## 2. Background

In Spain, students of the Bachelor of Science in Nursing must complete 533 hours of internships in PHC (Lana-Pérez et al., 2018) therefore, the vast majority of PHC centers regularly receive third- and fourth-year nursing students (NS). By integrating into the professional teams, bidirectional relationships are generated. Thus, NS receive supervised clinical training in real settings from nurse preceptors, which is programmed and evaluated by higher education professors in the context of a comprehensive university curricula (Cervera-Gasch et al., 2022; Dolansky et al., 2022; MacDonald et al., 2021). At the same time, NS make contributions to the nursing practice environment, including professionals and patients, however, such contributions are often not considered or measured (Fernández-Feito et al., 2021; Morrison and Brennaman, 2016), therefore, it is unknown whether these inputs are positive or negative for PHC centers. Students can provide intellectual stimulus to workers due to their innovative perspectives in nursing and they can help integrate evidence-based practice (EBP) into care. However, they can also add extra burden to the usually overloaded workday of nurse preceptors, increasing their work stress and becoming barriers to EBP. Therefore, understanding the nurses' perceptions about the contributions of NS may lead to better management of the clinical environment in PHC and may help to rethink and identify some of their hidden roles, such as improving nurses' teaching skills or serving as motivation to update knowledge, avoiding thinking that nurse preceptors are the only ones that are knowledgeable and that NS are almost void of knowledge.

At the beginning of the 21st century, Grindel et al. (2001) developed a scale to quantify the contributions of NS to the hospital setting. Using this scale, some studies addressed the contributions of NS to medical-surgical and mental health units primarily in the United States (Grindel et al., 2001; Matsumura et al., 2004; Slaughter-Smith et al., 2012); however, it was never formally validated. Later, Fernández-Feito et al. (2021) designed a new tool, the CEEEC scale (Spanish acronym for

“Contribuciones de los Estudiantes de Enfermería a los Entornos Clínicos”), on the basis of NS' contributions proposed by Grindel et al. (2001), after obtaining their consent. This scale was validated using the responses of 1098 nursing professionals involved in a multicenter study in Spain (Fernández-Feito et al., 2021). The CEEEC scale consists of 24 items detailing contributions that can be made by NS in the clinical agencies where they carry out their training. Nurses' perceptions about each NS' contribution is rated according to a Likert scale from “totally disagree” to “totally agree”; therefore, contributions may be considered positive or negative (see Table 1 for item wording). The original language of the CEEEC scale was Spanish, however, it is also available in English.

Currently, the CEEEC is the only available tool for assessing the contributions of NS to clinical practice settings; however, given that it was validated using a sample of specialized care professionals, the aim of this study was to adapt this scale to the PHC setting and to study the validity and reliability of data obtained when applying this scale to PHC preceptor nurses. In addition, a description of the contributions of NS to PHC in Spain based on the perception of preceptor nurses is presented.

## 3. Methods

### 3.1. Study design

This was a methodological study for instrument adaptation and psychometric testing. A four-phase study was carried out, which included a process of adapting the original CEEEC scale from a hospital clinical setting to a PHC setting in Spain, the study of its validity and reliability and finally, the description of the NS' contributions to PHC. For the study design, the guidelines for cross-cultural adaptation of self-reported measures proposed by Beaton et al. (2000) were used. In summary, Beaton et al. (2000) proposed six sequential stages to serve as a template for the translation and adaptation process. The first three stages involved reverse translation of the original questionnaire. In stage IV, an expert committee discusses and reaches consensus about cross-cultural equivalence. In stage V, a test of the new questionnaire is performed with a small sample from the target population, together with an interview to prove the understanding of each item. Finally, although the measures made with final version will have a priori the same validity and reliability as with original version, it is highly recommended to demonstrate the measurement properties needed for the intended application (stage VI). Given that the original version of the CEEEC scale was in Spanish language, in the present study the first three stages were ignored.

#### 3.1.1. Phase I. Review by experts

In this first phase, we selected the three experts who had participated in the Delphi panel during the initial design of the CEEEC whose scope of work was PHC nursing (Fernández-Feito et al., 2021) –they also had extensive expertise in nurse preceptorship– and were included in a committee together with the two principal investigators of this study, who are university professors and methodologists. This committee of experts (n = 5), conducted group discussions regarding the conceptual and semantic adequacy and intelligibility of each of the items and of the instrument as a whole, for its application in PHC.

