

Nursing students' knowledge and attitude on pressure ulcer prevention evidence-based guidelines: A multicenter cross-sectional study

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Abstract

Background: Pressure ulcers still remain a significant problem in many health care settings. Poor knowledge and negative attitudes toward pressure ulcer prevention could undesirably affect preventive care strategies.

Objective: To assess both knowledge and attitudes among nursing students on Pressure Ulcer Prevention Evidence-Based Guidelines.

Design: A multicenter cross-sectional survey was carried out from December 2012 to August 2013.

Settings: The study was carried out in seven Italian nursing schools.

Participants: We involved a convenience sample of nursing students (n= 742)

Methods: Data were collected using two validated questionnaires to assess students' knowledge and attitudes on pressure ulcer prevention.

Results: The overall Knowledge and Attitude scores were 51.1% (13.3/26) and 76.7% (39.9/52), respectively. We found a weak correlation between total Knowledge scores and total Attitude scores ($\rho= 0.13$, $p < 0.001$). We also observed that nursing students' year of education, training experience and number of department frequented during their clinical placement were significantly related to both the Knowledge and the Attitude total scores ($p < 0.05$).

Conclusions: Nursing students' knowledge on pressure ulcer prevention was relatively low. However, we observed an association between a high level of education/training experience and higher knowledge scores. Most of the participants showed high attitude scores. These results suggest that positive attitudes toward pressure ulcer prevention may contribute to the compliance with the guidelines in clinical practice.

Keywords:

Pressure ulcer prevention, Attitude, Knowledge, Nursing students, Guidelines, Cross-sectional design

Introduction

Pressure ulcer (PU) incidence is widely considered as an indicator measuring the quality of care (Gunningberg and Stotts, 2008; Baharestani et al., 2009). However, PUs still remain a significant problem in many health care settings (Gunningberg, 2006; Schoonhoven et al., 2007; Vanderwee et al., 2007a; Hurd and Posnett, 2009; Shahin et al., 2009), and the prevalence of PUs in Europe is still unacceptably high (9.0–18.1) (Vanderwee et al., 2007a; Barrois et al., 2008; Tannen et al., 2009; Gunningberg et al., 2012). This causes pain and frustration for patients (de Laat et al., 2005), with an increase of morbidity and mortality rates and healthcare costs (Erwin-Toth, 1995; Berlowitz et al., 1997; Allman et al., 1999; Severens et al., 2002).

Background

Interventions to prevent PUs play a pivotal role on early identification of patients at risk to develop lesions (Schoonhoven et al., 2007; Vanderwee et al., 2007b; Shahin et al., 2009) and nurses' knowledge of PU prevention is crucial to evaluate, treat risk factors (Lyder and Ayello, 2012), and mediate preventive care (Gunningberg et al., 2013). PU guidelines are considered important evidence-based knowledge's tools in guiding the care procession health care institutions (Meesterberends et al., 2010). However, in spite of their utility, non-adherence of guidelines is frequently reported (Meesterberends et al., 2010; van Gaal et al., 2010).

