



Classification of Pressure Injury Stages and Skin Damage Photographs by RNs and Nursing Students in Spain

An Observational Comparison Study

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ABSTRACT

PURPOSE: The purpose of this study was to evaluate and classify pressure injuries (PIs) and other skin lesions according to the judgment of hospital-based RNs and nursing students who recently trained in wound care using photographs and comparing findings to those of wound care experts.

DESIGN: Cross-sectional observational survey.

SUBJECT AND SETTING: RNs working at Manacor Hospital, Mallorca, Spain, and third-year nursing students from the University of the Balearic Islands. Data were collected in June 2017.

METHODS: The survey instrument was accompanied by a set of 24 photographs in 7 categories of skin lesions, such as PIs or moisture-associated skin damage, which the respondents were asked to classify. Descriptive analysis of the classifications was carried out, and levels of agreement using the chi-square test were compared with evaluations/classifications of a panel of experts.

RESULTS: In total, 314 surveys (199 RNs and 115 students) were included in the analyses. Findings showed a wide variability among participants with levels of agreement, with expert opinion ranging from 91.4% to 15.61%. The levels of agreement were substantially lower for unstageable PIs (47.92%), those caused by moisture (53.50%), and mixed etiology (38.37%) than for stages 1-4 PIs. Of note, 62.12% of RNs had not received PI training or continuing education during the previous 2 years. This lack of education was statistically significantly associated with the accuracy of the classification made by the RNs for some of the photographs evaluated such as moisture-associated skin damage.

CONCLUSIONS: We found discrepancies in the classification of PIs and other wounds/lesions among experts, RNs, and students. The regular provision of up-to-date information in training and continuing education programs is imperative to maintain nurses' abilities to identify and classify PIs and other skin-related damage.

KEY WORDS: Incontinence-associated dermatitis, Moisture-associated skin damage, Pressure injury, Skin lesions.

INTRODUCTION

Pressure injuries (PIs) pose an important threat to health and the quality of life of patients and their caregivers. Pressure injuries are defined as lesions located on the skin and/or underlying tissue, usually on a bony prominence, resulting from pressure or a combination of pressure and shear forces. They may also appear on soft tissue subjected to external pressure by various materials or devices.¹ According to the European

Pressure Ulcer Advisory Panel, the National Pressure Ulcer Advisory Panel, and the Pan Pacific Pressure Injury Alliance, PIs can be classified into 6 stages or categories depending on the degree of tissue involvement, with stage 1 being the least severe and stage 4 the most advanced.² The term “unstageable pressure injury” is used to classify lesions in which the depth of tissue damage cannot be confirmed as the wound base is obscured by eschar.² The term “deep pressure tissue injury” refers to deep lesions that appear as a result of pressure and shear forces at the bone-muscle interface.³ Pressure injuries may be present in patients receiving any level of care, and international studies have calculated the overall prevalence in hospitals at approximately 9%.⁴⁻⁶ In Spain, the national prevalence study conducted by Pancorbo and colleagues,⁷ which included acute care hospitals and other health care institutions, obtained similar figures, with the prevalence of PIs ranging from more than 18% in intensive care units (ICUs) and 10% to 17% in nursing homes and primary care facilities. These findings are in line with those from a study conducted in the Balearic Islands, Spain, by Tomàs-Vidal and colleagues⁸ in 2011 that showed a prevalence of 8.6% in acute care hospitals and up to 18.9% in nursing homes.

Pressure injuries remain a major problem for hospital patient safety. A review of patient safety conducted by the English

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All authors declare the absence of any conflict of interest.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (JWOCNOnline.com).

