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## Original research

# Knowledge, skills and attitudes related to evidence-based practice among undergraduate nursing students: A survey at three universities in Colombia, Chile and Spain

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## ABSTRACT

Teaching nursing students about the model of evidence-based practice is a challenge for university faculty. The aim of this study was to measure knowledge, skills and attitudes related to evidence-based practice among undergraduate nursing students, as well as associated factors. The study involved a cross-sectional design using a survey of all students enrolled in a Bachelor of Nursing programme (1st to 4th year) in three nursing faculties of universities in Chile, Colombia and Spain. The Spanish version of the Evidence-Based Competence Questionnaire was used to measure knowledge, skills, attitudes and overall competency.

In total, 875 students completed the questionnaire. The overall score of competency in evidence-based practice was similar in all three universities (range 1–5) (3.63 in Chile, 3.58 in Colombia and 3.68 in Spain). The score of self-rated attitudes was strongly correlated with the overall competency measured. More hours of training in research methods and reading nursing journals articles in the last month were the factors associated with higher scores in evidence-based practice competency. The undergraduate nursing students at the three universities surveyed obtained a high score in overall competency in evidence-based practice. No differences were found among them, despite the different approaches used in educational programmes.

## 1. Introduction

The evidence-based practice (EBP) model has developed greatly in recent decades and is proposed for application in the delivery of healthcare in a variety of professional fields, including nursing (Melnyk and Fineout-Overholt, 2011; Hickman et al., 2014). The EBP model offers advantages for both patients (Parker, 2002; Talsma et al., 2008) and nurses (Melnyk et al., 2012). It influences both the practice and the education of nurses, emphasising the need to acquire new competencies (Häggman-Laitila et al., 2016). These competencies have been included in various consensus documents (such as the Sicilian Declaration), which conclude that all health professionals should understand the principles of the EBP model, take a critical view of their own professional practice and implement EBPs (Dawes et al., 2005). The education of nursing students should take into account their reactions to the educational experience, knowledge and attitudes towards EBP, and skills and self-efficacy regarding its use (Tilson et al., 2011).

The implementation of EBP remains a challenge for the nursing profession (Häggman-Laitila et al., 2016; Ruzafa-Martinez et al., 2016) as nurses often feel that they lack sufficient knowledge and skills to implement it, even though its use is positively perceived (Stichler et al., 2011). In order to promote its implementation, the following measures have been proposed: improving attitudes, knowledge and skills related to EBP in clinical nurses so that they can integrate and retain these competencies (Melnyk et al., 2008; Hickman et al., 2014); increasing teachers' understanding, participation and level of commitment to EBP; and measuring the effectiveness of educational programmes (Malik et al., 2016).

Currently, education on research methods and on the EBP model is considered standard in the learning programmes designed for nurses and other health professionals (Hickman et al., 2014). In this context, a study concluded that 3 years of EBP learning in the nursing degree is helpful for developing the skills related to EBP (Finotto et al., 2013).

However, there is no consensus on how training of nurses in EBP

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should be implemented in undergraduate studies (Ruzafa-Martinez et al., 2015; Malik et al., 2016). Therefore, teachers have the challenge and responsibility to integrate this learning through innovative methodologies (Hickman et al., 2014).

Competency has been defined as the capability to choose and use an integrated combination of knowledge, skills and attitudes with the intention of performing a task in a certain context (Korthagen, 2004). The assessment of competency (knowledge, skills and attitudes) in EBP of nursing students can be a very useful tool, not only as an indicator of future use of evidence in nursing practice, but also to develop teaching strategies adapted to the educational needs in each context (Brown et al., 2010).

The literature on the acquisition of EBP competencies is rich. There are studies focusing on the instruments used to measure the EBP competencies of nurses (Leung et al., 2016) or nursing students (Ruzafa-Martinez et al., 2013; Llasus et al., 2014; Upton et al., 2016; Yildiz and Güngörmüş, 2016; Ureña Molina et al., 2017); others focused on the models used to guide training in EBP such as the ARCC-E model, the TRADE EBP model and the SON model (Ruzafa-Martinez et al., 2016); and finally, there are studies evaluating the effectiveness of the interventions used to teach EBP (Young et al., 2014; Kyriakoulis et al., 2016). The participation of undergraduate students in clinical research projects increases their knowledge and skills, as well as changes their attitudes towards EBP in a positive direction (André et al., 2016). Multifactorial interventions and the use of technologies based on web and mobile devices seem to be the most effective (Kyriakoulis et al., 2016).