Evidence suggests that adequate nurses' knowledge and positive attitudes toward PU prevention are positively associated with evidence-based compliance (Beeckman et al., 2010a, 2010b). Several studies explored nurses' attitudes (Bostrom and Kenneth, 1992; Hill, 1992; Maylor and Torrance, 1999; Moore and Price, 2004) and knowledge as factors influencing PU prevention (Gunningberg et al., 2013; Bostrom and Kenneth, 1992; Hill, 1992; Halfens and Eggink, 1995; Pieper and Mattern, 1997; Maylor and Torrance, 1999; Pancorbo-Hidalgo et al., 2007; Källman and Suserud, 2009), showing contrasting results on adequacy of nurses' knowledge on prevention and treatment of PUs. We also need to underline, that the use of different tools to assess knowledge make difficult to compare findings among various studies. To date, literature exploring this topic on a population of student nurses is lacking and few studies explored nursing students' (NS) knowledge (Gunningberg et al., 2013; Caliri et al., 2003; Snarska et al., 2005; Samuriwo, 2010; Beeckman et al., 2010b) and attitudes of PU prevention (Beeckman et al., 2010b). Of the examined studies, two were monocentric in design (Caliri et al., 2003; Snarska et al., 2005), one used a qualitative approach (Samuriwo, 2010), and two were instruments' psychometric evaluation studies (Beeckman et al., 2010a, 2010b). Only one was multicentric with a large sample size (Gunningberg et al., 2013); however, authors did not analyze data by ward, training experience, and year of education of NS. Although, all authors showed univocal consent on the necessity to implement comprehensive actions toward increasing PU prevention knowledge among students, only Beeckman et al. (2010b) investigated NS' attitudes toward PU prevention, but with the purpose to develop and validate the attitudes toward ulcer prevention instrument (APuP). In particular, to our knowledge, limited literature (Beeckman et al., 2011; Strand and Lindgren, 2010; Källman and Suserud, 2009; Demarré et al., 2011) explored both knowledge and attitudes about pressure ulcer prevention but in a population of nursing staff, showing contrasting results. Källman and Suserud (2009) and Strand and Lindgren (2010) reported acceptable nurses' knowledge and positive attitudes toward PU prevention, while Beeckman et al. (2011) and Demarré et al. (2011) reported inadequate level of knowledge, and high attitude scores. In particular, Beeckman et al. (2011) showed a significant correlation between knowledge and attitudes. In fact, it is universally recognized that knowledge alone is not capable of influence an individual's likelihood of carrying out a positive behavior (Beeckman et al., 2011). Moreover,

findings from systematic reviews focused on the relation between individual characteristics and nurses' research utilization, showed that "attitudes toward research" is the only one that is consistently (with a positive effect) related to research utilization among nurses (Estabrooks et al., 2003; Squires et al., 2011). Thus, efforts in changing individual attitudes toward clinical practice guidelines could be a useful strategy for their effective implementation (Semin-Goossens et al., 2003). To study attitudes can give more indications of what to expect from subjects (Petty and Cacioppo, 1996; Ajzen and Fishbein, 2005), as positive feeling about pressure ulcer prevention is significantly correlated with the application of evidence-based clinical guidelines (Beeckman et al., 2011).

Recent studies on research utilization in newly graduated registered nurses showed that about 50% of the nurses at one, two, and three years after graduation considered their use of research in clinical practice as low or very low (Forsman et al., 2009, 2010). Although several challenges remain regarding the transition from education into practice, factors associated with research utilization are strongly emphasized in the context of nursing education (Hegarty et al., 2009). Therefore, an increased focus on this topic is necessary to better understand individual characteristics of student nurses related to research utilization and how these factors could be taken into account in tailoring early interventions to increase nurses' use of research-based knowledge.

This is the first study specifically tailored to assess both knowledge and attitudes among nursing students, in order to ensure progress in implementing recommendations to guide care and improve the quality of nursing practice. Although the students were undergoing education and cannot be expected to have the same experiences or knowledge of nurses, the findings of this study could be useful to the curriculum development for nursing students, to tailor specific educational programs and, therefore improving the management of PU in the clinical setting during their clinical placement and during their work as future nurses. Thus, the main objective of the study was to investigate attitudes and knowledge of Italian nursing students on PU prevention. We also explored the correlation between knowledge and attitudes, years of education, and nursing training experience.

Methods

Design and Setting

A multicentric cross-sectional study was performed in seven Italian nursing schools of three different regions (Marche, Abruzzo and Emilia Romagna) between December 2012 and August 2013.

Study Population

Data on nursing students' knowledge and attitudes were collected using convenience sampling: all students enrolled in the first, second, third year of the Bachelor of Nursing were included. NS who did not accept to participate or who do not sign the informed consent were excluded.

On a total of 855 nurse students, 742 completed the questionnaire, for an overall response rate of 86.8%.

Study Procedures and Data Collection

In each participating center a trained researcher was personally responsible for participants' recruitment and information about the purpose of the study. Also, the researchers verified if competence on PU management were present in each bachelor program of the included universities. To be enrolled all students had been informed about the study via written information and, those who voluntarily agreed to participate in the study, had to sign the informed consent. The unwillingness to participate had no consequences for the students' education. After enrollment, the researcher personally administered two validated and self-

reported questionnaires (Beeckman et al., 2010a, 2010b) to each student. Participants had 30 min to individually fill out and return the instrument, and the researcher supervised the test's fulfillment in order to avoid other resources consultation by participants. To guarantee the confidentiality and anonymity, students re-submitted the completed questionnaire in an envelope inside a special urn.