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DOI: 10.1097/WON.0000000000000803

National Health System indicated that PIs are among the most frequently reported injuries, accounting for 19% of incidents of serious injuries.^{9,10} As such, PIs continue as a major source of concern for researchers and health care providers and have become an important indicator of quality of care.^{11,12}

Classification of PIs is required to guide effective nursing care management¹³; thus, accurate staging is critical. However, other “dependence-related lesions”¹⁴ and skin conditions such as friction injuries, moisture-associated skin damage (MASD) and incontinence-associated skin damage (IAD) that cause skin inflammation, and mixed-etiology wounds can manifest as PIs, leading to inaccurate staging. This, in turn, may lead to inappropriate treatment, in particular for MASD, which can be confused with stage 1 or 2 PI.¹⁵

Due to confusion over similarities among some skin conditions and PIs, the importance of PI training and ongoing education for health care professionals is warranted.¹⁶⁻¹⁸ One method to provide initial and continuing education is the use of photographs, which have been widely used in the study and monitoring of wounds and skin lesions, including the assessment of PIs, for practicing health care professionals and for nursing and health professions students.^{19,20}

Findings from a study conducted in 5 European countries by Beeckman and colleagues¹⁴ in 2007 showed a low degree of agreement ($K = 0.33$) in the classification of PIs and MASD between instructors and nurses with different levels of experience. However, the degree of agreement was substantially higher for nurses who had received formal training in wound care. Similar findings were noted in a more recently conducted study in 2016 in Spain by Valls-Matarín and colleagues,²¹ with nurses working in critical care showing a low degree of total agreement ($K = 0.38$). In the Valls-Matarín study, 33% of the skin lesions were classified incorrectly and 35.2% of MASD cases were classified as PIs.

To mitigate the incorrect staging of PIs and MASD, a study conducted in the Netherlands by Ham and colleagues¹⁵ in 2015 included an educational intervention for nurses and physicians working in the emergency department (ED), which led to substantial improvements (95.6%) in the identification and classification of different types of PIs. Similarly, a more recent study conducted by Henry¹⁶ achieved a relevant improvement (mean score in knowledge test 59.69 before vs 77.98 after the intervention; $P < .05$) in PI prevention skills among ICU nurses through the implementation of a multimedia education program. These findings suggest that education can address the difficulties in accurately determining the appropriate type of skin lesions and stage of PIs, in particular for hospital and student nurses, and thus may improve classification outcomes. We found that a need existed in our region of Spain to design and implement appropriate educational programs. Thus, the aim of our study was to evaluate the accuracy of identification of PIs by RNs and by third-year nursing degree students, using photographs as a proxy for actual PIs.

METHODS

In June 2017, we conducted a cross-sectional observational study of second- and third-year nursing students from the University of the Balearic Islands, Spain, and RNs working in the Hospital Manacor, Mallorca, Spain, on units such as medical/surgical, intensive care, perioperative, dialysis, and the ED. Specifically, we conducted a survey to assess ability to

correctly identify PIs using photographs. Students were invited to participate after completing coursework in which they obtained information on theoretical concepts of wound care and clinical assessment skills. Content was delivered via photographs during coursework in the second and third years of training and during which time students were doing clinical rotations in the hospital setting where they had opportunity to apply the wound knowledge gained. The study was approved by the Manacor Hospital Research Committee February 22, 2017, and the Research Ethics Committee of the University of the Balearic Islands (#2642; April 10, 2017). Informed consent was not required, as participation in the survey was anonymous and voluntary, and therefore the anonymity of the participants was maintained at all times. The RNs and all the students were given an information sheet describing the purpose of the study and its implications.

Sample Size

The sample size was estimated according to 69% of correct PI classification based on findings in a study conducted by Valls-Matarín and colleagues¹⁷ in Spain. Assuming an $\alpha = .05$ and power = 0.9, 2-tailed test, the sample was estimated to be 175 participants needed to detect a greater than 10% difference from expert classification.

Instrument

The survey included demographic information (age and sex), professional experience, previous training in managing PIs and other injuries, and a set of photographs of different PI stages and other skin lesions. The respondent was asked to classify the photographs as follows: (1) stage 1 PI, (2) stage 2 PI, (3) stage 3 PI, (4) stage 4 PI, (5) suspicion of deep-tissue injury (SDTI) or unstageable PI, (6) MASD or IAD, (7) mixed-etiology wounds/lesions that were unable to be categorized, or (8) “I don’t know/I’m not sure.”