Only a few studies have compared EBP competencies in nursing students across universities and/or countries (Brown et al., 2010; Brooke et al., 2015), and we have not identified any study that specifically refers to Spanish-speaking countries.

## 2. Aims

The aims of this study were to: a) measure the competency (composed of knowledge, skills and attitudes) in EBP in nursing students at three Ibero-American universities (in Chile, Colombia and Spain), and b) explore what students factors could be associated with EBP competency.

## 3. Methods

### 3.1. Design and setting

A cross-sectional survey study was conducted in three Ibero-American universities (located in Chile, Colombia and Spain). The survey was carried out in 2016.

In these three countries, nursing studies are at the university level (Bachelor's degree); the duration of the programme is 4 years in Colombia and Spain and 5 years in Chile. The academic education included theoretical training and practical experience in healthcare centres. In Spain, the study was conducted in the Faculty of Health Sciences of a public university located in the south of the country; in Colombia, in the Faculty of Health Sciences of a public university located in the northeast region of the country, and in Chile, at the Faculty of Nursing of a public university in the south.

Basic training on research methods is provided at the three universities over the first 3 years. At the university located in Chile, there is a specific course on EBP; however, there is no such course at the other two universities, but the contents about EBP (literature search, critical appraisal, evidence transfer) and about research methods (epidemiology and data analysis) was embedded in other courses and the degree thesis (Table 1).

The study included students who were enrolled in the nursing programme, years 1–4 (5th year students in Chile were not included as they did not receive any education on campus, but clinical placement).

There were no exclusion criteria. Participation was offered to all enrolled students in order maximize the sample size.

Sample size was not calculated "a priori". Instead, an "a posteriori" power analysis was carried out. The final sample collected, in the three groups, allowed the detection of an effect size of 0.107 in the mean difference for the overall score of EBP competency (main variable), with an alpha error of 5% and a power of 80%.

### 3.2. Data collection

Three sets of instruments were used for data collection: the Spanish version of the Evidence-Based Practice Competence Questionnaire (EBP-COQ); a questionnaire on self-rated knowledge, skills and attitudes; and a demographic questionnaire.

The EBP-COQ in the Spanish version (Ruzafa-Martinez et al., 2013) was used to measure knowledge, skills and attitudes towards EBP and calculate an overall competency score. This questionnaire contains 25 items grouped into three factors: Attitudes, Skills and Knowledge, with a Likert-type item response scale having 5 points (1- Strongly disagree to 5 - Strongly agree). It has high internal consistency (Cronbach alpha = 0.88) and good values for construct and discriminant validity. Some minor changes were made to the wording of some items prior to their use in Chile and Colombia, for cultural adaptation.

The self-rated questionnaire was also developed by Ruzafa-Martinez et al. (2013). In this questionnaire, students were asked to score themselves on a scale of 0–10 points (where more points mean more confident in having this skill) on eight items: EBP attitude, EBP skills, EBP knowledge, attitude toward EBP promotion, attitude of other students toward EBP, knowledge of English language, computer skills and knowledge of statistics.

The demographic questionnaire included: gender, age, work activity, year in the nursing programme, learning on research methods and on EBP, and the number of nursing journals articles read in the last month (as estimated by students), as a proxy for students' reading habits of journal articles (Ruzafa-Martinez et al., 2013).

The questionnaires were distributed on paper to students in the classroom during a class (in Chile and Colombia) or completed online using a secure web (SurveyMonkey) (in Spain, for convenience, and with students in the last semester in Colombia, because they were out of the classroom, in clinical placement). In case where questionnaires were administered online, a reminder was sent to the students after 10 days, as a way to improve the response rate.

### 3.3. Ethical aspects

Permission to use the EBP-COQ was obtained from Dr. Ruzafa-Martinez. The academic directors and the IRB of the three faculties authorized the study. Oral and written information was provided on the nature of the study and students gave their consent to complete the questionnaires. No personal data were collected, so the data were anonymised.