Instrument Description

The structured questionnaire included three parts:

(i) *General information.* Socio-demographic information was collected: name of nursing schools, age, gender, and year of education. Students were asked to provide information of training experiences and in which department (medical, surgical, maternal-child, mental health, and critical). We used the term of "department" to indicate two or more wards/services with the similar specialization.

(ii) *Knowledge Assessment Instrument.* The Knowledge Assessment Instrument (Beeckman et al., 2010b) is a validated questionnaire to assess knowledge of pressure ulcer prevention. It consists of 26 multiple choice items and three alternative responses reflecting 6 themes expressing the most relevant aspect of pressure ulcer prevention: (1) etiology and development; (2) classification and observation; (3) nutrition; (4) risk assessment; (5) reduction of the magnitude of pressure and shearing; and (6) reduction of the duration of pressure and shearing. The maximum score's value was 26 and a mean knowledge score of $\geq 60\%$ was considered to be satisfactory (Beeckman et al., 2011).

(iii) *Attitude toward Pressure Ulcer (APuP) tool.* The APuP (Beeckman et al., 2010a) is a 13-item questionnaire that measures subjective attitudes toward pressure ulcer prevention. The questionnaire comprises five subscales: (1) personal competency to prevent pressure ulcers, (2) priority of pressure ulcer prevention, (3) impact of pressure ulcers, (4) responsibility in pressure ulcer prevention, and (5) confidence in the effectiveness of prevention. A 4-point Likert-type scale was designed to collect the data (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree). Sum scores were calculated to obtain the total attitude score. Scores on the negatively worded items were reversed to obtain a total score. Higher scores indicated more positive attitudes. A mean attitude score of $\geq 75\%$ was considered to be satisfactory (Beeckman et al., 2011).

After author's permission to use both validated questionnaires, a forward-backward translation of the instruments was performed, in order to establish semantic and conceptual equivalence with Italian context. Then, the Italian version of the questionnaires was preliminary tested on a sample of 219 students. An item analysis was conducted on the Knowledge Assessment Instrument to determine the difficulty index and the discrimination index. Overall, the difficulty index of the instrument ranged from 0.3 to 0.8 and none of the questions had a difficulty index of less than 0.10 or more than 0.90. Most of the items reported a good discrimination index (ranged from 0.29 to 0.60) showing similar results than Beeckman et al. (2010b). The Cronbach's alpha coefficient was calculated for the APuP tool. We obtained a value of 0.88, suggesting good internal consistency.

Sample Size

The reliability of the Knowledge Assessment Instrument and the APuP was tested in two studies, which enrolled 312 nurses and 296 nursing students (Beeckman et al., 2010a) and 258 nurses and 291 nursing students (Beeckman et al., 2010b), respectively. However, no study assessed the knowledge and attitudes of nursing students in PU prevention using both these tools. Our primary outcome was the rate of correct answers among the three possible in each item of the questionnaire; given the lack of literature data, we assumed a 33.3% likelihood to give the correct answer, and we considered an acceptable variation of $\pm 5\%$ from the mean value of 33.3%. Therefore, a minimum of 396 subjects were requested to achieve lower and

upper 95% confidence intervals of 28% and 38%, respectively. The secondary outcome of this study was to compare the level of knowledge of nursing students according to year of course. Assuming an expected difference of 15% in the rate of correct answers between the first and the third year and a two-tailed alpha error of 5%, a minimum of 147 subjects for each year of course (and a total of 441 subjects) were requested to achieve an 80% statistical power. Given that we expected a relatively low rate of incorrect answers (<5%), we conservatively planned to enroll 500 subjects overall.

Data Analysis

Continuous variables were summarized as mean and standard deviation (SD). Categorical variables were synthesized as frequencies and percentages. In order to test for differences in scores among groups, one-way analyses of variance and independent sample *t*-test were performed. A correlation analysis was performed to quantify the strength of association between knowledge and attitude scores. The statistical significance was set at *p* value <0.05. All statistical analyses were performed with SPSS®13.0 (SPSS Inc, Chicago, Illinois).