#### 3.1.2. Phase II. Cognitive interviews

This phase included individual cognitive interviews with five PHC registered nurses, selected by convenience sampling. The inclusion criteria included working in a PHC setting and having trained NS during the last two years. To guarantee knowledge of both the PHC setting and the current academic environment, we selected nurses with different levels of work experience: three nurses with a thorough knowledge of the setting (>20 years of experience in PHC) and two specialists in Family and Community Nursing (nurse practitioners) with a better recall of the NS' role, considering that in Spain formal training to become

**Table 1**  
Discrimination indices, factorial weights and intraclass correlation coefficients of the CEEEC\* items.

Nº	Item	Total correlation of corrected elements	Factorial weights	CCI (95 % CI)
1.	Help to lighten the workload	0.44	0.46	0.56 (0.01; 0.81)
2.	Stimulate staff to work according to scientific evidence	0.59	0.68	0.65 (0.21; 0.85)
3.	Generate satisfaction in nurses by participating in the professional development of students	0.62	0.70	0.86 (0.67; 0.94)
4	Increase communication with patients and families	0.61	0.64	0.43 (-0.30; 0.76)
5	Act as a reminder to update the work protocols	0.61	0.71	0.54 (-0.66; 0.80)
6	Enhance the learning environment of the health center	0.67	0.76	0.74 (0.36; 0.89)
7	Provide a break in the care of demanding patients	0.46	0.47	0.54 (-0.32; 0.80)
8	Encourage staff to update their knowledge	0.68	0.77	0.83 (0.60; 0.93)
9	Promote interest in research among nurses	0.66	0.74	0.88 (0.71; 0.95)
10	Increase patient and family satisfaction	0.70	0.74	0.57 (-0.29; 0.82)
11	Provide comprehensive care to patients	0.58	0.63	0.49 (-0.25; 0.79)
12	Represent a responsibility for nurses	0.65	0.74	0.83 (0.61; 0.93)
13	Constitute a link between the healthcare center and the university	0.50	0.57	0.88 (0.71; 0.95)
14	Become future nurses who know the healthcare center	0.46	0.56	0.58 (-0.24; 0.82)
15	Encourage the development of empathy among staff	0.69	0.76	0.41 (-0.31; 0.74)
16	Contribute to the recognition of the nursing profession	0.65	0.72	0.71 (0.31; 0.88)
17	Intellectually stimulate staff with different or innovative perspectives	0.71	0.79	0.67 (0.22; 0.86)
18	Improve the work environment	0.71	0.78	0.41 (-0.45; 0.71)
19	Participate in interdisciplinary collaborative work	0.52	0.59	0.48 (-0.27; 0.78)
20	Improve the reputation of the institution	0.60	0.67	0.55 (-0.16; 0.81)
21	Are helpful for the development of technological skills among staff	0.56	0.63	0.32 (-0.66; 0.72)
22	Collaborate in the integration and teaching of other students	0.57	0.61	0.48 (-0.16; 0.77)
23	Enable nurses to carry out their teaching role	0.51	0.61	

**Table 1 (continued)**

Nº	Item	Total correlation of corrected elements	Factorial weights	CCI (95 % CI)
				0.35 (-0.58; 0.73)
24	Monitor the patient's status more frequently	0.40	0.42	0.70 (0.29; 0.88)

CEEEC: Contribuciones de los Estudiantes de Enfermería a los Entornos Clínicos (Nursing Student Contributions to Clinical Settings); CCI: correlation coefficients intraclass; CI: confidence interval.

\*When the CEEEC scale is administered to primary health care nurses, the term "patient" is used as a synonym for "primary health care user".

nurse practitioners has been in place for less than 10 years. The semi-structured cognitive interview focused on the evaluation of the intelligibility, acceptability and comprehension of the items and dimensions. For this purpose, the interviewee read each item aloud and scored its intelligibility according to a Guttman-type scale ("1: I did not understand the item", "2: I understood, but I have some doubts", "3: I understood perfectly and I have no questions"), being free to make comments. The interviews also included three open-ended questions: "Are the terms used in the questionnaire familiar to you in your work environment?"; "Are there any terms in any of the items that you find ambiguous or difficult to understand?"; and "Are there any suggestions you would like to make to improve the understanding of the questionnaire?" (Pereira and Viana, 2021). Additionally, during the interviews, the interviewer noted the interviewees' verbalizations and paraphrases during the completion of the questionnaire.