### 3.4. Data analysis

Data were tabulated, cleaned and coded prior to statistical analysis. Cases with more than two items not answered in the EBP-COQ questionnaire were eliminated. According to the instructions for scoring the EBP-COQ questionnaire, the scores for certain items were reversed. The overall score and the score on each of the three subscales were calculated. The scoring range is 1–5, where a higher score indicates greater competency in the measured aspect.

For the descriptive analysis, frequencies and percentages were used for categorical variables; means and standard deviations for continuous variables. The adjustment of the normal distribution was verified using the Kolmogorov-Smirnoff test. A bivariate analysis was conducted using ANOVA or Kruskal-Wallis test (depending on the type of distribution).

**Table 1**  
Courses related to evidence-based practice in the undergraduate nursing programme in the three universities.

Year	University		
	Spain	Colombia	Chile
1st year	Information system and data analysis in healthcare 1st semester 6 ECTS <sup>a</sup>	Epidemiology 2nd semester 2 credits	English for communication (Beginner) 1st semester English for communication (Basic) 2nd semester
2nd year	Family and Community Nursing I 1st semester 6 ECTS	Integrated course for Research I 3th semester 2 credits Integrated course for Research II 4th semester 5 credits	–
3 <sup>th</sup> year	–	Integrated course for Research III 5th semester 4 credits	Methods for quantitative research 5th semester Methods for qualitative research 6th semester
4th year	Degree thesis 2nd semester 6 ECTS	Degree project 8th semester	Evidence Based Nursing 7th semester

<sup>a</sup> ECTS: European Credit Transfer System. One ECTS is equal to 25 working hours for students.

Correlations were measured using the Spearman rank order correlation test. Effect size was measured using the Cohen's *d* value (2 groups) or the  $\eta^2$  statistic (3 or more groups) considering  $\eta^2 > 0.01$  to be a small effect;  $\eta^2 > 0.06$  a medium effect, and  $\eta^2 > 0.14$  a large effect (Cohen, 1988). Two-tailed tests were used, using a value of  $p < 0.05$  for statistical significance.

## 4. Results

### 4.1. Students demographic and educational characteristics

The study included 875 students: 240 in Spain (response rate: 41.7%), 292 in Colombia (response rate: 91.8%) and 343 in Chile (response rate: 69.8%). After the elimination of the incomplete questionnaires, the final sample analysed was 846 students (221 in Spain, 291 in Colombia and 334 in Chile). Demographic and educational characteristics of the students appear in Table 2.

### 4.2. Comparison in EBP competency among the universities

Table 3 shows the overall EBP competency score and sub-scales scores measured by EBP-COQ. There are no differences between the three universities in the overall score ( $p = 0.054$ ), nor in the skills subscale ( $p = 0.34$ ); however there are differences in attitudes ( $p < 0.0001$ ) (medium effect size) and knowledge ( $p < 0.0001$ ) (large effect). Post-hoc tests reveal differences between the students from the three universities in these two sub-scales. In the attitudes subscale, the highest score was obtained from the university in Chile, while the knowledge subscale obtained the highest score in Colombia. The scores obtained on the student self-rated scale for the EBP and some technical skills show differences ( $p < 0.0001$ ) among the three universities in all aspects except "Attitudes of other students" ( $p = 0.18$ ). The effect size ranges from small to medium. Students from the university in Spain scored higher in English; those from Colombia in EBP knowledge, EBP skills and statistics; and those from Chile in EBP attitudes and computer skills.

The correlations between the EBP-COQ scores and the students' self-rated scores have been analysed (Table 4). Some differences among the three universities have been found in the pattern of correlations, especially for the overall EBP score and the skills subscale. Different self-rated factors showed the highest correlation with the overall EBP score, according to the university; in Spain was the attitudes, in Chile the knowledge, whereas in Colombia was the self-rated computer skills.

**Table 2**

Characteristics of the students enrolled in nursing programme at the three Universities.