Results

Characteristics of the Sample

Seven nursing schools from three different Italian regions accepted to participate, and a total of 742 students of the Bachelor of Science in Nursing completed the questionnaire. The mean age of the sample was 22.1 ±4.4 years (range: 18–40 years). Most participants attended the Nursing School of Chieti (38.4%), were female (74.3%), enrolled in the first year of the course (40.6%), had one year of training experience (43.0%), attended 2 departments (36.5%) and had training experiences in medical and surgical departments (76.9% and 64.2%, respectively). Demographics and participants' characteristics are summarized in Table 1.

Knowledge

Multiple choice questions, response possibilities, and respective answers are shown in Table 2. Among options of the questionnaire, none achieved 100% correct answers. The mean knowledge score was 51.1% (13.3/26). Only 23% (171/742) of the students had a mean score ≥60% (Table 3).

The lowest scores were obtained in the themes “*Preventive measures to reduce the amount of pressure/shear*” (37%) and “*Etiology and development*” (48.3%). By analysing the six items of “*Etiology and development*”, a high rate of incorrect answers can be observed to the questions number one and four (factors causing PUs), and three (sliding down of patient sitting in bed in a semi-up right position) (72.8%, 69.4% and 70.6%, respectively). Approximately half of the students answered incorrectly to the question number five (inspection of patient's conditions) of the theme “*Classification and observation*” (58.4%), to the question number two (use of assessment tool for risk prediction) of the theme “*Risk assessment*” (52.8%), and to the question number three (correct position to reduce the pressure) of the theme “*Preventive measures to reduce the duration of pressure/shear*” (50.7%). As concerned the items of the theme “*Preventive measures to reduce the amount of pressure/shear*”, most students did not know: the sitting position with the lowest contact pressure between the body and these at (66.5%), how reduce the magnitude of pressure at the seat, if a patient is sliding down in a chair (76%); how to use a visco-elastic foam mattress for a patient at risk of developing a pressure ulcer (70.2%) and how to do when a patient is lying on a pressure reducing foam mattress (67.6%) (Table2).

There were no statistically significant differences in scores between genders (*p*=0.367). Differences in scores showed, however, to be statistically significant when related to the year of education (*p* <0.001), training experience (*p*<0.001) and number of department frequented

by students($p < 0.001$) (Table3).

Attitudes

The mean attitude score was 76.7% (39.9/52). Statistically significant differences were found when the scores were related to year of education ($p = 0.030$), training experience ($p = 0.026$) and number of department frequented by students ($p = 0.029$). In particular, students' attitudes proved to be higher in students enrolled in the third year of the Bachelor of Science in Nursing (79% vs. about 76% of the other two previous years), in students with at least one year of training experience (77.9% vs. 67.9% of those with no experience) and that have attended at least one department (79.4% vs. 74.2 of those who did not attend any department) (Table3).

Noteworthy that 73.7% of the students had a mean attitude score of greater than or equal to 75%.

A weak correlation was found between total knowledge scores and total attitude scores ($\rho = 0.13$, $p < 0.001$).

Discussion

Adequate knowledge to guidelines and positive attitudes toward PU prevention is a crucial aspect to guide healthcare workers, especially nurses, that allows correct application of adequate prevention to patients and reduction of rates of Pus and hospitalization, morbidity of patients, and financial costs (Erwin-Toth, 1995; Berlowitz et al., 1997; Allman et al., 1999; Severens et al., 2002). The aim of this study was to investigate the knowledge and attitudes of Italian nursing students about PU prevention and to explore the correlation between knowledge and attitudes, and to evaluate any association with year of education, and training experience.

Knowledge

Our results showed that most participants had a poor knowledge of many of 33-multiple choice questions of the instrument (mean knowledge score of 51.1%), in agreement with Beeckman et al. (2011), who conducted a multicenter study among 533 Belgian nurses and reported a knowledge score of 49.6% using the same instrument. However, our scores are lower than those reported from similar studies using different instruments of measurement (i.e. The Pressure Ulcer Knowledge Assessment Tool). Gunningberg et al. (2013) reported a knowledge score of 61.0% for SNs, 59.3% for Registered Nurses (RNs) and 55.4% for Assistant Nurses (ANs) in Sweden. Demarré et al. (2011) reported a value of 28.9% for RNs and NAs in nursing home settings.