### 3.1.3. Phase III. Validity and reliability study

In this third phase, the administration of the scale was tested. For this purpose, a person trained in data collection went to the 57 PHC centers from two provinces in northern Spain (Asturias and León) that regularly received third- and fourth-year students of the Bachelor of Science in Nursing thanks to an agreement signed with two public universities. At these sites, the study was presented and a questionnaire was administered to all nursing professionals in active employment acting as preceptors (n = 460), who were asked to complete it and return it anonymously via internal postal mail. For the purpose of this research, only registered nurses supervising NS in PHC for more than three months a year were considered as preceptors. Considering an expected mean score (standard deviation, SD) for NS' contributions of 54,7 points (SD: 14,2) (Fernández Feito et al., 2021), a confidence level of 95 % and a precision of 2 %, we estimated that 137 responses to the questionnaire would be enough to represent the target population. Finally, a total of 300 nurse preceptors returned the completed questionnaire (response rate=65 %).

The questionnaire included the CEEEC scale, which is composed of 24 items, reflecting positive and negative contributions of NS to the PHC clinical setting. Each item was scored on a 5-point Likert-type scale (from "0: strongly disagree" to "4: strongly agree"). Scoring of negative items was reversed so that higher scores corresponded to more positive student contributions. The total score was obtained by summing the item scores and thus the possible score ranged from 0 to 96 points.

In addition, the questionnaire also collected social and occupational information. Specifically, self-reported information was obtained on sociodemographic variables (sex, age and highest level of education) and work variables, including years of work experience, size of basic area (i.e. number of inhabitants covered by the PHC center), job satisfaction from 0 to 10 points, frequency of emotional exhaustion (days per month) and frequency of rest breaks during the workday; the latter variables as proxies of nursing burnout and work overload (Laserna

Jiménez et al., 2022; Nejati et al., 2016). Finally, the questionnaire also included a validated scale on beliefs and attitudes toward EBP, named the HS-EBP scale (Fernández-Domínguez et al., 2016; Fernández-Domínguez et al., 2017). This scale consisted of 12 items with Likert-type responses that reflect the degree of agreement with statements referring to EBP (from "1: minimum agreement" to "10: maximum agreement"). The scores ranged from 12 to 120 points, with higher scores indicating more positive beliefs and attitudes towards EBP. The questionnaire also included two questions about previous EBP training and provision of care according to EBP.

Finally, a matched test-retest was carried out using a convenience sample of approximately 10% of the initial sample. For this purpose, two to four weeks after the first contact, the CEEEC scale was again administered via internal postal mail to participants who belonged to the centers/units with greater involvement in the study (i.e., a higher response rate and faster return of the first questionnaire) and who voluntarily entered their personal registration number on the first response.

#### 3.1.4. Phase IV. Description of contributions

For this fourth phase, a brief descriptive statistical analysis of the contributions of NS to PHC was carried out using data from the sample of 300 professionals who responded to the questionnaire. The analysis included measures of central tendency (mean) and dispersion (standard deviation) of the total CEEEC and individual item scores.

#### 3.1.5. Statistical analysis

Data analysis was performed using SPSS v.25 (IBM Corp.) and FACTOR v.8.02 software (Universidad Rovira i Virgili, Barcelona). Statistical significance was set at  $p < 0.05$ .

First, the corrected item-total correlations were calculated and an index greater than 0.30 was considered adequate. An exploratory factor analysis was carried out, based on the polychoric correlation matrix (since the scale items were evaluated using a Likert-type scale) and the unweighted least squares (ULS) method was used as the extraction method. Additionally, Bartlett's test of sphericity (optimal value:  $p < 0.05$ ) and the Kaiser-Meyer-Olkin index (KMO) (optimal value:  $>0.5$ ) were calculated to confirm the adequacy of the data for factor analysis, since they report whether the necessary correlation exists between the items to perform an exploratory factor analysis (Lorenzo-Seva and Ferrando, 2006). The following parameters (and their optimal values) were calculated: percentage of total variance explained ( $>30\%$ ), goodness-of-fit index (GFI;  $>0.90$ ) and the standard deviation of the residuals (RMSR;  $<0.08$ ). According to factor analysis, a single factor was established and therefore no rotation method was used.

