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Research article

Patient safety and its relationship with specific self-efficacy, competence, and resilience among nursing students: A quantitative study

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ABSTRACT

Background: Patient safety is a relevant subject in the nursing curriculum. Each university programs patient safety teaching and practical training differently. However, few studies have sought to explore the relationship between patient safety as perceived by nursing students and other important psychosocial competencies in the nursing curriculum, such as self-efficacy, competence, and resilience.
Objectives: To analyze differential patient safety integration into three nursing education programs, and to assess agreement levels regarding patient safety climate, students' knowledge of patient safety and correlations with specific self-efficacy, competence and resilience.
Methods: Participants were 647 undergraduate students from three universities. Patient safety climate and knowledge of patient safety (good praxis) were measured using the Hospital Survey on Patient Safety Culture for nursing students, and other psychosocial variables were also analyzed using other instruments: specific self-efficacy, perceived competence and resilience. Nursing education programs and patient safety climate were analyzed using the Rwg(j) and ICC measures of inter-rater agreement across different academic levels.
Results: The ICC and Rwg indexes revealed high inter-rate agreement in all three universities. Differences were observed between Univ-2 and Univ-3 in patient safety climate scores and agreement values between academic levels. Differences in good praxis were found when academic levels were compared in Univ1-and Univ-2. Patient safety climate was found to correlate significantly with the psychosocial variables studied, but only in Univ-1.
Conclusions: Perceived patient safety climate differs between universities and academic levels. This competency is related to self-efficacy, competence and resilience, which endorses the assessment of patient safety integration from a broader perspective.

1. Introduction

Patient safety is a widely-used term in healthcare systems. Patient safety is an important element in the healthcare process since it seeks to avoid and prevent harm to patients (Lee et al., 2016; Torkaman et al., 2020). As such, it is broadly accepted that nursing students should, by the end of their university training, have acquired the tools and knowledge required to prevent mistakes and adverse effects (Levett-Jones et al., 2020; Ortiz de Elguea et al., 2019; Usher et al., 2019).

However, there is a large degree of variability in the way patient safety is dealt with and taught in nursing education programs (Cervera-Gasch et al., 2021; Levett-Jones et al., 2020; Tella et al., 2014). This has sparked an interesting debate in recent literature, which may be summed up through the following points: *a)* the controversial appearance of a new concept known as Safety-II (Mannion and Braithwaite, 2017; Smith and Valenta, 2018); *b)* the ambiguous use of the concepts culture

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and climate in patient safety (Alsalem et al., 2018; Churruca et al., 2021; Flin, 2007; Mannion and Davies, 2016); *c)* the psychometric unsuitability of some questionnaires seeking to measure these variables (Alsalem et al., 2018; Churruca et al., 2021; Alanazi et al., 2021); *d)* the emergence of the new 2.0 version of the Hospital Survey on Patient Safety (AHRQ, 2021) and the flexibility of its factor structure; and finally, *e)* the interaction of patient safety with other variables, such as burnout (Sováriová-Soósová, 2021), resilience (Gitell, 2008; Iflaifel et al., 2020), leadership (Rangachari and Woods, 2020), self-efficacy (Baernholdt et al., 2022; Harsul et al., 2020) and competence (Cervera-Gasch et al., 2021; Okuyama et al., 2011; Torkaman et al., 2020).

Given this diversity, it seems reasonable for current research in the field of nursing education to seek to shed light on these questions, on the assumption that, in order to implement changes in patient safety learning, we must first obtain as accurate a diagnosis as possible of the level of patient safety knowledge acquired by nursing students. Since students operate in a non-professional training context, it seems sensible to analyze their perceptions and behaviors regarding patient safety and good praxis, as well as the interaction of these factors with psychosocial variables (competence, self-efficacy and resilience) that are particularly salient among nursing students.

2. Background

2.1. Safety-I and Safety II

If we analyze the aspects surrounding the term Safety-I (prevention, analysis, understanding of mistakes and adverse events in the health system), we see that they are consistent with the postulates of the AHRQ (Agency for Healthcare Research and Quality) and the spirit of its Surveys on Patient Safety Culture. Mannion and Braithwaite (2017) argue that Safety-I is a paradigm that has not evolved in order to keep up with the ever-increasing complexity of the modern healthcare environment, and nor has it been able to offer any substantial improvement to the patient safety system. According to these authors, it is important to focus also on successful work and its origins, paying attention to the system as a whole and its interactions, which are rooted in performance variability. They therefore advocate Safety-II as the new emerging paradigm.

Smith and Valenta (2018) respond to this by pointing out that the failure to improve patient safety outcomes is not due so much to the acceptance of this specific paradigm (or indeed any other), but rather to the incomplete training provided to nurses in the field of patient safety, particularly in terms of human behavior within complex health systems. Therefore, if the road to improvement is through better training and specialization in patient safety, it seems logical to ask when and how we should measure patient safety within nursing education programs.