	Spain N = 221	Colombia N = 291	Chile N = 334
	Frequency (%)	Frequency (%)	Frequency (%)
Age (mean; SD)	22.2; 5.3	20.2; 2.4	20.3; 1.9
Genre			
Women	166 (75.1)	224 (77.0)	264 (79.0)
Men	52 (23.5)	67 (23.0)	68 (20.4)
Year			
1st year	17 (7.7)	82 (28.2)	95 (28.4)
2nd year	152 (68.8)	69 (23.7)	100 (29.9)
3 <sup>th</sup> year	22 (10.0)	76 (26.1)	68 (20.4)
4th year	28 (12.7)	64 (22.0)	70 (21.0)
Other studies			
Yes	37 (16.7)	38 (13.1)	19 (5.7)
No	181 (81.9)	252 (86.6)	310 (92.8)
Working			
Yes	22 (10.0)	48 (16.5)	32 (9.6)
No	190 (86.0)	243 (83.5)	295 (88.3)
Learning on EBP <sup>a</sup>			
No	144 (65.2)	167 (57.4)	216 (64.7)
Less than 40 h	57 (25.8)	72 (24.7)	66 (19.8)
40 h or more	11 (5.0)	50 (17.2)	36 (10.8)
Learning on research methods <sup>a</sup>			
No	149 (67.4)	124 (42.6)	173 (51.8)
Less than 40 h	48 (21.7)	69 (23.7)	73 (21.9)
40 h or more	15 (6.8)	97 (33.3)	76 (22.8)
Number of nursing journals articles read in last month <sup>b</sup>			
No	93 (42.1)	74 (25.4)	170 (50.9)
1 to 5	78 (35.3)	181 (62.2)	146 (43.7)
6 or more	21 (9.5)	35 (12.0)	9 (2.7)

<sup>a</sup> Hours of learning on EBP or research methods estimated by the students.

<sup>b</sup> As estimated by the students.

The self-rated knowledge of the English language only correlates with the overall EBP score in Spain, but not with the others.

### 4.3. Educational factors and EBP competency

The hypothesis that students in higher years would score higher on the EBP-COQ questionnaire was tested. The data presented in Table 5 reveal that there is an association between the scores in EBP competency and the year in the nursing programme at the universities in Colombia ( $p < 0.0001$ ) and Chile ( $p < 0.0001$ ) (strong size effect),

**Table 3**  
Comparisons for EBP overall score and knowledge, skills and attitudes score among the three Universities.

	Spain A	Colombia B	Chile C	Significance <sup>a</sup>	Effect size <sup>b</sup> $\eta^2$	Pairs comparison <sup>c</sup>
	Mean (SD)	Mean (SD)	Mean (SD)			
<b>EBP-COQ questionnaire (range 1–5)</b>						
Attitudes subscale	4.08 (0.50)	3.82 (0.53)	4.20 (0.41)	< 0.0001	0.107	A-B; A- C; B- C
Skills subscale	3.42 (0.65)	3.45 (0.55)	3.50 (0.67)	0,34		
Knowledge subscale	3.05 (0.70)	3.19 (0.62)	2.53 (0.76)	< 0.0001	0.157	A-B; A- C; B- C
EBP overall score	3.68 (0.46)	3.58 (0.41)	3.63 (0.42)	0.054		
<b>Self-rated scales (range 1–10)</b>						
Attitudes	7.30 (1.82)	6.51 (1.83)	7.56 (1.91)	< 0.0001	0.058	A-B; A- C; B- C
Knowledge	5.38 (1.92)	5.66 (1.91)	4.29 (2.54)	< 0.0001	0.075	A-C; B-C
Skills	5.25 (2.02)	5.72 (2.0)	4.47 (2.56)	< 0.0001	0.056	A-B; A- C; B- C
Promotion attitude	6.90 (1.98)	6.23 (1.88)	6.81 (2.18)	< 0.0001	0.020	A-B; B-C
Other students attitude	5.72 (1.87)	5.45 (1.77)	5.54 (2.06)	0.182		
English	5.94 (2.22)	5.13 (2.03)	5.64 (2.29)	< 0.0001	0.022	A-B; B-C
Computer use	6.13 (2.05)	6.52 (1.94)	7.49 (1.97)	< 0.0001	0.078	A-B; A- C; B- C
Statistic	4.99 (2.05)	5.10 (2.30)	4.24 (2.47)	< 0.0001	0.029	A-C; B-C

<sup>a</sup> One-way ANOVA with Welch robust test for EBP-COQ questionnaire. Kruskal-Wallis test for Self-rated scales.

<sup>b</sup> Effect size estimated with General Lineal model. Effect size  $\eta^2$  0.01 = small, 0.06 = medium, 0.14 = large.