The internal consistency of the total scale was calculated using Cronbach's alpha, which was considered weak  $< 0.70$ , good between 0.70 and 0.89 and excellent  $\geq 0.90$  (Cronbach, 1951). In addition to the parameters indicated above, the following determinations (optimal values) on the dimensionality of the scale were added: unidimensional congruence (UniCo;  $>0.95$ ), explained common variance (ECV;  $>0.85$ ) and mean residual load of each item (MIREAL;  $<0.30$ ).

Additionally, to provide an extra test of the validity and accuracy of the scale, an analysis was performed by applying Samejima's (1969) graded response model (GRM) (Item Response Theory). According to this model, the item discrimination index ( $\alpha$ ) indicates the level of association between the item and the trait to be measured; and the index of difficulty ( $b$ ) indicates the possibility to choose one response category or higher (Stover et al., 2019). In the GRM, the number of parameters corresponding to the number of responses to the item minus one is obtained, in this case a  $t_{b_1-b_4}$  threshold is obtained, where  $b_1$  corresponds to the possibility of selecting response options 1,2,3 or 4;  $b_2$  for response options 2,3 or 4;  $b_3$  for response options 3 or 4 and  $b_4$  for response option 4.

To examine construct validity, we studied the association between social and occupational variables and mean total score of the CEEEC

scale (known-groups validity) and the correlation of beliefs and attitudes towards EBP with CEEEC total score (convergent validity). According to previous research, the perception of NS' contributions was expected to be more positive among nurses with who were younger and with less professional experience, who were more satisfied with their work and with a better attitude towards EBP (Fernández-Feito et al., 2021; Morrison and Brenneman, 2016). Student's t-tests, ANOVA (Tukey's post-hoc method) and the Pearson correlation test were used for this purpose. Previously, the internal consistency of the HS-EBP scale was confirmed in our sample (Cronbach's  $\alpha=0.96$ ).

Finally, reliability through temporal stability (test-retest) was studied by calculating the intraclass correlation coefficient (ICC). Values  $< 0.40$  indicated low, 0.40–0.74 indicated moderate and  $\geq 0.75$  indicated very good test-retest reliability (Zaki et al., 2013).

#### 3.1.6. Ethical considerations

The study protocol was approved by the Clinical Research Ethics Committee of Asturias (REF 19/18). All participants received information on the study design and gave informed consent.

## 4. Results

### 4.1. Phase I results

The expert panel concluded that the original version of the CEEEC scale was suitable for use in the PHC setting (see Table 1 for item wording). The relevance of the item "They monitor patients' condition more frequently" (item 24) was the only one that generated debate; however, the panel of experts opted to maintain it because, according to the experts' consensus opinion, PHC staff should offer longitudinal care, being proactive in the control of people's health. In addition, it was decided not to alter the original scale, since it was considered more useful to have a single CEEEC scale that could be used indistinctly in specialized and PHC. For this reason, although the term "user" offers a better description of people attending a PHC compared with "patient", the latter was kept throughout the scale and the following note was added: *when the CEEEC scale is administered to primary care nurses, the term "patient" is used as a synonym for "primary health care user"*.

#### 4.1.1. Phase II results

During the cognitive interviews, once more, item 24 proved to be the most difficult item to understand; indeed, three of the five people interviewed stated "I didn't understand the item". Some suggestions made by these interviewees to improve comprehension were as follows: "They facilitate the identification of users' health needs" or "They quickly identify health needs", however, none captured the essence of the original item, which referred more to close monitoring of changes in health status.

#### 4.1.2. Phase III results

The characteristics of the sample are described in Table 2 ( $n = 300$ ). The mean age was 46.8 years (SD: 13.2) and the mean professional experience was 22.7 (SD: 13.6) years. Most only had undergraduate training (80.1%) and worked at a health center in a basic health area of more than 50,000 inhabitants (72%).