2.2. Patient safety culture vs. climate

The answer to this question is directly linked to the ambiguous way in which the concepts safety culture and safety climate have been used to date. Indeed, in some studies, these two terms are even used interchangeably (Cox and Flin, 1998; Guldenmmund, 2000; Halligan and Zecevic, 2011; Hodgen et al., 2017; Nielsen, 2014). Other authors (Mearns and Flin, 1999; Ortiz de Elguea et al., 2019) have stated quite clearly that patient safety climate should be measured using a synchronous instrument, at one specific moment in time.

Patient safety climate seeks to measure and describe individual perceptions of safety (Neal et al., 2000) within certain areas/units of the healthcare system (Ortiz de Elguea et al., 2019), which together form part of a subgroup of safety culture (Alsalem et al., 2018). Safety climate is therefore a gateway into safety culture (Sováriová-Soósová, 2021), which is located at a higher level (Ortiz de Elguea et al., 2019) and seeks to measure, diachronically, the beliefs, values and shared characteristics of the healthcare system (Committee of Experts on Management of Safety and Quality in Health Care (SP-SQS), 2005; Churruca et al., 2021; Flin et al., 2006).

2.3. Assessing patient safety climate

According to recent systematic reviews on patient safety (Alsalem et al., 2018; Churruca et al., 2021), the instruments with the best psychometric indicators in this field are the Hospital Survey on Patient Safety Culture (Sorra and Dyer, 2010) and the Safety Attitudes Questionnaire (Sexton et al., 2006). Both measure safety climate and are also the most widely-used indexes (Alsalem et al., 2018; Churruca et al., 2021). Version 1.0 of the Hospital Survey on Patient Safety Culture comprised 12 dimensions and was adapted for use with nursing students (Survey on Patient Safety Culture for nursing students) (Ortiz de Elguea et al., 2019). Unlike the version for professionals, this new version had a factor structure comprising five safety climate dimensions and included a new scale called "*Indicator of good praxis*" which measures students' knowledge of patient safety, thereby solving one of the main shortcomings identified in relation to the Safety Attitudes Questionnaire. The Hospital Survey on Patient Safety Culture is also more flexible and can be more easily adapted to different healthcare contexts (Sorra and Nieva, 2004). The Hospital Survey on Patient Safety Culture was released in 2004 by the AHRQ. Since then, different versions and adaptations have been developed across different countries and cultures (Bodur and Filiz, 2010; Brborovic et al., 2014; Haugen et al., 2010; Moghri et al., 2012; Occelli et al., 2013; Smits et al., 2008; Tereanu et al., 2018).

The latest of these - Hospital Survey on Patient Safety Culture version 2.0 (Sorra et al., 2021) has 10 instead of 12 dimensions and a total of 40 items, placing greater emphasis on the profile of both respondents and healthcare areas/units. The changes made in this new version of the Hospital Survey on Patient Safety Culture do not substantially affect the Hospital Survey on Patient Safety Culture-NS, since the latter does not use the *staffing* and *teamwork across units* dimensions that were transformed in the new instrument.

Gambashidze et al. (2021) point out that, as well as measuring patient safety and implementing improvements, it is also important to analyze the interplay between the individual characteristics of members of the healthcare system. The acquisition of competence linked to patient safety is rooted in the development of specific self-efficacy, defined as the belief that one is capable of performing well a specific professional role (Grau et al., 2001). In the case of nursing students, this means their belief that they are able to perform their role as students as they train to become fully qualified nurses (Pierazzo, 2014).

In general terms, students with a high level of self-efficacy perform better and persevere more when faced with new and challenging situations (Bandura, 1997; Schunk, 2005). According to Arabzadeh et al. (2012), this prompts them to use cognitive strategies more positively as a means of guiding their own learning. Different studies have analyzed the role of self-efficacy in the acquisition of nursing competence (Baernholdt et al., 2022; Harsul et al., 2020), finding that it is necessary to pay more detailed attention to patient safety in nursing education.

In addition to self-efficacy and competence, Scoloveno (2018) argues that resilience is an important dynamic process that occurs in the interplay between the protection and risk factors for patient safety. As such, the systematized development of resilience by nursing students throughout their undergraduate degree will prepare them to care for patients in all their complexity (Amsrud et al., 2019; Arrogante, 2015). Resilience should therefore be studied in order to determine its association with positive healthcare practices.

Other authors (Iflaifel et al., 2020) extend the individual nature of resilience to areas/units also, including the higher plane of healthcare systems themselves, adopting certain aspects of the Safety-II approach. Gillespie et al. (2007) believe that resilience is vital for nurses, given the changing and demanding nature of the environment in which they work. These authors found a significant association between resilience, self-

efficacy and competence in a sample of Australian nurses, thereby highlighting the importance of this variable for patient safety, as indeed the abnormal circumstances of the COVID-19 pandemic made clear (Rangachari and Woods, 2020).

3. Study aims

As we discuss later in this paper, the principal aim was to test patient safety knowledge levels and provide a "diagnosis" of agreement levels, as a means of gaining insight into university curricula. Moreover, measures of students' self-efficacy, competence and resilience may contribute to a broader diagnosis.

Given this background, and in light of recent changes in the Hospital Survey on Patient Safety Culture and Safety-II, the specific aims of this study were:

1.- To detect levels of agreement or homogeneity between patient safety climate and students' knowledge of patient safety (good praxis) across different academic years and universities.
2.- To analyze differences in self-efficacy, competence and resilience among different universities, in accordance with different academic levels.
3.- To analyze correlations between patient safety and students' self-efficacy, perceived competence and resilience.