In this study the main critical issue has been found on nursing students' knowledge about the preventive strategies to reduce the amount of pressure/shear, which are clearly described in the European Pressure Ulcer Advisory Panel (EPUAP) guidelines (2009). We suppose that, in everyday clinical practice, the lack of knowledge could be related to a poor adherence to the guidelines with regard to the following points: (1) decide the right position the patient should assume to prevent PUs, (2) teach patient who is able to change position which is the best way to mobilize, (3) understand which prevention should be applied, and (4) discriminate between disadvantages and advantages of different devices for PU prevention.

By analyzing the relationship between nursing students' characteristics and knowledge, we observed the mean score values were influenced by: year of education, training experience and number of departments attended by students ($p < 0.001$). Students who attended the second or third class of the Degree Program, with more than one year of training experience, or who attended different departments, scored significantly higher in knowledge scores than did those with lower/any years of education/training experience or who did not attend any hospital department. This finding could be expected, given that the exposure to clinical setting during

the students' clinical placement may increase their level of knowledge. In fact, the importance of clinical experiences during the students' learning development is well recognized as a key to professional competence (Kline and Hodges, 2006). Beeckman et al. (2010b) and Pancorbo-Hidalgo et al. (2007) found similar correlation between educational background and score for knowledge, even though in a sample of nurses. Different results were reported by Pieper and Mott (1995) and Pieper and Mattern (1997) who did not observe that a high level of education was associated with greater knowledge scores.

Attitudes

In spite of lower NSs' level of knowledge, more than two thirds of the participants showed high attitude scores (equal to or greater than 75%). These results suggest good students' disposition to respond favorably to preventing PUs, in fact a negative attitude toward pressure ulcer prevention may be considered among factors contributing to non-compliance for pressure ulcer prevention guidelines (Grol and Wensing, 2004).

In agreement with Beeckman et al. (2011) we found a weak correlation between total knowledge scores and total attitude scores, suggesting that a student with a higher level of knowledge would be more prone to PU prevention.

In this study, we observed a difference of attitude scores when related to variables as year of education, training experience and number of departments attended by NSs. Students enrolled in the third year of the Degree Program showed significantly higher attitudes than those of the other two previous years. Similarly, an increased number of years of training experience and the frequency of at least one department seem to be related to higher score of attitudes. Therefore, we assume that, in our sample, attitudes could be influenced by students' exposure to clinical practice. Clinical learning plays a pivotal role in the nursing curriculum because nursing is a practical discipline and its knowledge is embedded both in theoretical knowledge and in clinical experience (Benner, 1984). In particular, several authors underline that clinical experiences are important to develop students' competence and to integrate theory with practice (Comparcini et al., 2014; Tomietto et al., 2012; Davies et al., 1999).

This study provides an exploration of Italian nurses' student knowledge and attitudes toward pressure ulcer prevention. Although several studies highlighted that the mere knowledge of the guidelines is not sufficient to change clinical practice (Cicolini et al., 2013; Manzoli et al., 2012; Grimshaw et al., 2004; Charrier et al., 2008), it has been commonly assumed that lack of knowledge, negative attitudes, or underdeveloped skills are the principal barriers to evidence-based practice at the level of the individual health care professional (Grimshaw et al., 2004). In every day clinical practice nurses are responsible for providing safe, person-centered, evidenced-based care (NMC, 2008); however, it is important to consider how to best develop research knowledge and utilization skills in undergraduate nursing students. In fact, the lack of research knowledge during student training could lead to poor research utilization by qualified nurses (Closs et al., 2000; Marsh et al., 2001; Christie et al., 2012).

In this vein, our findings underline the needs to develop educational strategies to improve NS' knowledge which, in turn, may predispose changes in clinical practice during the transition from student to fully qualified nurses.

Limits

The strength of this study is due to the multicenter design and the large sample that allow a fairly good representativeness of the overall population of Italian NSs. Also, the data collection was conducted by equally trained researchers for each nursing school, thus decreasing the potential information bias.