The corrected item-total correlations were  $\geq 0.40$  in all cases (Table 1). The lowest value (0.40) was obtained for item 24 "They monitor patients' condition more frequently" and the highest (0.71) was obtained for item 17 "They intellectually stimulate professionals with different perspectives". All items had adequate factor loadings, ranging from 0.42 to 0.78. The p-value associated with Bartlett's statistic ( $p < 0.001$ ), together with the KMO index (0.94) confirmed the possibility of performing a factor analysis, where the following parameters were obtained: UniCo = 0.95, ECV = 0.86, MIREAL = 0.22, eigenvalue = 9.88, which support the unidimensional nature of the scale, explaining 46.3% of the variance. The GFI was 0.97, the RMSR was 0.08 and the standardized Cronbach's alpha value was 0.95.



**Table 2**  
Participants' characteristics and mean CEEEC score according to social and occupational variables (n = 300).

	%	Mean (SD)	p-value
<b>Sociodemographic</b>			
Age			
<35 years	29.0	66.3 (13.1)	
35–54 years	30.0	61.6 (12.9)	0.075
≥ 55 years	41.0	58.9 (15.9)	< 0.001
Sex			
Female	85.3	61.6 (14.8)	
Male	14.7	64.3 (12.1)	0.181
Level of education			
Degree studies	80.1	61.1 (14.2)	
Postgraduate studies	19.9	66.3 (14.9)	0.018
<b>Work</b>			
Professional experience			
<5 years	8.1	66.9 (13.7)	
5–15 years	32.2	65.0 (13.9)	0.942
16–35 years	32.5	59.4 (14.5)	0.103
> 35 years	27.2	59.4 (14.9)	0.114
Size of the basic health area			
<50.000 inhabitants	28.0	63.5 (14.4)	
> 50.000 inhabitants	72.0	61.2 (14.6)	0.264
Work satisfaction			
1–6 points	8.2	51.3 (14.8)	
7–8 points	51.9	60.2 (13.6)	0.017
9–10 points	39.9	63.2 (14.6)	0.001
Frequency of emotional exhaustion			
Never or sporadic (<1 day/month)	45.7	62.0 (14.6)	
Occasionally (1–4 days month)	36.5	60.7 (12.5)	0.779
Frequently (>4 days/month)	17.8	57.1 (16.9)	0.106
Frequency of rest			
Never or sporadic	34.2	60.2 (14.5)	
Regularly	43.1	61.3 (14.5)	0.829
Daily	22.7	60.2 (14.1)	0.999
<b>Evidence-based practice (EBP)</b>			
Attitudes and beliefs towards EBP			
Tertile 1 (<97 points)	31.3	55.2 (13.7)	
Tertile 2 (98–110 points)	34.0	61.0 (14.2)	0.017
Tertile 3 (≥111 points)	34.7	65.6 (13.5)	< 0.001
EBP training			
No	37.7	58.2 (16.0)	
Yes	62.3	62.1 (13.1)	0.040
EBP care			
No	17.2	57.2 (14.5)	
Yes	82.8	61.4 (14.3)	0.076

CEEEEC: Contribuciones de los Estudiantes de Enfermería a los Entornos Clínicos (Nursing Student Contributions to Clinical Settings); SD: standard deviation; EBP: evidence-based practice

Table 3 shows the results of the analysis using the GRM. Item 18 ("Improve the work environment") obtained the highest discrimination index (1.24) and item 24 ("Monitor the patient's status more frequently") was the lowest (0.47). Only three items obtained a value considered suboptimal (<0.65).

Regarding known-groups validity, lower age, higher educational attainment, higher job satisfaction and having training in EBP were significantly associated with higher CEEEC scores (Table 2). In addition, regarding convergent validity, the analyses showed a positive correlation between the total score of the HS-EBP scale and the students' contributions (Pearson correlation coefficient= 0.33; p < 0.001). The same result was found when the score of the HS-EBP scale was summarized in tertiles (i.e., the ordered distribution divided in three parts) (Table 2), such that belonging to the higher tertile was associated with a higher score in the CEEEC scale.