4. Methods

4.1. Sample

Participants were 647 undergraduate nursing students from three different universities who voluntarily agreed to complete the survey. After excluding 66 incomplete questionnaires (10.24 %), a final sample of 581 cases was obtained.

To present the results, participating universities were codified as UNIV-1, UNIV-2 and UNIV-3. No university had a specific subject focusing on patient safety climate. In UNIV-1 and UNIV-3, cross-cutting patient safety contents were mostly concentrated in the 2nd year of the degree course. In the case of UNIV-2, they were distributed across the 2nd and 3rd years.

First-year students were excluded from the study since they had received no practical training at any of the three universities analyzed.

4.2. Regulatory approval

The study was authorized by the three Ethical Committees at the three universities (PIIDUZ_17_337, 2809_2018_10618 and CEI-SJD 2019-11). All participants received written information about the study, its aim, and the voluntary nature of their participation, and gave their informed consent. They were also informed that refusal to participate would have no detrimental effect on their studies.

4.3. Instruments

HSOPS-NS - *Hospital Survey on Patient Safety Culture for nursing students*: this questionnaire was adapted for nursing students (Hospital Survey on Patient Safety Culture for nursing students) by Ortiz de Elguea et al. (2019). It is made up of 49 items rated on a five-point Likert-type scale, one question to assess individual perceptions of the degree of patient safety (1 to 10 points), three questions designed to measure respondents' knowledge and use of the incident notification system, and one open-ended question. The survey is corrected in two phases. In the first phase, 14 factors are obtained, which are later grouped in the second phase into five main dimensions: 1) frequency of events reported, 2) overall perceptions of patient safety, 3) perception of patients' safety in the unit or area, 4) individual perception of the overall level of patient safety, and a new scale, 5) indicator of good praxis.

A Confirmatory Factor Analysis (CFA) was performed to test the original five-factor model of the Hospital Survey on Patient Safety Culture for nursing students (Ortiz de Elguea et al., 2019). The model was found to have a good fit in the sample and was statistically significant χ^2 (5) = 18.87, p = .002; CFI = 0.98; IFI = 0.98; RMSEA = 0.07. It also had moderate factor loadings (0.52 to 0.82) that were very similar to those reported for the original model. In terms of study validity, the Hospital Survey on Patient Safety Culture for nursing students showed a good internal consistency when used in this sample (Cronbach's alpha = 0.88), as indeed was the case in the preliminary validation of the instrument (Ortiz de Elguea et al., 2019). The average Cronbach's alpha values across the three universities were also very similar to those reported for the subscales of the original survey in some of its validations in different samples and countries (Brborovic et al., 2014; Haugen et al., 2010; Occelli et al., 2013).

CSES: the Clinical Skills Self-Efficacy Scale, originally designed by Oetker-Black et al. (2016), comprises nine items rated on a confidence scale from 1 to 10 (1 = No confidence, 10 = Total confidence) and measures specific self-efficacy among nursing students. The CSES had a Cronbach's alpha = 0.83.

PCNS: the Perceived Competence for Nursing Students is a questionnaire developed by Orkaizagirre-Gómara et al. (2020) to measure competence among nursing students. The instrument comprises 10 items rated on a Likert-type scale from 1 to 5 (1 = Not at all competent; 5 = Totally competent). The PCNS had a Cronbach's alpha = 0.81.

BRS: the Spanish validation (Rodríguez-Rey et al., 2016) of the Brief Resilience Scale created by Smith et al. (2008) was used in this study. It comprises six items rated on a five-point Likert-type scale (1 = Totally disagree; 5 = Totally agree). The BRS had a Cronbach's alpha = 0.82.

4.4. Procedure

An incidental sampling method was used. Three universities were chosen for the data collection, located in three different geographical regions of Spain that were representative for the purposes of the study: Andalusia (southern Spain), Madrid (central Spain) and Aragón (northern Spain). After the study had been approved by the Ethics Committee, a project leader was appointed at each university. Upon obtaining the consent of the Management Team in their respective Faculties, the three project leaders contacted students and faculty to collect the data. The data was collected voluntarily in the classroom, in a face-to-face format.

Once students had consented to taking part in the study, the Hospital Survey on Patient Safety Culture for nursing students was administered in written form and was completed in the presence of at least one member of the research team, who was able to solve any doubts or concerns participants may have had. The order of presentation of the different instruments was as follows: sociodemographic information, HSOPS-NS Hospital Survey on Patient Safety Culture for nursing students, CSES-Clinical Skills Self-Efficacy Scale, PCNS-Perceived Competence for Nursing Students and BRS-Brief Resilience Scale.

