



## Knowledge and competence with patient safety as perceived by nursing students: The findings of a cross-sectional study



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### ARTICLE INFO

#### Article history:

Accepted 1 April 2015

#### Keywords:

Patient safety  
Nursing education  
Clinical learning  
Student perceptions  
Adverse events  
Close calls  
Adverse events report

### SUMMARY

**Background:** Ensuring safety in health-care settings is provoking improvements both in education and clinical practice. However, the studies available have not offered to date information regarding knowledge and competence on patient safety (PS) developed by nursing students over their academic career. There is no documentation of the amount of close calls and/or adverse events that students may have witnessed and the degree of safety perceived in the attended clinical settings.

**Objectives:** To describe the perception of nursing students regarding their own knowledge and competence on PS and describe differences, if any, among students attending the first, second and third academic year.

**Design:** A cross-sectional study design was undertaken in 2013.

**Participants and Setting:** A convenience sample of 621 nursing students of two bachelors nursing degrees located in two Italian universities, was the population target of the study. Students attending the first, second and third academic year, obtaining admission to the annual clinical competence examination, were eligible.

**Methods:** The Italian version of the Health Professional Education in Patient Safety Survey (H-PEPSS<sub>Ita</sub>) and open-ended questions was administered to the students after having obtained their informed written consent.

**Results:** A total of 573 students (response rate 92.4%) participated. Around a quarter (28.8%) of students reported having experienced an adverse event or close call during their clinical experience. The settings where they learn were perceived as unsafe by 46.9% of students. PS knowledge and competence as perceived by students, was high (Median = 4) in all factors and dimensions of the H-PEPSS<sub>Ita</sub> tool. High PS knowledge and competence was reported by first-year students, moderate by second-year students and higher at the end of the third-year.

**Conclusions:** Faculties and health-care institutions offering clinical placements have to share the responsibility of well-prepared future nurses, working together to improve PS through dialogue when issues are identified by students.

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### Introduction

Ensuring safety in health-care settings is driving, on a global scale, the development of policies to improve both education and clinical practice of professionals (Sherwood, 2011; WHO, 2012). Patient safety (PS) was defined by the Institute of Medicine (IOM) as the prevention of harm to patients (Aspden et al., 2004). Emphasis of PS is placed on a) the system of care delivery that prevents errors; b) learning from errors that do occur; and c) a culture of safety that involves health-care professionals, organizations, and patients (Aspden et al., 2004).

Aimed at reaching and assuring high levels of PS, strategies are continuously designed, tested and implemented in clinical settings (Steven

et al., 2014) where unpredictable and unlikely controllable factors may affect patient care (Deborough, 2012). In this process, the role of nurses is considered a key factor (Alfredsdottir and Bjornsdottir, 2008) and their PS education has become fundamental (Mansour, 2014; Slater et al., 2012). However, little evidence on how PS concepts are embodied in the curricula of health-care professionals is available to date (Attree et al., 2008).

In the specific field of nursing education, increased attention has been paid over the years (Abbott et al., 2012; Deborough, 2012; Ginsburg et al., 2012; Cooper, 2013). Nursing curricula should include specific contents on PS and faculties should develop educational methods oriented to both academic and clinical practice settings (Tella et al., 2014). Nevertheless, the increased occurrence of nursing student errors, as well as the episodes of close calls or adverse events witnessed/experienced by students, suggests an urgent need to reform nursing curricula (Gregory et al., 2007; Steven et al., 2014; Tella et al., 2014).

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However, evidence concerning the effectiveness of learning strategies on PS knowledge and competence remains poor (Ironsides et al., 2014) and faculties are not supported by research-data in their decisions regarding curriculum re-design (Debourgh and Prion, 2012). In addition, due to their lack of clinical exposure, faculty members may have a low awareness toward the increased complexity of the clinical settings, and their teaching approach to PS might be limited (Ironsides et al., 2014). Therefore, PS programs are still heterogeneous and often lacking in content (Cronenwett et al., 2007; Debourgh and Prion, 2012); as a consequence, the gap between the nursing educational programs offered and the competence required in the clinical context has progressively increased (Pacini, 2005; Attree et al., 2008).

From their point of view, nursing students develop experience in several clinical settings with different PS cultures (Pauly-O'Neill and Prion, 2013); as a result, they struggle to understand the importance of safe clinical practices and of the knowledge and competence needed to identify and manage earlier adverse events and/or close calls (Cooper, 2013). Helping students to reflect on their PS knowledge and competence may prepare them to offer care safely in different circumstances.

In this context, measuring student perceptions of their own PS preparedness with reliable tools is widely recommended (Lucian Leape Institute, 2010) for: a) continuing to revise the curriculum, b) accrediting the clinical placements on the basis of PS standards perceived in practice, c) evaluating the effects of educational strategies adopted, and d) improving PS learning goals achieved by students.

In accordance with the systematic review made by Okuyama et al. (2011), around 34 instruments devoted to health-care professionals have been developed, few of which are capable of measuring the breadth of PS competences. Among these instruments (Madigosky et al., 2006; Flin et al., 2009) some have been validated within the nursing student population (e.g., Christiansen et al., 2010; Ginsburg et al., 2012; Mansour, 2014) offering, therefore the opportunity of evaluating systematically the PS knowledge and competence developed. However, studies in the field of nursing education are limited, not offering a global description of PS competence gained by students over the years, not documenting the close calls and/or adverse events witnessed by students during their clinical experience, and not reporting the degree of safety perceived in the clinical settings. Therefore, contributing to advancing the knowledge of PS, as perceived by nursing students in an European context, was the main aim of the study.