<sup>c</sup> Pairs differences with significance  $p < 0.05$  in post-hoc analysis; T2 test for EBP-COQ questionnaire; Mann-Witney test form Self-rated scales.

but not in Spain ( $p = 0.108$ ), where there is only association for the attitudes subscale ( $p = 0.001$ ) (with a moderate effect). For students in Colombia and Chile, the scores obtained for both the overall competency and the knowledge, skills and attitudes are progressively higher as the years of the programme increase.

The association between EBP scores and learning on research methods or the frequency of reading nursing journal articles was analysed using a one-way ANOVA (Table 6). The learning on research methods is significantly associated with the overall EBP score and with skills and knowledge, but not with attitudes (except at the university in Chile). The effect size is small for the university in Spain, and moderate or high for the other two universities. A post-hoc analysis only found significant differences between students who had not received education versus those who had more than 40 h of learning, but not for those who had a shorter course length. Learning on EBP are significantly associated with the knowledge subscale scores (at all three universities), but not with the overall EBP score or other subscales. The effect size varies from moderate to large. The post-hoc analysis reveals that significant differences are only found for students who have not received any education on EBP compared to those who have received more than 40 h of learning, but not for those who have received shorter courses.

The frequency of reading nursing journals articles in last month is significantly associated with the score of competencies in EBP, both overall and the three subscales. This association appears in all three universities and has a moderate to large effect size. Post-hoc analysis reveals that there are only differences between students who do not

read any article in last month and those who read some articles, with no differences between those who read between 1 and 5 articles and those who read 6 or more.

## 5. Discussion

This article reports on a comparative study of the competencies in EBP of undergraduate nursing students in three Faculties in Chile, Colombia and Spain, offering a new international perspective. No differences were found among the three universities in the overall EBP score, nor in the three sub-scales: Attitudes, Knowledge and Skills. Self-rated attitudes, knowledge and skills, and computer use are the factors that show the strongest correlations with the overall EBP score, as measured by the EBP-COQ questionnaire.

The score in competencies in EBP obtained by students at the three universities was high (from 71.6 to 73.6% of the maximum score). These results reveal similar values to those obtained by Ruzafa-Martínez et al. (2015) (77.4%), Ruzafa-Martínez et al. (2016) (72.4%), and higher than those obtained by Ashktorab et al. (2015) in Iran (62%). Although the three universities have different learning programmes, no significant differences were found in the overall score for EBP competency, although differences were found for the attitudes and knowledge subscales. While the Chilean students revealed better attitudes toward EBP, the Colombian students received the best score in knowledge. This could be explained by the higher number of credits in specific EBP courses and in research methods in the programmes of these universities, but some other factors such as teaching styles, may

**Table 4**  
Correlations between knowledge scores of the EBP-COQ questionnaire and scores on the students' Self-rated scales. Spearman rank order test. Only the values with significance ( $p < 0.05$ ) are shown. For each column in bold the greatest correlation.

Self-rated scales	EBP-COQ questionnaire											
	Attitudes sub-scale			Skills sub-scale			Knowledge sub-scale			EBP overall score		
	Spain	Colombia	Chile	Spain	Colombia	Chile	Spain	Colombia	Chile	Spain	Colombia	Chile
Attitudes	0.618	<b>0.376</b>	<b>0.512</b>	0.478	0.265	0.285	0.299		0.140	<b>0.612</b>	0.367	0.451
Skills	0.285		0.209	<b>0.522</b>	0.186	<b>0.366</b>	0.464	0.432	0.537	0.477	0.254	0.490
Knowledge	0.309		0.229	0.522	0.167	0.324	<b>0.552</b>	<b>0.443</b>	<b>0.598</b>	0.543	0.292	<b>0.515</b>
Attitude on EBP promotion	<b>0.621</b>	0.312	0.444	0.434	0.323	0.219	0.242	0.177	0.226	0.573	0.374	0.416
Others students Attitude	0.324		0.232	0.295	0.205	0.139	0.353	0.216	0.261	0.418	0.170	0.301
English				0.207	0.141					0.133		
Computer use	0.261	0.301		0.351	<b>0.420</b>	0.236	0.164	0.205		0.318	<b>0.400</b>	0.197
Statistic	0.249	0.308		0.402	0.382	0.337	0.330	0.173	0.305	0.398	0.393	0.326