4.5. Data analysis

A descriptive analysis was carried out using means and standard deviation (SD) to describe the quantitative variables. Skewness and kurtosis indicators were applied to test for univariate normal distribution. A confirmatory factor analysis was performed to verify the structure of the Hospital Survey on Patient Safety Culture for nursing students. Goodness of fit was calculated in accordance with the following recommended values: CMIN/df < 4, root mean square error of approximation (RMSEA) < 0.10, comparative fit index (CFI) > 0.95, and incremental fit index (IFI) > 0.95 (Hair et al., 2014; Hu and Bentler, 1999; Kline, 2016). The internal consistency of each scale was calculated using Cronbach's α. Tavakol and Dennick (2011) argue that anything between 0.70 and 0.95 is an acceptable α value.

Between-group differences were analyzed using Student's *t*-test and an ANOVA (the Bonferroni *post-hoc* test was used to identify paired differences), whereas associations between quantitative variables were determined using the Pearson correlation coefficient. All data analyses were conducted using IBM SPSS-22 and AMOS, with a significance level of $p < .05$.

A specific tool in Excel 2007 (Biemann et al., 2012) was used to examine possible differences in patient safety climate (Ginsburg and Gilin-Oore, 2016) and good praxis across different academic levels in each university. The strength and nature of the agreements were measured using the Intraclass Correlation Coefficient (ICC) and Rwg(j). Rwg and ICC(2) values ≥0.70 indicate a high inter-rater agreement and sufficient group mean reliability, respectively. ICC(1) values ≥0.05 indicate a substantial group effect or sufficient between-group variance (Biemann et al., 2012; LeBreton and Senter, 2008).

There were no missing values on the Hospital Survey on Patient Safety Culture for nursing students scale, and on the rest of the scales, the percentage was <1 %, with all missing values being replaced by the mean value of the item.

5. Results

5.1. Demographic characteristics of the participants

The sample was formed by 494 (85 %) woman and 87 (15 %) men, with a mean age of 23.5 (SD: 5.14). Of these, 253 (43.5 %) were from the UNIV-1, 117 (20.1 %) from the UNIV-2, and 211 (36.3 %) from the UNIV-3. Furthermore, 178 (30.6 %) participants were in the second year, 201 (34.6 %) in the third year and 202 (34.8 %) in the fourth year of their undergraduate degree. Information regarding the distribution of participants across the three universities is provided in Table 1.

Table 1
Sociodemographic data.

	n = 253	n = 117	n = 211
	UNIV-1	UNIV-2	UNIV-3
Age, (range), mean and (SD)	[19–50] 22 (4.60)	[21–57] 24 (5.34)	[21–57] 24 (5.39)

	n = 253		n = 117		n = 211	
	UNIV-1		UNIV-2		UNIV-3	
	N	% Valid	N	% Valid	N	% valid
Sex						
Men	40	15.8	14	12	33	5.6
Women	213	84.2	103	88	178	84.4
Academic level						
1st year						
2nd year	109	43.1	17	14.5	52	24.6
3rd year	77	30.4	51	43.6	73	34.6
4th year	67	26.5	49	41.9	86	40.8
Hospital areas						
(1) Outpatient care: day clinics, primary care and physical therapy.	77	30.4	41	35.9	–	–
(2) Medical-surgical inpatient care: medical and surgical inpatient units.	66	26.1	30	25.6	101	47.9
(3) Critical-special services: intensive care, accident and emergency and the OR.	73	28.9	39	33.3	84	39.8
(4) Mother-child inpatient care: maternity and pediatrics, obstetrics and gynecology.	8	3.2	4	4.3	21	10
(5) Other areas.	29	11.5	1	0.9	5	2.3

5.2. Descriptive statistics

The means of the five dimensions of the Hospital Survey on Patient Safety Culture for nursing students ranged from 3.37 (SD: 0.55) for overall perceptions of patient safety, to 4 (SD: 0.70) for individual perception of the overall level of patient safety, with an average of 3.62 (SD: 0.65) for the whole survey. Students scored 7.54 (SD: 1.38) on the Clinical Skills Self-Efficacy Scale, 3.24 (SD: 0.53) on the Perceived Competence for Nursing Students questionnaire and 3.50 (SD: 0.63) on the Brief Resilience Scale (see Table 2).

Next, skewness indexes were calculated for all the scales. The skewness and kurtosis indicators were all <2, indicating a univariate normal distribution.

5.3. Agreement between patient safety climate and students' knowledge of patient safety across different academic years and universities

Table 3 shows the ICC(1), ICC(2) and median Rwg(j) values for the three universities. The Rwg(j) values in parentheses are medians for a non-uniform distribution (slight skew). ICC(1) values <0.05 in UNIV-1 and UNIV-3 reflect insufficient between-group (academic level) variance. ICC(2) > 0.70 indicates sufficient group mean reliability in UNIV-2, partial group mean reliability in UNIV-3, and very near group mean reliability in UNIV-1. Rwg(j) < 0.70 reflects a high level of inter-rater agreement at all three universities. In the Hospital Survey on Patient Safety Culture for nursing students, the proportion of respondents who scored 3.5 and over ("agree" or "strongly agree") for patient safety climate Total Average and Indicator of good praxis was the same as the proportion reporting a positive safety climate and good knowledge of safety, respectively. Agreement percentages for UNIV-1 decreased progressively the higher the academic level, where in UNIV-3 this trend was reversed (see Table 3).