## Method

### Aims

The aims of the study were to describe a) the perceptions of nursing students regarding their own PS knowledge and competence, b) the differences, if any, in the PS perceptions of nursing students attending the first, the second and third academic year; c) the adverse events or close calls that students have experienced/witnessed during the clinical placements, and d) the perception of safety in the clinical environments attended.

### Study Design

A cross-sectional study design (Polit and Tatano-Beck, 2014) based on qualitative and quantitative data, was undertaken in 2013.

### Sampling and Sample

All students attending their bachelors degree in nursing of two North-Eastern Italian universities, selected with a convenience sampling method, were the population target of the study. A total of 621 students attending the first, second and third academic years, who had regularly attended the theoretical courses and the clinical placements, obtaining admission to the annual clinical competence examination held in

September 2013, were considered eligible. Students were approached on the day of the annual clinical competence examination by external researchers. Preliminarily, information regarding the research aims and a detailed explanation regarding the data collection tool were offered to the students. The students were asked to complete a paper copy of the questionnaire reporting the aims of the study and the informed consent form.

### Data Collection Instrument

The Italian version of the Health Professional Education in Patient Safety Survey (H-PEPSS<sub>IT</sub>) was considered a tool for data collection. The tool was selected in accordance with the validity measures documented (Ginsburg et al., 2012, 2013) and the fact that no other instruments were available in the Italian context at the moment of the research process. The H-PEPSS was originally developed and validated by Ginsburg et al. (2012, 2013). The instrument is based on 23 items composing six factors designed to measure self-reported PS knowledge and competence of health-professionals and students regarding the six key areas of PS:

- 1) Working in a team with other health professionals;
- 2) Communicating effectively;
- 3) Managing safety risks;
- 4) Understanding human and environmental factors;
- 5) Recognizing, responding to and disclosing adverse events and close calls;
- 6) Culture of safety.

The tool is composed of two dimensions measuring PS knowledge developed in the classroom and competence developed in the clinical training experience. Answers are given on a 5-point disagree-agree Likert scale that includes a 'don't know' option for each item.

The tool was translated into Italian with the permission of the authors using a back and forward translation process, verifying the suitability of the tool in the context of investigation (Beaton et al., 2000; Maneeriwongu and Dixon, 2004; Gjersing et al., 2010; Sidani et al., 2010; Sousa and Rojjanasrirat, 2010). Exploratory Factor Analysis (EFA) performed on the Italian version has confirmed the structure of the original tool documented through a Confirmatory Factor Analysis (CFA, Ginsburg et al., 2012). The internal consistency documented for the Italian version was higher (classroom  $\alpha = 0.939$ ; clinical training  $\alpha = 0.936$ ) than reported for the original version ( $\alpha$  0.81 to 0.85, Ginsburg et al., 2012).

Participants were asked to answer each dimension (classroom, clinical training experience), reflecting on PS knowledge acquired in the classroom and then on PS competence developed in the clinical placements. In addition, demographic data regarding gender, age, possession of previous degrees and/or experience as health-care workers (role and duration) were collected. With two open-ended questions, participants were asked to report, giving a full description, any adverse event(s) and close calls witnessed and/or experienced during their clinical experience, such as:

- a) events that unintentionally harmed the patient by an act of commission or omission rather than through the underlying disease or condition of the patient (IOM, 2004). The concept of 'harm' was intended as temporary or permanent impairment of the physical, emotional, or psychological function or structure of the body and/or pain resulting from the intervention (National Coordinating Council for Medication Errors Reporting and Prevention, 1998; Machin and Jones, 2014);
- b) close calls such as an event or situation that could have resulted in an adverse event but, either by chance or through timely intervention, did not (IOM, 2004).

Aimed at achieving consistency in data collection, researchers have assured that the above-mentioned definitions were also used by the faculty teachers and tutors during the PS theoretical and clinical teaching

process; in addition, the definitions of these concepts, were also reported in the questionnaire in an explicative fashion. Participants were finally asked to report also if the workplaces attended during their clinical placements were perceived by them as safe (= assuring both patients safety and health-care workers safety) or not, in an overall fashion.

#### Data Collection Process

The comprehensive questionnaire was distributed and collected by researchers, on different days, in accordance with the academic year attended by students (first, second or third) during a meeting held in a room, and potential participants were left free to adhere or not. Researchers guaranteed the time requested by the students to fill in the questionnaire; they also collected the questionnaires assuring anonymity.

#### Data Analysis

The analysis was performed according to the nature of the data collected which were both quantitative and qualitative.

The quantitative data analysis, was performed using SPSS Statistical Package version 22.0. Categorical variables were transformed in frequencies and percentages, and differences, if any, were calculated using the chi-square test ( $\chi^2$ , Fisher when appropriate). Continuing variables were transformed in averages, standard deviations (SD,  $\pm$ ) and medians. Differences were evaluated using a non-parametric test according to the non-normally distributed nature of the data. The statistical significance was fixed at  $p > .05$ .