Finally, the test-retest reliability study was carried out on a subsample of 23 nursing professionals. Eighty-seven percent were women, with a mean age of 34.4 (SD: 9.0) years and 11.0 (SD: 8.7) years of mean professional experience. This subsample was significantly younger (p < 0.001) and less experienced than the total sample (p < 0.001). Table 1 presents the CCIs of the CEEEC items. Of the 24 items, 17 achieved

**Table 3**  
Discrimination and difficulty indices of the CEEEC\* items according to the graded response model.

N°	Item	Discrimination index (a)	Difficulty index (b)			
			b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>
1.	Help to lighten the workload	0.52	-1.89	0.00	1.71	3.34
2.	Stimulate staff to work according to scientific evidence	0.92	-3.04	-1.92	-0.76	0.75
3.	Generate satisfaction in nurses by participating in the professional development of students	0.99	-5.00	-2.30	-0.89	0.78
4.	Increase communication with patients and families	0.84	-2.18	-0.79	0.56	2.11
5.	Act as a reminder to update the work protocols	1.01	-2.65	1.86	-0.89	0.72
6.	Enhance the learning environment of the health center	1.18	-2.91	-2.16	-0.79	0.69
7.	Provide a break in the care of demanding patients	0.53	-1.62	0.25	1.95	3.81
8.	Encourage staff to update their knowledge	1.22	-2.87	1.91	-0.82	0.63
9.	Promote interest in research among nurses	1.09	-2.49	-1.39	-0.26	1.19
10.	Increase patient and family satisfaction	1.10	-2.18	-0.80	0.76	1.96
11.	Provide comprehensive care to patients	0.81	-2.99	-1.62	0.25	2.01
12.	Represent a responsibility for nurses	1.11	-2.99	-1.99	-0.88	0.76
13.	Constitute a link between the healthcare center and the university	0.68	-2.85	-1.78	-0.52	1.15
14.	Become future nurses who know the healthcare center	0.67	-4.17	-3.47	-1.78	0.32
15.	Encourage the development of empathy among staff	1.15	-2.82	-1.58	-0.36	1.28
16.	Contribute to the recognition of the nursing profession	1.04	-3.22	-1.78	-0.35	0.81
17.	Intellectually stimulate staff with different or innovative perspectives	1.28	-2.95	-1.78	-0.63	0.73
18.	Improve the work environment	1.24	-2.48	-1.51	0.16	1.31
19.	Participate in interdisciplinary collaborative work	0.73	-4.19	-2.68	-0.70	1.45
20.	Improve the reputation of the institution	0.90	-2.89	-1.68	-0.05	1.20
21.	Are helpful for the development of technological skills among staff	0.81	-3.25	-1.64	-0.25	1.64
22.	Collaborate in the integration and teaching of other students	0.77	-3.01	-1.96	-0.12	1.63
23.		0.77	-5.00	-3.80	-1.82	0.15

(continued on next page)

**Table 3** (continued)

N°	Item	Discrimination index (α)	Difficulty index (b)			
			b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>
24.	Enable nurses to carry out their teaching role Monitor the patient's status more frequently	0.47	-2.69	-0.73	1.90	3.88

\*When the CEEEC scale is administered to primary health care nurses, the term "patient" is used as a synonym for "primary health care user".

scores between 0.40 and 0.74 (moderate reliability), five had scores ≥ 0.75 (very good reliability) and two scored < 0.40 (low reliability: "Are helpful for the development of technological skills among staff" and "Enable nurses to carry out their teaching role"). The overall ICC of the CEEEC scale was 0.91 (95 %CI: 0.77–0.96; p < 0.001).

**4.1.3. Phase IV results**

The mean CEEEC score was 61.9 (SD: 14.6) points. The two items that achieved the highest scores were item 23 "Enable nursing professionals to perform their teaching role" and item 14 "Become future professionals who know the healthcare facility"; thereby, they were the most important contributions (Table 4). By contrast, the items with lowest scores were item 1 "Help to lighten the workload" and item 7 "Provide a break in the care of demanding patients".

**5. Discussion**

According to the results of this study, the psychometric characteristics of the CEEEC scale, which was initially designed to measure the contributions of NS to hospital clinical settings, support its use in PHC. Also, according to the results of the descriptive analysis on nurses' perceptions, NS make overall positive contributions to the PHC environment, both to the nursing profession and to the health service.

Health systems are shaped by a wide range of actors, including policy makers, managers, professionals and patients. However, their actions must be aligned for the optimization of the healthcare system (Smith et al., 2020). NS are part of the cast, yet their contributions are often overlooked. If a value-based healthcare system is an essential goal of society, all resources must be used, however small they may seem. Having instruments to measure the positive and negative contributions of students will make it possible to determine their role and achieve better management of human resources. For instance, if it is found that NS are increasing the workload of the preceptors, but preceptorship achieves a better and faster future integration of nurses in the PHC center, it would be reasonable to reduce the preceptors' clinical tasks while instructing NS. In this study, the CEEEC scale was adapted to the PHC setting and the validity and reliability of a measure involving nurse preceptors from PHC centers were studied. The results obtained confirm that the CEEEC version has adequate psychometric properties.