**Table 5**  
Comparisons for EBP score according to the year in the nursing programme.

	Year	Spain			Colombia			Chile		
		Mean (SD)	Sig. <sup>a</sup>	Effect size <sup>b</sup> η <sup>2</sup>	Mean (SD)	Sig.	Effect size <sup>b</sup> η <sup>2</sup>	Mean (SD)	Sig.	Effect size <sup>b</sup> η <sup>2</sup>
<b>Attitudes</b>	1st yr	4.23 (0.53)	<b>0.001</b>	0.078	3.73 (0.49)	< <b>0.0001</b>	0.206	4.07 (0.45)	< <b>0.0001</b>	0.061
	2nd yr	4.00 (0.50)			3.48 (0.42)			4.19 (0.37)		
	3 <sup>th</sup> yr	4.29 (0.36)			3.94 (0.46)			4.22 (0.39)		
	4 <sup>th</sup> yr	4.34 (0.45)			4.15 (0.52)			4.36 (0.37)		
<b>Skills</b>	1st yr	3.64 (0.65)	0.425		3.38 (0.48)	< <b>0.0001</b>	0.257	3.32 (0.81)	<b>0.002</b>	0.046
	2nd yr	3.38 (0.60)			3.02 (0.26)			3.47 (0.65)		
	3 <sup>th</sup> yr	3.43 (0.71)			3.71 (0.52)			3.63 (0.53)		
	4 <sup>th</sup> yr	3.53 (0.83)			3.72 (0.59)			3.69 (0.54)		
<b>Knowledge</b>	1st yr	2.62 (0.73)	0.117		2.74 (0.64)	< <b>0.0001</b>	0.238	2.07 (0.78)	< <b>0.0001</b>	0.226
	2nd yr	3.08 (0.66)			3.21 (0.26)			2.42 (0.66)		
	3 <sup>th</sup> yr	3.02 (0.60)			3.39 (0.57)			2.97 (0.61)		
	4 <sup>th</sup> yr	3.15 (0.90)			3.52 (0.59)			2.87 (0.55)		
<b>EBP overall score</b>	1st yr	3.70 (0.41)	0.108		3.41 (0.31)	< <b>0.0001</b>	0.330	3.41 (0.43)	< <b>0.0001</b>	0.173
	2nd yr	3.63 (0.45)			3.30 (0.26)			3.59 (0.36)		
	3 <sup>th</sup> yr	3.78 (0.36)			3.76 (0.35)			3.78 (0.35)		
	4 <sup>th</sup> yr	3.86 (0.53)			3.90 (0.42)			3.84 (0.33)		

<sup>a</sup> Significance p value (One-way ANOVA with Welch robust test).

<sup>b</sup> Effect size estimated with General Lineal model. Effect size η<sup>2</sup> 0.01 = small, 0.06 = medium, 0.14 = large.

also be associated. Therefore, evidence suggests that some specific educational interventions (60 h of training over 15 weeks) improve knowledge, skills and attitudes about EBP in nursing students (Ruzafa-Martinez et al., 2016). However, a recent review concluded that the duration of interventions is not related to student competency in EBP (Kyriakoulis et al., 2016). In regard to effectiveness, multifactorial approaches that combine various educational interventions (Kyriakoulis et al., 2016); constructivist models of learning compared to traditional lecture-based courses (Hsieh et al., 2016); and the integration of EBP learning into clinical practice settings (Oh et al., 2010) appear to have a greater impact on competencies acquisition. Mena-Tudela et al. (2018) improved EBP competencies in nursing students through an educational intervention with theoretical and practical classes on EBP and the use of the critical incident technique during clinical practice. In this context, Aglen (2016) pointed out that knowledge transfer, while showing its connection to clinical problems, should be a priority-learning situation when teaching EBP in nursing education.

Only a few studies have compared the level of competency in EBP among students at different universities (Zhang et al., 2012). In the literature, we found only one qualitative study on students' perceptions about EBP and research, comparing the nursing students from UK and Slovenian Faculties (Brooke et al., 2015). We therefore believe that a more international approach is needed to assess not only the competencies of future nurses, but also the effectiveness of university

curricula in different countries.

Attitude towards EBP is the aspect with the highest score on the self-rated scale in our study. The self-rated attitude reveals a moderate correlation with that measured with the EBP-COQ questionnaire, especially in the case of Spain and Chile. Ruzafa-Martinez et al. (2013) also observed a positive, although weak, association between student self-rated attitude towards EBP and the attitudes subscale. Based on these results, the attitudes toward EBP is the component with the highest association with global competency in EBP. As Llasus et al. (2014) pointed out, EBP readiness is the first element needed, acting as a mediator between knowledge and implementation of EBP.