The qualitative data regarded the open-ended questions on any adverse event(s)/close calls witnessed and/or experienced during their clinical experience. Students reported a full description of the event(s). Researchers read the description preliminarily and re-read the description in an independent fashion. Then, they identified through content analysis (Polit and Tatano-Beck, 2014) the event reported (e.g. 'wrong patient identification during drug administration'). The list of adverse events/close calls identified by the researchers was then agreed upon: no disagreements emerged. The list was then adopted as a basis for calculating frequencies and percentages of the adverse events/close calls reported by students.

#### Ethical Issues

In accordance with Italian law regarding cross-sectional studies, permission to conduct the survey was granted preliminarily by the deans of the nursing degree courses involved. Then students were approached and received a specific illustration of the study aims. Researchers stressed that non-participation would not in any way affect the annual clinical competence evaluation and that completion of the questionnaire was voluntary and anonymous. Researchers were also not involved in the processes of student education and clinical placement accreditation; therefore, specific feedback was assured by researchers to the faculty members responsible for the curriculum review and clinical placements accreditation process as soon as the data collected was analyzed aiming to improve the quality of education.

Written consent by each student willing to participate in the study was obtained before administration of the questionnaire. Data was handled in accordance with the right to privacy, ensuring anonymity and confidentiality of the responses.

#### Results

##### Participants

A total of 573 students (response rate = 92.4%) participated; students who not participated for different reasons (absent in the day of tool administration, or refuse to participate) were homogeneously

distributed between the bachelor degrees involved. A total of 204 students were attending the first-year, while respectively 188 and 181 were attending the second and third-year, homogeneously distributed between the degrees involved.

As reported in Table 1, the majority of students were female (75.7%); their mean age was 23.5 (SD 4.7) years. Some 39 students (6.8%) had previously graduated in different disciplines, while 56 (9.7%) reported previous work experience in different health-care settings: 41/56 (73.2%) as an ambulance assistant/red cross volunteer, 7 (12.5%) as a licensed practical nurse, 4 (7.1%) as a biomedical laboratory technician, 2 (3.6%) as a dental technologist, 1 (1.8%) as a midwife and 1 (1.8%) as a veterinary without any difference in the degrees involved.

##### Clinical Experience Regarding PS

As reported in Table 1, around a quarter (28.8%) of the students reported having experienced an adverse event or close call during clinical training, and the frequency was significantly higher among the students attending the second and third-year compared with those who had just ended the first academic year. The adverse events (84.8%) reported most often were at risk to harm physically the patient. In order, these events have regarded were those occurring during drug administration (52.9%), followed by accidental falls (35.7%) and those occurred during blood sample collection or transfusion reactions (5.7 and 2.1%, respectively). Students attending the first-year, reported mainly accidental falls, those attending the second and third-year, reported mainly adverse events linked to drug administration.

A total of 25 students (15.1%) experienced instead a close call, which were more frequent among those students attending the second and third-year. Episodes related to drug administration (80%, by all three academic years' students) and accidental falls (12%, only by students attending third-year) were mainly reported. A case of attempted suicide and an avoided collection of the wrong patient's blood sample were reported by students attending the second and third-year.

After the adverse event/close call, the majority of the students (96.3%) witnessed a health-professional filling up the 'adverse event' report form. A number of students (77.4%) have also personally filled in the report form, mainly among second and third-year students.

The workplace where students attended their clinical training was perceived as unsafe by 46.9% of students: unsafely was perceived lesser by students attending the first-year (37.9%) compared to second (57.0%) and third-year students (46.9%). The students who reported having experienced adverse events and close calls, were more likely to report the perception of working in an unsafe environment ( $\chi^2 = 4.073$ ,  $p = .044$ ) and these differences are statistically significant. The unsafe workplace perception was not statistically associated with having personally filled an adverse event form ( $\chi^2 = .014$ ,  $p = .907$ ) as well as was not associated significantly with having witnessed its compilation ( $\chi^2 = 2.129$ ,  $p = .144$ ).

##### Students' Self-perceived PS Knowledge and Competence

PS knowledge and competence as perceived by students, was high in all factors and dimensions of the H-PEPSS<sub>ITA</sub> tool (Table 2). At the factor level, students perceived higher PS knowledge and competence in the 'Communicating effectively' factor (mean: 4.42, SD 0.60 classroom; 4.35, SD 0.63 clinical training), followed by the 'Culture of safety' factor (mean: 4.24, SD 0.57 classroom; 4.23, SD 0.57 clinical training) and by 'Understanding human and environmental' factor (mean: 4.22, SD 0.61 classroom; 4.29, SD 0.61 clinical training). Other factors reported higher values both in the classroom and in the clinical environment without statistical differences between the total scores ( $p = 0.539$ ).