However, the study presents some limitations that need to be discussed. First of all, the cross-

sectional design of the study did not allow to determine causal relationships but only associations in the analysis of potential predictors of Knowledge/Attitude. Also, we cannot exclude the differences regarding students' knowledge related to teachers' approach, experiences and methods. Teachers may have positively or negatively influence on qualitative and quantitative student education, but this aspect has not been investigated yet. Moreover, after forward–backward translations and the pilot test of both instruments, we performed an item analysis for the Knowledge Assessment Instrument. However, we did not conduct the psychometric validation of the APuP tool but we calculate only the internal consistency of the instrument. Thus, given the importance to use validate instruments that allow comparison of results among different contexts, further research is necessary to fill out this gap.

Conclusions

In conclusion, despite more than two thirds of Italian nursing students showed a good disposition to respond favorably to preventing PUs, several of the preventive measures for the management of PU were not known by most of the participating NS, showing an inadequate overall level of knowledge on pressure ulcer prevention. Even though, positive attitudes manifest well-adjusted behaviors, the poor level of knowledge suggests a potential partial adherence to clinical guidelines by NS, with negative consequences for patient' scaring. However, we observed an association between a high level of education/training experience and better knowledge scores. These results suggest the importance to implement a comprehensive and systematic approach aimed at raising knowledge among nursing students regarding PU prevention and management.

The transition from nursing students to qualified nurses is stressful, the awareness of professional responsibility differs between nurses and students (Wangensteen et al., 2008) and during their final placement students realize that they will be accountable for their own practice as nurses (Kajander-Unkuri et al., 2014). When students have good competence at the moment of graduation the transition to professional nurses could be less stressful. Recently, the concept of competence in literature has been recognized as outcomes of nursing education and has been defined in terms of functional adequacy and the capacity to integrate knowledge, skills, attitudes and values in specific situation of clinical practice (Meretoja and Leino-Kilpi,2003). Therefore, the assessment of specific competences such as pressure ulcer prevention, in particular at the moment of graduation, is part of quality assurance of nursing education and could be used during students' learning experiences (Kajander-Unkuri et al.,2014). Given the importance of the topic, as PUs still remain a relevant problem for healthcare costs' raise and patient's discomfort, nursing educators which are involved both in basic nursing education and training, should play a pivotal role in developing methods to improve both knowledge and attitudes toward pressure ulcer prevention.

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Table 1. Overall characteristics of the sample

Characteristics	
Overall sample, <i>n (%)</i>	742 (100)
Age (years), <i>mean ± SD</i>	22.1 ±4.4
Nursing Schools, <i>n (%)</i>	
Ancona	185 (24.9)
Chieti	285 (38.4)
Cotignola	26 (3.5)
Faenza	139 (18.8)
Fermo	17 (2.3)
Forli	73 (9.8)
Macerata	17 (2.3)
Gender, <i>n (%)</i>	
Female	551 (74.3)
Male	191 (25.7)
Year of education, <i>n (%)</i>	
1	301 (40.6)
2	250 (33.7)
3	191 (25.7)
Training experience, <i>n (%)</i>	
None	169 (22.8)
One year	319 (43.0)
Two years	234 (31.5)
Three years	20 (2.7)
Department's number, <i>n (%)</i>	
None	169 (22.8)
One dept	93 (12.5)
Two depts	271 (36.5)
Three or more depts	209 (28.2)
Department's type*, <i>n (%)</i>	
Medical dept	571 (76.9)
Surgical dept	476 (64.2)
Maternal-Child dept	128 (17.7)
Mental health dept	26 (3.5)
Critical dept	102 (13.7)

* Total >100% due to the possibility to choose more than one response categories

Table 2. Students' answers on multiple-choice questions regarding prevention of Pressure ulcer