Students' skills in statistics, English and computer use may play a role in their competency in EBP. Students self-reported having poor statistical knowledge at all three universities, which is similar to that described in the USA by Llasus et al. (2014) and Cosme et al. (2018). Furthermore, this aspect was not correlated to EBP competency; these results are similar to those reported by Ruzafa-Martínez et al. (2013). In regard to English skills, both the students' self-rated scores and the correlation with EBP competency were low, as found in another study in Spain (Ruzafa-Martínez et al., 2013). This can be a major obstacle to accessing research evidence for students from Spanish-speaking countries, since a large part of current scientific production is published in English. Both our study and that of other researchers (Ruzafa-Martínez et al., 2013) reveal a correlation between computer skills and EBP

**Table 6**  
Association between competencies in EBP measured by EBP-COQ questionnaire and learning research methods and reading nursing journals in the last month.

		Spain		Colombia		Chile	
		Sig. <sup>a</sup>	Effect size <sup>b</sup> η <sup>2</sup>	Sig. <sup>a</sup>	Effect size <sup>b</sup> η <sup>2</sup>	Sig. <sup>a</sup>	Effect size <sup>b</sup> η <sup>2</sup>
<b>Learning on Research methods</b>	Attitudes	0.188		0.232		<b>0.005</b>	0.034
	Skills	<b>0.045</b>	0.024	<b>0.003</b>	0.038	< <b>0.0001</b>	0.059
	Knowledge	<b>0.019</b>	0.043	< <b>0.0001</b>	0.141	< <b>0.0001</b>	0.230
	EBP total	<b>0.027</b>	0.042	< <b>0.0001</b>	0.058	< <b>0.0001</b>	0.152
<b>Learning on EBP</b>	Attitudes	0.160		0.472		<b>0.005</b>	0.030
	Skills	0.077		0.514		<b>0.006</b>	0.024
	Knowledge	<b>0.002</b>	0.052	< <b>0.0001</b>	0.077	< <b>0.0001</b>	0.140
	EBP total	0.076		0.403		< <b>0.0001</b>	0.093
<b>Reading Nursing Journals articles in last month</b>	Attitudes	< <b>0.0001</b>	0.108	<b>0.001</b>	0.052	< <b>0.0001</b>	0.064
	Skills	< <b>0.0001</b>	0.166	< <b>0.0001</b>	0.081	<b>0.015</b>	0.030
	Knowledge	<b>0.001</b>	0.086	< <b>0.0001</b>	0.073	< <b>0.0001</b>	0.146
	EBP total	< <b>0.0001</b>	0.178	< <b>0.0001</b>	0.116	< <b>0.0001</b>	0.127

<sup>a</sup> Significance p value. (One-way ANOVA with Welch robust test).

<sup>b</sup> Effect size estimated with General Lineal model. Effect size η<sup>2</sup> 0.01 = small, 0.06 = medium, 0.14 = large.

competencies. Therefore, we proposed that a basic understanding of English nursing literature and training in computer skills should be included in the nursing curriculum.

EBP competency increases in senior year (4th year) students in both the overall score and in attitudes, knowledge and skills. This increase in the score of 4th year students was not found at the Spanish university; it is not clear what could be the cause of this fact, but we hypothesized that it could be related with the slightly higher scores of 1st year Spanish students (baseline). These results are consistent with some other studies in different countries (Florin et al., 2012; Ruzafa-Martínez et al., 2015; Gerçek et al., 2016; Upton et al., 2016); although some authors proposed that this association can be adjusted by confidence in clinical decision-making and perceived level of readiness (Brown et al., 2010). Based on these results, we believe that the improvement in EBP competency observed in the 4th year may be due to the convergence of the education received in the previous three years, together with the need to prepare a written project for a Bachelor's thesis integrating all the competencies acquired. Several authors have suggested the importance of clinical placements in the development of competencies in EBP. Ruzafa-Martínez et al. (2015) highlight the effect of students' participation during their placement in a programme to implement clinical guidelines in hospitals. Similarly, Balakas & Smith (2016) warned that the academic institutions alone cannot fully prepare nurses to implement changes that will result in improved healthcare service in clinical settings. This can only be achieved in a healthcare environment that fully supports the changes and with an academic and clinical partnership.