At the item level, in both classroom and clinical training dimensions, students reported higher scores in 'Enhancing patients' safety through clear and consistent communications with patients' (mean: 4.48, SD 0.69 and 4.43, SD 0.73 respectively). High scores were also

**Table 1**  
Participants' characteristics (n = 573).

		Participants		1st year		2nd year		3rd year		$\chi^2$ or KW; p	
		n	%	n	%	n	%	n	%		
Bachelor nursing degree	Degree n. 1	375	65.4	128	62.7	128	68.1	119	65.7	1.244; .536	
	Degree n. 2	198	34.6	76	37.3	60	31.9	62	34.3		
Gender	Male	139	24.3	57	27.9	44	23.4	38	21.0	2.630; .268	
	Female	434	75.7	147	72.1	144	76.6	143	79.0		
Age (years)	Average (SD $\pm$ )	23.5 ( $\pm$ 4.7)		22.2 ( $\pm$ 4.3)		23.3 ( $\pm$ 4.4)		25.1 ( $\pm$ 4.8)		135.652; .000	
Witnessed and/or experienced adverse events and/or close calls during clinical placements	Yes	165	28.8	26	12.7	62	33.0	77	42.6	43.915; .000	
	No	408	71.2	178	87.3	126	67.0	104	57.4		
	Total	573	100	204	100	188	100	181	100		
	If yes, adverse events	140	100	23	88.5	51	82.2	66	85.7		0.632; .728
Adverse event description	Close calls	25	100	3	11.5	11	17.8	11	14.3		
	Total	165	100	26	100	62	100	77	100		
	Adverse event linked to drug administration <sup>a</sup>	74	52.9	8	34.8	22	43.1	44	66.7		11.708; .068
	Accidental falls	50	35.7	12	52.2	21	41.3	17	25.8		
Close calls description	Adverse event linked to blood sample collection <sup>b</sup>	8	5.7	1	4.3	4	7.8	3	4.5		
	Transfusion reactions <sup>c</sup>	3	2.1	–	–	2	3.9	1	1.5		
	Other <sup>d</sup>	5	3.6	2	8.7	2	3.9	1	1.5		
	Total	140	100	23	100	51	100	66	100		
Did you see a health professional filling up adverse event/close call report form?	Adverse event linked to drug administration <sup>d</sup>	20	80.0	3	100	10	90.9	7	63.6		
	Avoided falls	3	12.0	–	–	–	–	3	27.3		
	Other <sup>e</sup>	2	8.0	–	–	1	9.1	1	9.1		
	Total	25	100	3	100	11	100	11	100		
Did you fill up an adverse event/close call report form?	Yes	129	96.3	18	90.0	53	100	58	95.1	4.481; .106	
	No	5	3.7	2	10.0	–	–	3	4.9		
	Total	134	100	20	100	53	100	61	100		
During your clinical training, did you perceive unsafe working conditions? <sup>f</sup>	Yes	24	77.4	3	50.0	9	100	12	75.0	5.259; .072	
	No	7	22.6	3	50.0	–	–	4	25.0		
	Total	31	100	6	100	9	100	16	100		
	Yes	266	46.9	77	37.9	87	57.0	102	66.9	13.866; .001	
Total	No	301	53.1	126	62.1	98	43.0	77	53.1		
	Total	567	100	203	100	185	100	179	100		

$\chi^2$  = Chi Square, KW = Kruskal–Wallis Test.

<sup>a</sup> Wrong drug administration n = 30; wrong patient identification n = 18; wrong drug dose n = 11; wrong patient drug administration n = 5; drug allergic reaction n = 4; wrong-route drug administration n = 3; missed drug administration n = 2; missed drug prescription n = 1.

<sup>b</sup> Wrong patient blood sample collection n = 5; blood sample tubes not sent to the laboratory n = 1; wrong patient medical record blood test results assignment n = 1; wrong blood sample tube labeling n = 1.

<sup>c</sup> Accidental disinfectant ingestion n = 1; Ab-ingestis pneumonia n = 3; pressure injuries n = 1.

<sup>d</sup> Avoided wrong patient drug administration n = 15; wrong drug preparation detected n = 3; avoided drug extravasation n = 2.

<sup>e</sup> Suicide attempt n = 1; avoided wrong patient blood sample collection n = 1.

<sup>f</sup> Missing data.

reported by 'Engaging patients as a central participant in the health-care team' (mean: 4.42, SD 0.70) in classroom dimensions and by 'The importance of having a questioning attitude and speaking up when seeing things that may be unsafe' item (mean: 4.37, SD .694) in clinical training dimensions.

Items with higher 'don't know' frequency were 'Managing inter-professional conflict' (n = 27) and 'Debriefing and supporting team members after an adverse event or close call' (n = 29) for classroom and clinical training dimensions respectively.

Between items appertaining to classroom and clinical training dimensions, significant statistical correlations (p = from .000 to .001) have emerged.

#### PS Knowledge and Competence Progression Over the Years

Students reported a significantly different perception regarding PS knowledge and competence over the years. Regarding the classroom dimension, which develops PS prerequisites, first-year students reported significantly higher knowledge and competence (mean: 4.15, SD .521), which remained stable among the second-year students (mean:

4.12, SD .439), while increased scores were reported by those students attending the third-year (mean 4.36 SD .433), as reported in Table 3 and in Fig. 1, both in the total scores average and in the specific factors. For the clinical training dimensions, students reported similar trends to the classroom dimension, with decreased values between first and second academic year (mean: 4.23, SD .496 first-year; mean: 4.04 SD .506 second-year, respectively) and significantly higher scores on average for those attending the third-year (mean: 4.32, SD .466), as reported in Table 3 and in Fig. 2.

No significant statistical differences emerged regarding the frequency of 'don't know' answers across students attending different academic years for both the classroom ( $\chi^2$  53.222; p = 0.160) and clinical setting ( $\chi^2$  23.844; p = 0.994).