We found differences between UNIV-2 and UNIV-3 in terms of mean patient safety climate scores and strength values ($F_{ratio} = 12.78$, $p < .01$ and $F_{ratio} = 3.87$, $p < .05$, respectively). Differences were also observed between UNIV-1 and UNIV-2 in terms of indicator of good praxis scores and strength values ($F_{ratio} = 3.11$, $p < .05$ and $F_{ratio} = 5.20$, $p < .01$, respectively).

5.4. Differences in patient safety climate, self-efficacy, competence and resilience among different universities, in accordance with different academic levels

An ANOVA was performed to verify possible differences in scores on the different scales in accordance with academic level. A significant increase was found (see Table 4) in the specific self-efficacy of students in all three universities in each subsequent academic year ($p < .01$). Similarly, scores for perceived competence also increased year by year in all three universities. No significant results were observed in terms of resilience.

5.5. Correlations between patient safety and students' self-efficacy, perceived competence and resilience

Table 5 shows the partial correlations between patient safety climate and self-efficacy, competence and resilience, controlling for academic year in the three sub-samples. Self-Efficacy correlated significantly ($p < .01$) with perceived competence and resilience in all three universities. Patient safety climate correlated significantly with all three variables in UNIV-1, and only with perceived competence in UNIV-2. No significant correlations with patient safety climate were found in UNIV-3.

Table 2
Descriptive statistics and reliabilities.

Factor	University	Range	Mean	SD	Skewness	Kurtosis	Cronbach's α
HSOPS-NS							
A - Frequency of events reported (3 items)	University-1	[1–5]	3.40	0.85	−0.23	−0.23	0.80
	University-2	[1–5]	3.57	0.78	−0.08	−0.54	0.69
	University-3	[1–5]	3.63	0.91	−0.76	0.93	0.80
B - Overall perceptions of patient safety[1] (4 items)	University-1	[1–5]	3.36	0.52	−0.51	−0.15	0.60
	University-2	[1–5]	3.34	0.54	0.11	0.22	0.43
	University-3	[1–5]	3.38	0.58	−0.46	0.22	0.60
C – Perception of safety in the unit or area (20 items)	University-1	[1–5]	3.62	0.44	−0.44	0.68	0.85
	University-2	[1–5]	3.72	0.42	−0.29	0.03	0.82
	University-3	[1–5]	3.82	0.44	−0.37	−0.21	0.86
D- Individual perception of the overall level of patient safety[2] (1 item)	University-1	[1–10]	8.14	1.09	−1.13	1.64	–
	University-2	[1–10]	8.09	1.21	−1.71	1.39	–
	University-3	[1–10]	7.79	1.76	−1.53	1.76	–
E- Indicator of good praxis (6 items)	University-1	[1–5]	3.46	0.67	−0.45	0.19	0.73
	University-2	[1–5]	3.52	0.61	−0.62	0.59	0.69
	University-3	[1–5]	3.43	0.63	−0.24	0.12	0.71
HSOPS-total average for P.S. Climate	University-1	[1–5]	3.59	0.46	−0.53	0.51	0.89
	University-2	[1–5]	3.64	0.42	−0.48	0.40	0.87
	University-3	[1–5]	3.62	0.48	−0.61	0.40	0.89
Specific self-efficacy (9 items)	University-1	[1–5]	3.72	0.69	−0.65	0.01	0.85
	University-2	[1–5]	3.96	0.56	−0.57	−0.22	0.82
	University-3	[1–5]	4.08	0.45	−0.38	−0.54	0.79
Perceived competence (10 items)	University-1	[1–5]	3.97	0.54	−29	−0.37	0.82
	University-2	[1–5]	3.32	0.62	−0.25	0.78	0.79
	University-3	[1–5]	3.38	0.63	−0.01	−0.37	0.79
Brief Resilience Scale (5 items)	University-1	[1–5]	3.43	0.63	−0.01	−0.37	0.82
	University-2	[1–5]	3.77	0.62	−0.22	0.20	0.80
	University-3	[1–5]	3.41	0.61	−0.56	−0.03	0.81

(1) If item 10 deleted.
(2) Alpha not calculated, only 1 item.

Table 3
HSOPS-NS Patient Safety Climate (PSC) dimension agreement indexes.

	A		B		C		D						E	
			"Academic level"		Median	Rwg (j)	Percent	Rwg	Percent	Rwg	Percent	Rwg	ANOVA	
Dimension	Scale mean	(SD)	ICC (1)	ICC (2)	n = 3 levels		2nd year		3rd year		4th year		F ratio	
UNIV-1 (n = 253)														
HSOPS-NS (E) indicator of good praxis[1]	3.47	(0.68)	0.02	0.68	0.76	(0.65)	53.2 %	0.72	39.0 %	0.65	38.8 %	0.57	3.11	$p < .05$
PSC total average[2]	3.58	(0.46)	0.02	0.63	0.89	(0.83)	66.1 %	0.87	53.2 %	0.86	49.3 %	0.78	2.67	$p = .07$
UNIV-2 (n = 117)														
HSOPS-NS (E) indicator of good praxis[1]	3.53	(0.61)	0.10	0.81	0.80	(0.70)	41.2 %	0.56	58.8 %	0.82	49.0 %	0.72	5.20	$p < .01$
PSC total average[2]	3.64	(0.42)	0.23	0.92	0.92	(0.88)	35.3 %	0.84	84.3 %	0.91	61.2 %	0.88	12.78	$p < .01$
UNIV-3 (n = 211)														
HSOPS-NS (E) indicator of good praxis[1]	3.43	(0.63)	0.01	0.14	0.80	(0.70)	40.4 %	0.71	42.5 %	0.67	44.2 %	0.86	1.17	$p = .33$
PSC total average[2]	3.63	(0.49)	0.04	0.74	0.89	(0.83)	51.9 %	0.80	61.6 %	0.81	73.3 %	0.86	3.87	$p < .05$