Firstly, consensus was reached in the group of experts on the applicability of the scale in the PHC setting, which supported its content validity. The cognitive interviews revealed adequate intelligibility, acceptability and comprehension of the items and only one of the items (no. 24) raised doubts about its suitability for the PHC setting, mainly because of the term "patient", which is less common in the PHC setting. However, given that the experts considered that it was preferable to be consistent with the original scale, a footnote was added noting that "patient" is interchangeable with "primary health care user".

Secondly, a wide range of psychometric analyses supported the internal validity of the instrument, with an excellent internal consistency and an adequate temporal stability, also confirming the reliability of the scale. Additionally, the difficulty indexes obtained through the analysis corroborate the adequate behavior of the items to measure the degree of

**Table 4**

CEEEC\* items ordered according to mean score.

N°	Item	Mean (SD)
23.	Enable nurses to carry out their teaching role	3.32 (0.73)
14.	Become future nurses who know the healthcare center	3.23 (0.82)
3.	Generate satisfaction in nurses by participating in the professional development of students	2.97 (0.85)
8.	Encourage staff to update their knowledge	2.97 (0.92)
6.	Enhance the learning environment of the health center	2.96 (0.89)
12.	Represent a responsibility for nurses	2.95 (0.91)
5.	Act as a reminder to update the work protocols	2.92 (1.00)
2.	Stimulate staff to work according to scientific evidence	2.89 (1.00)
17.	Intellectually stimulate staff with different or innovative perspectives	2.88 (0.93)
19.	Participate in interdisciplinary collaborative work	2.79 (0.84)
16.	Contribute to the recognition of the nursing profession	2.77 (0.99)
13.	Constitute a link between the healthcare center and the university	2.66 (1.13)
15.	Encourage the development of empathy among staff	2.64 (0.93)
9.	Promote interest in research among nurses	2.58 (1.03)
18.	Improve the work environment	2.57 (1.02)
21.	Are helpful for the development of technological skills among staff	2.54 (0.97)
22.	Collaborate in the integration and teaching of other students	2.54 (0.97)
20.	Improve the reputation of the institution	2.46 (0.95)
11.	Provide comprehensive care to patients	2.36 (0.93)
4.	Increase communication with patients and families	2.06 (1.08)
10.	Increase patient and family satisfaction	2.03 (0.97)
24.	Monitor the patient's status more frequently	1.75 (1.03)
1.	Help to lighten the workload	1.59 (1.15)
7.	Provide a break in the care of demanding patients	1.45 (1.10)

CEEEEC: Contribuciones de los Estudiantes de Enfermería a los Entornos Clínicos (Nursing Student Contributions to Clinical Settings); SD: standard deviation.

\*When the CEEEC scale is administered to primary health care nurses, the term "patient" is used as a synonym for "primary health care user".

student contribution. Again, item 24 was the most doubtful in the validity analyses, although the corrected item-total correlation was > 0.30 which had a moderate/high temporal stability.

Third, as we had expected, the convergent validity analysis showed a positive correlation between the students' contribution and EBP. It is well known that NS could be forerunners of EBP in professional settings (Moch et al., 2010), as the ongoing interactions between students and nurses would produce a synergy that would facilitate the integration of EBP in both groups (Cronje and Moch, 2010). In fact, according to our results, the main contributions of the students include perceptions such as: "they favor the updating of professionals' knowledge" (rank 4 out of 24), "they enhance the learning environment in the healthcare center" (rank 5), "they serve as a reminder to update work protocols" (rank 7) and "they stimulate professionals to work according to scientific evidence" (rank 8). Moreover, the association is consistent with the findings of other studies. Fernandez-Feito et al. (2021) found a dose-response association of attitudes and beliefs toward EBP and nursing students' positive

contributions to the hospital setting. Additionally, (Fernández-Salazar et al., 2021) found that mentoring NS contributed significantly to EBP knowledge, attitude and skills. As expected, time was an important facilitator for nurses to help students implement EBP in community settings (Brooke and Mallion, 2016) and time to adequately develop the preceptor role may also be key in the positive perception of student contributions.