#### Discussion

With the increasing concern about safety issues in health-care at worldwide level, nursing education has started to consider PS as a core content of the curriculum (Robson et al., 2013); however, despite its well-recognized importance, few studies (Madigosky et al., 2006;

**Table 2**  
Descriptive statistics of H-PEPSS<sub>116</sub>.

Items	Dimension: Classroom				Dimension: Clinical training				Correlation between dimensions Pearson (r)		
	Mean	SD	Median	Don't know <sup>f</sup>	Mean	SD	Median	Don't know <sup>f</sup>			
				n				%		n	%
1 Team dynamics and authority/power differences	4.12	.79	4.00	7	1.2	4.20	.81	4.00	4	.7	.285 <sup>*</sup>
2 Managing inter-professional conflict	3.84	.83	4.00	27	4.8	3.87	.87	4.00	20	3.6	.242 <sup>*</sup>
3 Debriefing and supporting team members after an adverse event or close call	3.89	.88	4.00	23	4.0	3.96	.82	4.00	29	5.1	.216 <sup>*</sup>
4 Engaging patients as a central participant in the health-care team	4.42	.70	5.00	5	.9	4.17	.88	4.00	2	.4	.222 <sup>*</sup>
5 Sharing authority, leadership and decision-making	4.10	.73	4.00	11	1.9	4.04	.80	4.00	10	1.8	.222 <sup>*</sup>
6 Encouraging team members to speak up, question, challenge, advocate and be accountable as appropriate to address safety issues	4.12	.80	4.00	11	1.9	4.04	.87	4.00	13	2.3	.283 <sup>*</sup>
Working in teams with other health professionals (6 items)	4.12	.58	4.16	–	–	4.08	.62	4.00	–	–	.235 <sup>*</sup>
7 Enhancing patient safety through clear and consistent communication with patients	4.48	.69	5.00	6	1.1	4.43	.73	5.00	4	.7	.263 <sup>*</sup>
8 Enhancing patient safety through effective communication with other health-care providers	4.38	.71	4.00	3	.5	4.31	.76	4.00	5	.9	.251 <sup>*</sup>
9 Effective verbal and nonverbal communication abilities to prevent adverse events	4.31	.74	4.00	5	.9	4.23	.78	4.00	4	.7	.232 <sup>*</sup>
Communicating effectively (3 items)	4.42	.60	4.66	–	–	4.35	.63	4.33	–	–	.264 <sup>*</sup>
10 Recognizing routine situations in which safety problems may arise	4.20	.73	4.00	7	1.2	4.26	.73	4.00	6	1.1	.302 <sup>*</sup>
11 Identifying and implementing safety solutions	4.15	.74	4.00	9	1.6	4.15	.74	4.00	13	2.3	.361 <sup>*</sup>
12 Anticipating and managing high risk situations	3.98	.82	4.00	17	3	3.99	.81	4.00	14	2.5	.391 <sup>*</sup>
Managing safety risks (3 items)	4.14	.64	4.00	–	–	4.15	.63	4.00	–	–	.372 <sup>*</sup>
13 The role of human factors, such as fatigue, which affect patient safety	4.23	.78	4.00	5	.9	4.33	.75	4.00	4	.7	.241 <sup>*</sup>
14 The role of environmental factors such as work flow, ergonomics and resources, which affect patient safety	4.14	.76	4.00	4	.7	4.18	.77	4.00	5	.9	.365 <sup>*</sup>
15 Safe application of health technology	4.26	.71	4.00	9	1.6	4.23	.79	4.00	8	1.4	.275 <sup>*</sup>
Understanding human and environmental factors (3 items)	4.22	.61	4.33	–	–	4.29	.61	4.33	–	–	.323 <sup>**</sup>
16 Recognizing an adverse event or close call <sup>a</sup>	4.16	.71	4.00	5	.9	4.13	.74	4.00	6	1.1	.283 <sup>*</sup>
17 Reducing harm by addressing immediate risks for patients and others involved	4.14	.69	4.00	5	.9	4.13	.74	4.00	6	1.1	.339 <sup>*</sup>
18 Disclosing an adverse event to the patient	4.08	.83	4.00	21	3.7	4.03	.87	4.00	19	3.3	.388 <sup>*</sup>
19 Participating in timely event analysis, reflective practice and planning in order to prevent recurrence	4.10	.77	4.00	10	1.8	4.05	.82	4.00	16	2.8	.361 <sup>*</sup>
Recognize, respond to and disclose adverse events and close calls (4 items)	4.15	.60	4.00	–	–	4.11	.65	4.00	–	–	.354 <sup>*</sup>
20 The ways in which health-care is complex and has many vulnerabilities (e.g., workplace design, staffing, technology, human limitations)	4.08	.76	4.00	22	3.9	4.11	.76	4.00	21	3.7	.334 <sup>*</sup>
21 The importance of having a questioning attitude and speaking up when you see things that may be unsafe	4.37	.69	4.00	4	.7	4.38	.69	4.00	4	.7	.260 <sup>*</sup>
22 The importance of a supportive environment that encourages patients and providers to speak up when they have safety concerns	4.36	.69	4.00	3	.5	4.27	.76	4.00	2	.40	.311 <sup>*</sup>
23 The nature of systems (e.g. aspects of the organization, management or the work environment including policies, resources, communication and other processes) and system failures and their role in adverse events	4.10	.76	4.00	14	2.5	4.05	.78	4.00	15	2.7	.310 <sup>*</sup>
Culture of safety (4 items)	4.24	.57	4.25	–	–	4.23	.57	4.25	–	–	.336 <sup>*</sup>
Total Tool score	4.22	.47	4.23	–	–	4.20	.50	4.25	–	–	.318 <sup>**</sup>

<sup>f</sup> In this column, there were counted the answers reporting 'don't know'.