(1) The Rwg index was used for single item measures.
(2) Rwg(j) was used for multiple item measures.
A = Climate level mean and Standard Deviation for Indicator of good praxis and Patient Safety Climate (Total Average).
B = ICC(1) within-group and between-group variability, ICC(2) reliability of academic group means.
C = Rwg(j) is a measure of absolute agreement in the ratings endorsed for good praxis and Patient Safety Climate (Total Average) by students at the three different academic levels. Values in parenthesis are median Rwg(j) values for a slightly skewed distribution.
D = Percentage of "Agree" and "Strongly Agree" answers by academic level, and their Rwg(j).
E = The F ratio is the result of an ANOVA testing differences between academic levels and their statistical significance.

6. Discussion

Several organizations (EUNetPaS project, 2010; World Health Organization, 2017) have highlighted the importance of patient safety for healthcare education. The main aim of the present study was to analyze levels of agreement or homogeneity regarding patient safety

Table 4
Means and descriptive values for the PSC dimensions, self-efficacy, resilience, and perception of competence, and differences between the three universities (ANOVA controlling for academic level).

UNIV-1	2nd year	3rd year	4th year	ANOVA	*p*		
	n = 109	n = 77	n = 67		2–3	2–4	3–4
	Mean (SD)	Mean (SD)	Mean (SD)				
HSOPS-A	3.47 (0.87)	3.37 (0.82)	3.31 (0.86)	$F(250,2) = 0.72$ n.s.	0.72	0.49	0.93
HSOPS-B	3.39 (0.50)	3.37 (0.51)	3.33 (0.56)	$F(250,2) = 0.27$ n.s.	0.96	0.74	0.90
HSOPS-C	3.71 (0.39)	3.57 (0.41)	3.53 (0.52)	$F(250,2) = 4.72$**	0.06	**0.01**	0.84
HSOPS-D	8.28 (0.96)	8.05 (0.97)	8.01 (1.37)	$F(250,2) = 1.65$ n.s.	0.33	0.25	0.95
HSOPS-E	3.57 (0.61)	3.45 (0.68)	3.32 (0.67)	$F(250,2) = 3.11$*	0.42	**0.03**	0.47
HSOPS PSC	3.66 (0.42)	3.56 (0.44)	3.50 (0.55)	$F(250,2) = 2.67$ n.s.	0.30	0.07	0.75
Specific self-efficacy	3.22 (0.66)	4.00 (0.43)	4.23 (0.39)	$F(250,2) = 89.86$**	**0.01**	**0.01**	**0.01**
Perceived competence	2.77 (0.51)	3.24 (0.47)	3.36 (0.43)	$F(250,2) = 38.01$**	**0.01**	**0.01**	0.31
Resilience	3.43 (0.58)	3.41 (0.68)	3.44 (0.63)	$F(250,2) = 0.29$ n.s.	0.97	0.84	0.74

UNIV-2	2nd year	3rd year	4th year	ANOVA	*p*		
	n = 17	n = 51	n = 49		2–3	2–4	3–4
	Mean (SD)	Mean (SD)	Mean (SD)				
HSOPS-A	3.03 (0.76)	3.80 (0.80)	3.51 (0.67)	$F(114,2) = 6.96$**	**0.01**	0.06	0.13
HSOPS-B	3.10 (0.44)	3.51 (0.45)	3.25 (0.61)	$F(114,2) = 5.05$*	**0.02**	0.56	**0.04**
HSOPS-C	3.45 (0.44)	3.86 (0.37)	3.67 (0.41)	$F(114,2) = 7.67$**	**0.02**	0.12	**0.04**
HSOPS-D	7.76 (1.03)	8.39 (0.87)	7.90 (1.49)	$F(114,2) = 2.91$ n.s.	0.15	0.92	0.15
HSOPS-E	3.25 (0.76)	3.72 (0.49)	3.42 (0.61)	$F(114,2) = 5.20$*	**0.02**	0.56	**0.04**
HSOPS PSC	3.34 (0.46)	3.84 (0.34)	3.56 (0.40)	$F(114,2) = 12.78$**	**0.01**	0.13	**0.01**
Specific self-efficacy	3.43 (0.64)	3.83 (0.48)	4.29 (0.39)	$F(114,2) = 24.56$**	**0.01**	**0.01**	**0.01**
Perceived competence	2.97 (0.66)	3.24 (0.63)	3.54 (0.51)	$F(114,2) = 6.74$*	0.20	**0.02**	**0.04**
Resilience	3.63 (0.67)	3.77 (0.66)	3.84 (0.55)	$F(114,2) = 0.71$ n.s.	0.71	0.47	0.85