Additionally, other variables were associated with a positive perception of student contributions. Younger nurses, with higher educational levels and greater job satisfaction obtained higher scores. Young nurses may have a greater ability to understand the student's role and an easier time developing an interpersonal relationship with people closer in age to them (Grindel et al., 2003; Morrison and Brennaman, 2016). Moreover, preceptor nurses with higher educational levels have received more hours of clinical training due to their undergraduate and postgraduate education, therefore they may feel more confident during their professional performance and, consequently, more at ease than less educated nurses when they have a NS by their side throughout the workday (Matsumura et al., 2004). Another factor is that a poorer working environment leads to a negative attitude of nurses towards students, especially if they are in their first years and require greater teaching dedication (Arkan et al., 2018).

Finally, NS made positive contributions to two very important stakeholders: to the nursing profession and to the healthcare organization. The contributions were of lesser magnitude toward patients and families and toward the individual nurse preceptor, for example, by lightening their workload. These findings in PHC are consistent with the type of student contributions to the hospital setting, although the mean total scale score was higher in PHC than in the hospital (54.7 points) (Fernández-Feito et al., 2021), suggesting that the contributions of students are considered more positively in the PHC setting, perhaps because NS learn better in a slower paced environment, with enough time for cognitive processing. Given that PHC centers regularly train future healthcare workers, the clinical needs of PHC should be aligned with university curricula. Only in this manner can the students' contributions be even more positive and contribute to better healthcare in the real world environment (Anderson and Thorpe, 2014; Shaheen et al., 2020). For this purpose, faculty should share objectives for clinical rotations in PHC with preceptor nurses, to enhance teaching-learning experience. Moreover, nursing staff should be very clear about communicating the concrete clinical needs of the PHC center (Slaughter-Smith et al., 2012).

In short, shedding light on the value and positive contributions of students is a necessity, as this will make healthcare organizations more committed to training and offer more clinical practice sites willing to host students for their community nursing education (Shaheen et al., 2019), which will enable a better distribution of students throughout the PHC network and a better preceptor:student ratio. A first step to achieve these objectives would be to consider PHC centers as university teaching centers, as well as many hospitals that train health sciences students.

### 5.1. Limitations

Our study has some limitations. First, the experts invited to the Delphi panel were the same ones who participated in the validation of the original CEEEC and therefore they may have been more inclined to approve the validation of the CEEEC content. However, we used the guidelines for cross-cultural adaptation of self-reported measures proposed by Beaton et al (2000), together with cognitive interviews with PHC nurses, which provided robustness to the process. Second, we lacked information on the number of students per preceptor and PHC center, which may be a relevant variable in the study of student contributions. Third, to address the possible lack of intelligibility of the most problematic item, a slight modification was introduced in the questionnaire, in the form of a footnote from item 24; nevertheless, our study could not verify whether this modification resolved the problem.

Finally, the study and its results are a reflection of the situation prior to the COVID-19 pandemic. Current perceptions about the contributions of NS may have changed dramatically.

## 6. Conclusions

This study has shown that the CEEEC scale, originally designed to be administered to hospital nurses, may also provide a valid and reliable measure of the perception of nurse preceptors regarding NS' contributions to PHC facilities without the need for any adaptation. This scale could be the starting point for analyzing nurses' perceptions of the role of NS in PHC and for making decisions about their management.

Lastly, our preliminary study in Spain showed that the contributions of NS were positive, especially towards the nursing profession and healthcare organizations. Considering PHC centers as university centers would achieve a better alignment of students' learning objectives with the real needs of clinical practice.

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### CRedit authorship contribution statement

**Julian Díaz-alonso:** Formal analysis, Writing – original draft preparation, Writing – review & editing. **Ana Fernandez-Feito:** Conceptualization, Methodology, Writing – original draft preparation, Writing – review & editing. **Maria João Forjaz:** Methodology, Validation, Writing – review & editing. **Elena Andina Díaz:** Data collection, Writing – review & editing. **Eduardo García-cueto:** Methodology, Software, Validation, Formal analysis, Writing – review & editing. **Alberto Lana:** Conceptualization, Methodology, Formal analysis, Writing – original draft preparation, Writing – review & editing, All authors reviewed the different phases of the text, made substantial changes to successive drafts, and approved the final version of the manuscript.

### Declaration of Competing Interest

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

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