The results of this study showed a similar level of knowledge, skills and attitudes about EBP among students at the three universities surveyed, despite differences in the method of approaching EBP in their learning programs. While in the universities in Colombia and Spain, the contents on EBP are embedded into the curriculum throughout different courses; in Chile there is a specific EBP course. Literature results do not allow us to establish the most appropriate strategy for including EBP training in undergraduate nursing curricula. Some researchers recommend the introduction of a course on EBP as an initial strategy and an effective way of improving competencies (Ruzafa-Martínez et al., 2016), which is consistent with the experiences of nurse educators in implementing EBP (Mthiyane and Habedi (2018). However, most nursing programmes do not have such a specific EBP course, but rather include EBP training within other courses (Hung et al., 2015). The impact of an embedded approach to EBP on the acquisition of competencies by students remains unclear (Scurlock-Evans et al., 2017). Additionally, some teacher-related barriers have been identified that should be taken into account (Upton et al., 2015; Malik et al., 2016). Gerçek et al. (2016) stated that the attitudes and awareness of their students increased along with the number of credits in EBP courses. Thus, this education should go beyond mere training on information literacy and research methods, since students require competencies to use evidence and transfer it to clinical situations (Aglen, 2016; Leung et al., 2016).

This study has found an association between the hours of learning in research methods by students and the level of EBP competencies. This finding is similar to that described by Ashktorab et al. (2015) and by Hickman et al. (2014) as it reveals that students recognize the benefits when they are consumers of research, increasing their level of confidence in decision-making and improving patient outcomes. Reading nursing journals articles in the last month is also strongly associated with higher EBP scores, as has also been pointed out by Labrague et al. (2019). This suggests that critical reading of articles in nursing journals is associated with greater adherence to EBP by nursing students. Reading nursing literature was found to promote critical thinking in nursing students (Chen and Lin, 2003). Critical reading could be reinforced with certain teaching strategies such as workshops for critical appraisal of articles (Zhang et al., 2012; Hsieh et al., 2016), or through journal clubs (Mattila et al., 2013; Wilson et al., 2015).

### 5.1. Limitations

This study has certain limitations that should be recognized. Since this is a cross-sectional study, it is possible to show only associations between factors, but not any causal relationship. Measurements have been made through a self-administered questionnaire; thus it is possible there was an overestimation for self-scores of EBP competencies, since actual knowledge or performance of EBP has not been directly assessed. Sampling was conducted by convenience (and with a certain sampling imbalance between years in the Spanish sample) therefore it is possible that less motivated students with regard to EBP did not complete the questionnaires. However, the use of this type of instrument is typical in this sort of study, allowing comparison of results with other observational studies (Spurlock and Wonder, 2015; Upton et al., 2016; Yildiz and Güngörmüş, 2016). Data about EBP or research methods learning and about reading nursing journals articles in the last month was estimated by the students. No distinction was made between research journals and professional nursing journals when students were asked about reading articles, so this should be taken into account in the interpretation. There are also limitations in the generalization of the results, as only one Faculty of Nursing was studied in each country and the three universities were selected by convenience. As such, the conclusions should be applied only to the context of these centres and it is therefore necessary to conduct studies that include more universities and larger samples to be more representative. However, the inclusion of students from the three countries with distinct contexts may strengthen this study, as it adds an international perspective that has so far been unexplored.

### 6. Conclusions

The nursing students from the three Faculties surveyed have a high level of EBP competencies, in terms of knowledge, skills and attitudes. There are some differences in the attitudes toward EBP among universities. More senior students have higher scores in EBP competencies, evidencing the effect of the training received.

Students are aware of the level of their own competencies because there is a correlation between the students' self-rated score on the EBP competencies and the level measured using the scale. Self-assessment of the "Attitudes towards the EBP" possibly is the best predictor.

Students' learning about research methods is associated with both knowledge and overall EBP competency, although this effect may not be the same in all the Faculties. Finally, reading nursing journals articles in the last month is associated with EBP competency, not only on knowledge and skills, but also on attitudes.

### Conflicts of interest

None.

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### Ethical approval

The academic directors and the IRB of the three faculties authorized the study.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.nepr.2019.08.009>.

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