<sup>\*</sup> p-Value = .000.

<sup>\*\*</sup> p-Value = .001.

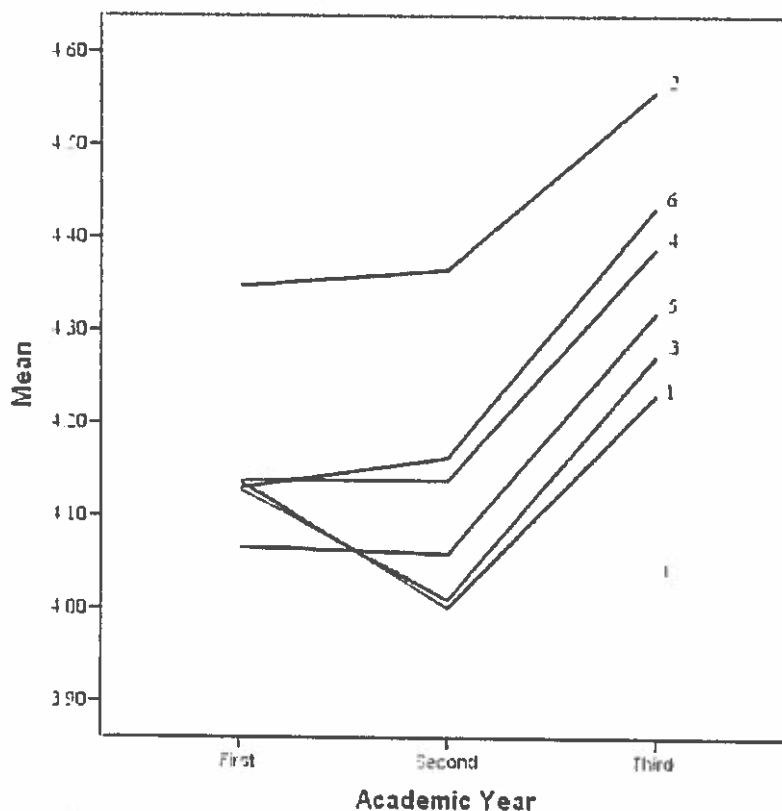
Attree et al., 2008; Steven et al., 2014) have reported PS knowledge and competence as perceived by students. In the context of self-directed learning (Hammond and Collins, 1991), analyzing students' PS

perceptions might stimulate them to develop more knowledge and, for the faculties, may help in evaluating the effectiveness of the PS teaching, aiming to graduate nurses capable of working in a safe manner.

**Table 3**  
Total and factor scores in each dimension as reported by the 1st, 2nd and 3rd years.

	1st year $\bar{x}$	2nd year $\bar{x}$	3rd year $\bar{x}$	p-Value
<i>Classroom dimension</i>				
Working in team	4.13 ± .59	3.97 ± .54	4.20 ± .59	.000
Communicating effectively	4.36 ± .64	4.30 ± .62	4.5 ± .66	.006
Managing safety risks	4.11 ± .64	4.01 ± .67	4.25 ± .58	.007
Understanding human and environmental factors	4.13 ± .61	4.12 ± .64	4.36 ± .57	.001
Recognizing and responding to adverse events	4.08 ± .64	4.04 ± .54	4.30 ± .58	.000
Culture of safety	4.13 ± .63	4.15 ± .54	4.43 ± .49	.000
Total score	4.15 ± .52	4.12 ± .43	4.36 ± .43	.000
<i>Clinical training dimension</i>				
Working in team	4.13 ± .61	3.94 ± .63	4.15 ± .61	.008
Communicating effectively	4.39 ± .63	4.15 ± .69	4.5 ± .52	.000
Managing safety risks	4.19 ± .63	3.95 ± .62	4.30 ± .60	.000
Understanding human and environmental factors	4.32 ± .55	4.17 ± .67	4.38 ± .60	.002
Recognizing and responding to adverse events	3.92 ± .64	4.08 ± .63	4.23 ± .65	.000
Culture of safety	4.25 ± .57	4.10 ± .579	4.33 ± .55	.000
Total score	4.23 ± .49	4.04 ± .50	4.32 ± .46	.000

$\bar{x}$  = average, ± SD.



#### Legend.

- 1) Working in a team with other health professionals;
- 2) Communicating effectively;
- 3) Managing safety risks;
- 4) Understanding human and environmental factors;
- 5) Recognizing, responding to and disclosing adverse events and close calls;
- 6) Culture of safety.

Fig. 1. Progression of classroom PS knowledge and competence as perceived by 1st, 2nd and 3rd year students.

#### Participants

In comparison with what was investigated by Ginsburg et al. (2013), who have studied the self-perception of PS in new graduates in medicine, nursing and pharmacy, our study has considered only nursing students stratifying their perceptions according to the academic year attended. Through the adoption of a questionnaire previously validated in Canada (Ginsburg et al., 2013), and then in the Italian context (Bressan et al., submitted for publication), nursing students' self-reported PS knowledge and competence was analyzed in six factors and two dimensions reflecting respectively the classroom and the clinical practice learning.