Item	% of answers
Theme 1: Aetiology and development	
1. Which statement is correct?	
A. Malnutrition causes pressure ulcers.	30.2
B ^c . A lack of oxygen causes pressure ulcers.	27.2
C. Moisture causes pressure ulcers.	42.6
2. Extremely thin patients are more at risk of developing a pressure ulcer than obese patients.	
A ^c . The contact area is small and thus the amount of pressure is higher.	49.6
B. The pressure is less extensive because the body weight of those patients is lower than the body weight of obese patients.	8.1
C. The risk of developing a vascular disorder is higher for obese patients. This increases the risk of developing a pressure ulcer	42.3
3. What happens when a patient, sitting in bed in a semi-upright position (60°), slides down?	
A. Pressure increases when the skin sticks to the surface.	14.2
B. Friction increases when the skin sticks to the surface.	56.4
C ^c . Shearing increases when the skin sticks to the surface.	29.4
4. Which statement is correct?	
A. Soap can dehydrate skin and thus the risk of pressure ulcers is increased.	6.3
B. Moisture from urine, faeces, wound drainage causes pressure ulcers.	63.1
C ^c . Shear is the force which occurs when the body slides and the skin sticks to the surface.	30.6
5. Which statement is correct?	
A ^c . Recent weight loss which has brought a patient below his or her ideal weight, increases the risk of pressure ulcers.	83.4
B. Very obese patients using medication that decreases peripheral blood circulation are not at risk of developing pressure ulcers.	7.7
C. Poor nutrition and age have no impact on tissue tolerance when the patients has a normal weight.	8.9
6. There is NO relationship between pressure ulcers risk and:	
A. Age.	19.9
B. Dehydration.	4.4
C ^c . Hypertension.	75.7
Theme 2: Classification and observation	
1. Which statement is correct?	
A ^c . A pressure ulcer extending down to the fascia is a grade 3 pressure ulcer.	52.9
B. A pressure ulcer extending through the underlying fascia is a grade 3 pressure ulcer.	15.5
C. A grade 3 pressure ulcer is always preceded by a grade 2 pressure ulcer.	31.6
2. Which statement is correct?	
A. A blister on a patient's heel is always a pressure ulcer of grade 2.	11.2
B. All grades (1, 2, 3 and 4) of pressure ulcers involve loss of skin layers.	16.2
C ^c . When necrosis occurs, it is a grade 3 or grade 4 pressure ulcer.	72.6
3. Which statement is correct?	
A ^c . Friction or share may occur when moving a patient in bad.	56.1
B. A superficial lesion, preceded by non-blanch able erythema is probably a friction lesion.	32.5
C. A kissing ulcer (copy lesion) is caused by pressure and shear.	11.4
4. In a sitting position, pressure ulcers are more likely to develop on:	
A ^c . Pelvic area, elbow and heel.	70.0
B. Knee, ankle and hip.	4.4
C. Hip, shoulder and heel.	25.6
5. Which statement is correct?	
A. All patients at risk of pressure ulcers should have a systematic skin inspection once a week.	13.4
B. The skin of patients seated in a chair, who cannot move themselves, should be inspected every two to three ours.	45.0
C ^c . The heels of patients who lie on a pressure redistributing should be observed minimum a day.	41.6
Theme 3: Risk assessment	
1. Which statement is correct?	
A. Risk assessment tools identify all high risk patients in need of prevention.	28.2
B. The use of need assessment scale reduce the cost of prevention.	14.8
C ^c . A risk assessment scale may not accurately predict the risk of developing a pressure ulcer and should be combined with clinical judgment.	57.0
2. Which statement is correct?	
A. The risk of pressure ulcer development should be assessed daily in all nursing home patients.	37.9
B. Absorbing pads should be placed under the patient to minimize the risk of pressure ulcer development.	14.9
C ^c . A patient with a history of pressure ulcers runs an higher risk of developing new pressure ulcers.	47.2
Theme 4: Nutrition	

1. Which statement is correct?	
A. Malnutrition causes pressure ulcers.	9.3
B. The use of nutritional supplements can replace expensive preventive measures.	1.9
C ^c . Optimizing nutrition can improve the patients general physical condition which may contribute to a reduction of the risk of pressure ulcers.	88.8