UNIV-3	2nd year	3rd year	4th year	ANOVA	*p*		
	n = 52	n = 73	n = 86		2–3	2–4	3–4
	Mean (SD)	Mean (SD)	Mean (SD)				
HSOPS-A	3.62 (1.01)	3.58 (0.99)	3.69 (0.78)	$F(208,2) = 0.25$ n.s.	0.97	0.92	0.76
HSOPS-B	3.34 (0.67)	3.30 (0.59)	3.49 (0.53)	$F(208,2) = 2.26$ n.s.	0.89	0.35	0.11
HSOPS-C	3.73 (0.44)	3.76 (0.48)	3.94 (0.41)	$F(208,2) = 4.98$*	0.95	**0.02**	**0.03**
HSOPS-D	7.38 (2.19)	7.0.61 (1.76)	8.18 (1.39)	$F(208,2) = 3.98$*	0.74	**0.03**	0.10
HSOPS-E	3.38 (0.62)	3.38 (0.67)	3.51 (0.60)	$F(208,2) = 1.17$ n.s.	0.99	0.44	0.38
HSOPS PSC	3.54 (0.50)	3.57 (0.52)	3.74 (0.44)	$F(208,2) = 3.87$*	0.98	**0.05**	**0.05**
Specific self-efficacy	3.77 (0.50)	4.07 (0.42)	4.29 (0.33)	$F(208,2) = 25.99$**	**0.01**	**0.01**	**0.01**
Perceived competence	3.16 (0.44)	3.51 (0.32)	3.42 (0.36)	$F(208,2) = 13.21$**	**0.01**	**0.01**	0.32
Resilience	3.38 (0.64)	3.50 (0.58)	3.36 (0.62)	$F(208,2) = 4.55$ n.s.	0.51	0.98	0.30

HSOPS-A frequency of events reported.
HSOPS-B overall perceptions of patient safety.
HSOPS-C perception of patient safety in the unit or area.
HSOPS-D individual perception of the overall level of patient safety.
HSOPS-E indicator of good praxis.
HSOPS PSC total average for Patient Safety Climate (PSC).
See statistically significant differences (in bold) between the three samples, according to the ANOVA and Tukey post-hoc tests.
Levene's test was not significant for any of the means.
** $p < .01$.
* $p < .05$.

climate and students' knowledge of patient safety (good praxis) across different academic years and universities. We also aimed to analyze correlations between patient safety and students' self-efficacy, perceived competence and resilience, thereby gaining a broader picture of the situation in each university.

Rather than comparatively analyzing possible differences between the three universities, in this case, the Hospital Survey on Patient Safety Culture for nursing students provides a separate profile for each one. Specifically, we explored how the Hospital Survey on Patient Safety Culture for nursing students could be applied to the educational process in each university to test the strength and nature of patient safety climate, as well as the good praxis indicator. ICC(2) values revealed good inter-rater agreement between three academic levels (2nd, 3rd and 4th years of the degree course) in all three universities, with the only the exception being the good praxis indicator in UNIV-3, which had a low inter-rater agreement. These indicators reveal three different situations:

A downwards trend of the Rwg indicators in both variables was observed in UNIV-1. This is consistent with the higher concentration of specific patient safety contents during the 2nd year of the degree, and the practical training provided in special areas/units (i.e., the Operating Room or Accident and Emergency) during the 3rd year, when nursing students are more in contact with adverse events. In the transition from 3rd to 4th year, students return to primary care and inpatient units. The stability of the agreement percentages may therefore be explained by students' greater experience with and sensitivity to adverse events during this final year of their degree.

A low agreement percentage was observed in UNIV-2 during the 2nd year. The F ratios were statistically significant in both variables, with a

Table 5
Partial correlations between nurses' specific self-efficacy, perceived competence, resilience, and Patient Safety Climate (PSC), controlling for academic year.

Sample	Specific self-efficacy	Perceived competencies	Resilience	PSC
UNIV-1	Specific self-efficacy			
n = 253	Perceived competence	0.31**		
	Resilience	0.26**	0.12*	
	PSC	0.15*	0.18**	0.14*
UNIV-2	Specific self-efficacy			
n = 117	Perceived competence	0.31**		
	Resilience	0.27**	n.s.	
	PSC	n.s.	0.24**	n.s.
UNIV-3	Specific self-efficacy			
n = 211	Perceived competence	0.48**		
	Resilience	0.22**	0.29**	
	PSC	n.s.	n.s.	n.s.

Note: Variables are normally distributed, there are no significant outliers and correlations conform to a linear relationship.
* $p < .05$.
** $p < .01$.

higher average strength and nature of patient safety climate, and a good praxis score that is consistent with regular teaching of patient safety content during the 3rd and 4th years at this university. The low agreement percentages observed during the 2nd year may be explained by the fact that practical training is carried out in only two units during this period: the medical and surgical inpatient units. During the 2nd year, patient safety teaching is the opposite of that observed in UNIV-1. Another possible reason for the higher agreement percentages observed during the 3rd year of the degree may be the greater diversification of the units or areas in which practical training takes place. Unlike in UNIV-1, in UNIV-2, practicum evaluations include indicators related to the achievement of competences linked to patient safety, which may make students more aware of the different risk situations.