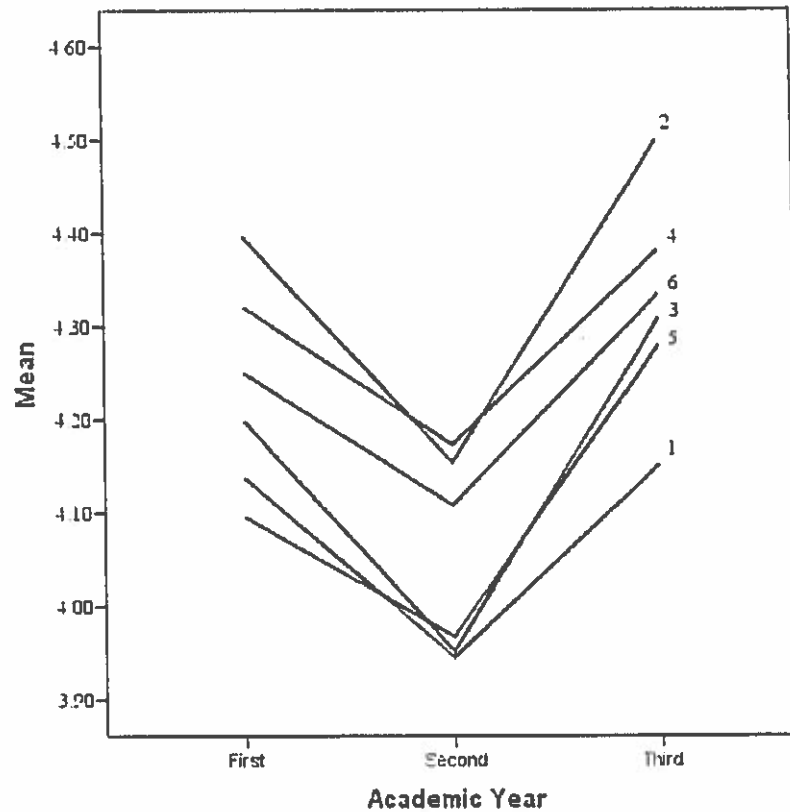
Significant participation in the research project has been achieved indicating that PS is an issue perceived as important also by students. Participants were mainly female, and their age was on average from 22.2 (first academic year) to 25.1 (third-year), with several previously experienced in the context of health-care before being enrolled in to the bachelor, reflecting nursing students' profile as reported at Italian national level (Federazione Nazionale dei Collegi IPASVI, 2010).

#### Clinical Experience Regarding PS

More than one third of participating students reported having experienced an adverse event or a close call during their clinical training,

more frequently in the second and third-year, possibly because they carry out more clinical activities compared to the first-year students. Students who reported the experience, specified only one event/close call. Therefore, considering that six months of clinical experience were attended by the third-year students involved (Inter-ministerial decree 19/2/2009), for about 130 h/month (= 780 for each student, 141,180 h for 181 students), the incidence of adverse events/close calls was around 0.5 events/1000 h of clinical learning. In the case of the second-years, it was also 0.5/1000 h of clinical training ( $([5 \cdot 130 \cdot 188]) / 62$ ), while for those students attending the first-year, the incidence was around 0.04/1000 h of clinical training ( $([4 \cdot 130 \cdot 204] / 26)$ ). According to data reported in the literature, an adverse event occurs every 9.85 admissions (Jha et al., 2013) while those related only to drug administration, every 22.7 h of in-hospital stay (every 19.73 admissions) (Bond et al., 2001).

Although the measures are not comparable, the incidence reported by students seems to be inferior to that documented in general; in addition, an increasing trend of occurrence seem to emerge from the first to the third-year. Students may be concentrating on their learning process and therefore exposed to limited examples of clinical activity, detecting few episodes; on the other hand, with increased involvement in clinical activities, students may detect more events in the second and third-year compared to the first-year. Future research should develop more knowledge regarding the occurrence of events in the perception of



#### Legend.

- 1) Working in a team with other health professionals;
- 2) Communicating effectively;
- 3) Managing safety risks;
- 4) Understanding human and environmental factors;
- 5) Recognizing, responding to and disclosing adverse events and close calls;
- 6) Culture of safety.

Fig. 2. Progression of clinical training PS knowledge and competence as perceived by 1st, 2nd and 3rd year students.

students as well as the reasons why this may have occurred, measuring also the perceptions of nurses responsible for the care, aimed at discovering the degree of concordance of their perceptions.

The events most reported by students where, in order, adverse events linked to drug administration, accidental falls and blood sample collection reflecting in part the data reported in USA context (Levinson, 2010) where, in order, those related to drug medication, patient care, surgery or different kind of procedures and infections has been reported. Also in this case, clinical activities selected with pedagogical purposes, may have limited the perceptions of the students on the wide range of events that may occur. In addition, students have reported adverse events/close call at risk of harming patients physically despite the fact that these events may also affect emotional or psychological functions or structures of the body (National Coordinating Council for Medication Errors Reporting and Prevention, 1998; Machin and Jones, 2014). Therefore, students should be coached to identify a wider range of adverse events/close calls, not only those related to physical harm.