Theme 5 Preventive measures to reduce the amount of pressure/shear

1. The sitting position with the lowest contact pressure between the body and the seat is:	
A. An upright sitting position, with both feet resting on a footrest.	47.3
B. An upright sitting position, with both feet resting on the floor.	19.2
C ^c . A backwards sitting position, with both legs resting on a footrest.	33.5
2. Which repositioning scheme reduces pressure ulcer risk the most?	
A. Supine position - side 90° lateral position – supine position - 90° lateral position - supine position - ...	20.2
B. Supine position - side 30° lateral position – side 30° lateral position - supine position - ...	19.3
C ^c . Supine position - side 30° lateral position –sitting position - 30° lateral position - supine position - ...	60.5
3. Which statement is correct?	
A ^c . Patients who are able to change position while sitting should be taught to shift their weight minimum every 60 minutes while sitting in a chair.	57.2
B. In a side lying position, the patient should be at a 90 degree angle with the bed.	5.2
C. Shearing forces affect a patient sacrum maximally when the head of the bed is positioned at 30°.	37.6
4. If a patient is sliding down in a chair, the magnitude of pressure at the seat can be reduced the most by:	
A ^c . A thick air cushion.	24.0
B. A donut shaped foam cushion.	43.1
C. A gel cushion.	32.9
5. For a patient at risk of developing a pressure ulcer, a visco-elastic foam mattress:	
A. Reduces the pressure sufficiently and does not need to be combined with repositioning.	6.6
B. Has to be combined with repositioning every 2 hours.	63.6
C ^c . Has to be combined with repositioning every 4 hours.	29.8
6. A disadvantage of a water mattress is:	
A. Shear at the buttocks increases.	11.5
B. Pressure at the heels increases.	15.1
C ^c . Spontaneous small body movement are reduced.	73.4
7. When a patient is lying on a pressure reducing foam mattress:	
A. Elevation of the heels is not necessary.	5.9
B ^c . Elevation of the heels is important.	32.4
C. He or she should be checked for “bottoming out” at least twice a day.	61.7

Theme 6: Preventive measures to reduce the duration of pressure/shear

1. Repositioning is an accurate preventive method because..	
A. The magnitude of pressure and shear will be reduced.	7.2
B. The amount and the duration of pressure and shear will be reduced.	40.6
C ^c . The duration of pressure and shear will be reduced	52.2
2.Fewer patients will develop a pressure ulcer if:	
A. Food supplements are provided.	3.4
B. The areas at risk are massaged.	7.6
C ^c . Patients are mobilized.	89.0
3. Which statement is correct?	
A. Patients at risk lying on a non-pressure reducing foam mattress should be repositioned every 2 hours.	20.6
B. Patients at risk lying on an alternating air mattress should be repositioned every 4 hours.	30.1
C ^c . Patients at risk lying on a visco-elastic foam mattress should be repositioned every 2 hours.	49.3
4. When a patient is lying on an alternating pressure air mattress, the prevention of heel pressure ulcers includes:	
A. No specific preventive measures.	17.1
B. A pressure reducing cushion under the heels.	22.5
C ^c . A cushion under the lower legs elevating the heels.	60.4
5. If a bedridden patient cannot be repositioned, the most appropriate pressure ulcer prevention is:	
A. A pressure redistributing foam mattress.	13.3
B ^c . An alternating pressure air mattress.	58.1
C. Local treatment of the risk areas with zinco oxide paste.	28.6

^cCorrect answer.

Table 3. Mean knowledge and attitudes scores of the participating nurses students.

Characteristics	Knowledge	Attitude
	n/26 (%)	n/52 (%)
Total cohort	13.3/26 (51.1)	39.9/52 (76.7)
Gender		
Female	13.4/26 (51.5)	39.9/52 (76.7)
Male	13.2/26 (50.8)	39.7/52 (76.3)
	<i>p=0.367</i>	<i>p=0.796</i>
Year of education		
1	12.6/26 (48.5)	39.5/52 (76.0)
2	13.1/26 (50.4)	39.4/52 (75.8)
3	14.7/26 (56.5)	41.1/52 (79.0)
	<i>p<0.001</i>	<i>p=0.030</i>
Training experience		
None	12.1/26 (46.5)	35.3/52 (67.9)
One year	13.3/26 (51.1)	40.5/52 (77.9)
Two years	14.3/26 (55.0)	40.1/52 (77.1)
Three years	12.9/26 (49.6)	39.8/52 (76.5)
	<i>p<0.001</i>	<i>p=0.026</i>
Department's number		
None	12.1/26 (46.5)	38.6/52 (74.2)
One dept	14.4/26 (55.4)	41.3/52 (79.4)
Two depts	13.4/26 (51.5)	40.0/52 (77.0)
Three or more depts	13.8/26 (53.1)	40.0/52 (77.0)
	<i>p<0.001</i>	<i>p=0.029</i>