A stable pattern was observed for good praxis in UNIV-3, along with an upwards trend in patient safety climate percentages across the academic years. In relation to the good praxis indicator, its low value at ICC (2) reflects poor reliability, even when the similar values of Rwg indicators during all three academic years are taken into account. In the case of total average patient safety climate, Rwg values reflect strong agreement, with a high percentage during the 4th year. This may be explained by the specific practical training provided in the intensive care and emergency units during this 4th year, in which special attention must be paid to patient safety.

These findings reveal different types of patient safety education (Levett-Jones et al., 2020; Tella et al., 2014; Torkaman et al., 2020) and different distributions of practical training across academic levels. Learning about patient safety can make students more confident (VanDenKerkhof et al., 2017), but it is unclear whether or not undergraduate degree programs provide an effective education in this field (Baernholdt et al., 2022).

In terms specific self-efficacy and perceived competence, consistently with the findings reported by Orkaizagirre-Gómara et al. (2020), a significant increase was observed in all three universities across the different academic levels. Indeed, perceived competence has been described as an attribute of resilience for nursing professionals (Cooper et al., 2020; Hart et al., 2014), and the perception of effective patient care among these professionals seems to be associated with more psychological empowerment (Hart et al., 2014). However, the relationship between these three variables and patient safety climate, controlling for academic level, was only significant in UNIV-1, possibly due to the high concentration of patient safety teaching content during the early years of the degree taught at that institution.

It is likely that, as nursing students progress in their acquisition of patient safety knowledge (good praxis) and competence, their self-efficacy and perceived competence increase and they feel more secure in their decisions and see themselves as more capable of overcoming challenges. Our results indicate the ability of the Hospital Survey on Patient Safety Culture for nursing students scale to detect changes regarding perception of patient safety and good praxis across different academic levels.

The present results also support the relationship between patient safety's different factors and resilience, self-efficacy, and perceived competence, variables that have been shown to be associated with patient safety in clinical environments (Han et al., 2020; Smith and Plunkett, 2019). Although some authors argue that self-efficacy and perceived patient safety are not related among nurses working in clinical settings (Harsul et al., 2020), the role of resilience in patient safety seems to be clearer, as indeed stated earlier in this paper (Vos et al., 2020). The interaction between self-efficacy, perceived competence and resilience therefore seems to be of vital importance for fostering both patient safety and its perception. Whereas self-efficacy and perceived competence are built on and enhanced by the knowledge acquired throughout a student's academic career, our three profiles indicate that resilience is not directly enhanced through the academic curriculum.

As argued by Vos et al. (2020), these relationships, coupled with the important influence that resilience seems to have on patient safety, highlight the need to train students to become more resilient in order to enhance patient safety, in accordance with a resilient safety or Safety-II approach, which focuses on adaptability, flexibility and robustness (Hollnagel et al., 2015; Smith and Plunkett, 2019; Vos et al., 2020). The different profiles identified here suggest that instructors should take advantage of the opportunity to train nurses in how to take care not only of patients, but themselves also, promoting the development of general resilience (Amsrud et al., 2019) that may eventually lead to specific resilience adapted to a working environment.

Despite the promising results outlined above, some limitations merit further discussion. First, bearing in mind the important role played by resilience in patient safety, it would be interesting to analyze the relationship between the Hospital Survey on Patient Safety Culture for nursing students and different dimensions of resilience, such as those described by Vos et al. (2020). Second, the study was conducted in a specific geographical environment. Transcultural studies are required in the future to assess these factors across different cultures.

7. Conclusions and implications for education and policy

This study helps analyze patient safety knowledge levels, as well the level of agreement in terms of patient safety climate. It offers a differential and specific diagnosis of patient safety integration in nursing education programs (Levett-Jones et al., 2020; Tella et al., 2014) and provides insight into university curricula. Other psychosocial variables may also contribute to a broader diagnosis.

From a resilient and Safety-II perspective, patient safety has become increasingly important in recent years, in both clinical and social environments. It is therefore important to assess it, as it has been found to be associated with other competencies such as resilience. The results of the present study also indicate how academic training can enhance self-efficacy and perceived competence, which, alongside resilience, seem to play a role in patient safety perception among nursing students. Further research is required to test whether these results are replicated in different nursing education programs and different countries.

CRediT authorship contribution statement

Manuel Sánchez De Miguel: Investigation, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Javier Ortiz de Elguea:** Conceptualization, Resources, Supervision. **Ainara Gómez-Gastiasoro:** Formal analysis, Writing – original draft. **Fernando Urcola:** Investigation, Data curation. **Maria Gema Cid-Expósito:**

Investigation, Data curation. **Dolores Torres-Enamorado:** Investigation, Data curation. **Aintzane Orkaizagirre-Gomara:** Conceptualization, Resources.

Declaration of competing interest

None.

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Author contribution

All authors listed on the title page participated in the full process of designing, planning and implementing the study.

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