The majority of the students were involved directly or have had the opportunity to participate in reporting an adverse event or close call. The students' participation in reporting the events by filling in the forms adopted by the hospital, may help students to learn the fundamentals of PS (EUNetPaS, 2010; Vaismoradi et al., 2011) understanding the whole process of adverse events management. However, many students reported a perception of the environment where they learn

as unsafe especially those of second and third-year, and those who have experienced an adverse event/close call. The complexity of the clinical environments attended by students, characterized by interruptions, integrated processes of care, high workloads and nursing shortages, is well acknowledged (Ebright et al., 2003; Hughes, 2008) and this may have stimulated the perception of an unsafe environment. In addition, the increased experience with adverse events/close calls over the years, may have confirmed students in their perception of an unsafe environment, in the wake of increased awareness of the PS issues.

Universities are responsible for student safety during their clinical placement and for the quality of the PS competence achieved. Therefore, collecting data regarding the perception of safety in clinical environments attended by students, as well as monitoring the adverse events/close calls witnessed by them, may help faculty members in the process of clinical placement accreditation. Those clinical units unsafe for patients and perceived as unsafe by students, should be encourage to undertake specific programs aimed at improving the safety of care delivered before being selected again as a clinical placement for nursing students.

#### PS Knowledge and Competence and Its Progression Over Years

PS students' knowledge and competence self-perception was high for all six factors investigated (on average >4) without any statistical

difference between the classroom and clinical training dimension. At the overall level, students perceive themselves prepared both in theoretical contents and in clinical practice. Lesser knowledge and competence has been reported in 'Managing inter-professional conflict' and in 'Debriefing and supporting team members after an adverse event/close call item', where students answered with higher frequency using the 'don't know' option, both in theoretical and practical dimensions. This finding is possibly due to the fact that the process of multi-professional integration is still ongoing in Italy while in the clinical practice students learn with the supervisor with few opportunities for teamwork experience. This point should be considered in the future given that safety issues require a multi-professional approach (La Pietra et al., 2005).

Over the years, while the first-year students have reported high PS knowledge and competence, a decreased perception was reported by students attending the second-year and an increase, reaching higher levels, was reported by those students ending the third-year. This phenomenon could be related to several factors: with the increase in knowledge, second-year students possibly have a greater perception of the complexity of the PS issues compared with the first-years; in addition, with the increasing clinical skills experienced by students (e.g. medication administration), they may perceived themselves unprepared to cover all the PS issues. Not least, students develop more autonomy in the second-year and this may increase the sense of unpreparedness or a greater gap may be perceived between the knowledge available and the competence required in the clinical setting (Ginsburg et al., 2013; Steven et al., 2014).

### Study Limitations

The study has several limitations. First, students reported their self-perceived level of PS competence, which may be affected by the social desirability phenomenon (Polit and Tatano-Beck, 2014). Second, they may have overestimated or underestimated the perceptions reflecting that students are not fully aware of the PS knowledge and competence they lack, especially in the early stages of their academic career. For this reason, researchers have referred to data patterns rather than their absolute values (Ginsburg et al., 2013). Third, being a cross-sectional study (Polit and Tatano-Beck, 2014), students attending different academic years were compared: in the future, in order to confirm (or not) the patterns emerged, there is a need to study a single cohort progressing from the first to third academic year. Fourth, students have given a general overview of their perceptions regarding unsafe conditions in their places of learning, which have been in different environments such as community settings and hospitals. Therefore, their unsafe workplace perception does not refer to a specific clinical environment.

Further research should link the perceptions of the students to the ward attended, given that different clinical environments may have different risks for patients as well as a different occurrence in adverse events/close calls. Finally, students were selected with a convenience sampling method, as also the bachelors programs were selected on the basis of their approachability to researchers. These limitations should also be addressed in further research.

### Conclusions

Patients' safety issues are becoming a priority in the agenda of nursing education. Students are exposed to clinical place environments that have always implemented PS strategies aimed at increasing patient safety. However, few studies have reported the perception of the students regarding their PS preparedness over the years, during their bachelors degree, and the amount of close calls and/or adverse events witnessed in the clinical training.

More than a quarter of the students surveyed have assisted in an adverse event or close call; this indicates that the issue of PS is tackled by students during their clinical learning experience with concrete examples. Therefore, it is recommended to prepare students in the

process of adverse event management, also activating multidisciplinary and multi-professional processes, which was weak in our participants. In addition, faculty members should consider the need of the students to share and reflect freely on adverse events/close call experiences, in appropriate settings and with competent support.

Students perceived a high PS preparedness in knowledge and competence; however, the most critical is the situation of second-year students who have perceived a lower level of knowledge and competence. Thus, it is recommended to support students continuously during the process of PS learning in particular, when new goals regarding clinical competences and skills are achieved.

About half of the students surveyed perceived internship environments as unsafe. Interviewing the students on the reasons for this perception could be an important aspect to consider in the future. Faculties and health-care institutions offering clinical placements have to share the responsibility of preparing future nurses well, working together to improve patient safety through dialogue when issues are identified by students.

### Author Contributions

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE: [http://www.icmje.org/ethical\\_1author.html](http://www.icmje.org/ethical_1author.html)):

- substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
- drafting the article or revising it critically for important intellectual content.

### Acknowledgment

The authors wish to extend their gratitude to all the student nurses who participated in the study for sharing their time and experience.

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