To ensure the internal validity of the survey, 24 photographs were evaluated anonymously by a panel of 5 experts from the Independent Pressure Ulcer Advisory Group (GAUPP) of the Health Service of the Balearic Islands, Spain, who assessed each image independently and blindly. Their participation was voluntary and unpaid. The initial version consisted of 3 photographs for each of the 7 classification options, which were displayed in random order. After the first round of evaluations, the percentage of agreement among these experts on the classification of each image was determined, and their comments on our procedures were considered by the research team. Based on this feedback, changes were made by the research team and a second round of evaluation was conducted. For the final version, only photographs that obtained at least 75% agreement among the 5 experts were accepted. Table 1 shows the results of the experts’ evaluations and the consensus decisions taken in constructing the data collection instrument. The final set of photographs included in the survey is shown in Supplemental Digital Content 1 (available at: <http://links.lww.com/JWOCN/A62>).

Of the 24 photographs that formed the initial set, 10 were obtained by the researchers and 14 from the National Advisory Group for the Study of Pressure Ulcers and Chronic Lesions (GNEAUPP), Spain, which is not affiliated with any members of the study team, and used after having obtained written authorization. The photographs contributed by the researchers were obtained in a clinical context, during the assessment and follow-up of patients treated in different units of Manacor

TABLE 1.
Results of Evaluations From the Panel of Experts

	Observed Agreement Round 1	Decision Round 1	Observed Agreement Round 2	Decision Round 2	Category of Lesion	Code for Final Version of Survey
Photograph 1	80%	Accept	...	...	MASD	1
Photograph 2	0%	Review in the second round	100%	Accept	Stage 3 pressure injury	2
Photograph 3	80%	Accept	...	...	Mixed etiology	3
Photograph 4	100%	Accept	...	...	Stage 4 pressure injury	4
Photograph 5	0%	Remove	...	...	Mixed etiology	...
Photograph 6	60%	Review in the second round	100%	Accept	Unstageable or SDTI	5
Photograph 7	100%	Accept	...	...	Stage 2 pressure injury	6
Photograph 8	80%	Accept	...	...	Stage 1 pressure injury	7
Photograph 9	60%	Remove	...	...	Stage 4 pressure injury	...
Photograph 10	60%	Review in the second round	75%	Remove	Unstageable or SDTI	...
Photograph 11	100%	Accept	...	...	Stage 3 pressure injury	8
Photograph 12	60%	Review in the second round	50%	Remove ^a	Multiple etiology ^a	...
Photograph 13	80%	Remove ^b	...	...	MASD	...
Photograph 14	0%	Review in the second round	0%	Remove	Multiple etiology ^a	...
Photograph 15	80%	Accept	...	...	Stage 1 pressure injury	9
Photograph 16	80%	Remove	...	...	...	...
Photograph 17	60%	Review in the second round	75%	Accept	Mixed etiology	10
Photograph 18	80%	Accept	...	...	Stage 4 pressure injury	11
Photograph 19	100%	Accept	...	...	MASD	12
Photograph 20	20%	Review in the second round	100%	Accept	Unstageable or SDTI	13
Photograph 21	20%	Review in the second round	25%	Remove	Multiple etiology ^a	...
Photograph 22	40%	Remove	...	...	Stage 1 pressure injury	...
Photograph 23	0%	Review in the second round	50%	Remove	Stage 3 pressure injury	...
Photograph 24	100%	Accept	...	...	Stage 2 pressure injury	14

Abbreviations: MASD, moisture-associated skin damage; mixed etiology, pressure and friction; multiple etiology, undefined multiple factors; SDTI, suspected deep-tissue injury.

^aThe category "Multiple etiology" was removed from the final version of the survey due to lack of agreement among the experts.

^bDespite agreement, the image was removed due to lack of sharpness.

Hospital, Mallorca, Spain. Patient consent was provided for the use of the photographs that only showed the injury/lesion; thus, there was no identifiable information.

Study Procedures

The survey was distributed by members of the research team in a paper format, together with a dossier containing the 24 photographs 148 × 210 mm (6 × 8 in), with the permission and involvement of the unit supervisors. Surveys were placed in a visible location on the units, together with the information sheets and phone contact or e-mail of all team members. The survey was distributed among the nursing students by a third-year practicum instructor. Each respondent (RNs and students) had access to the photograph dossier to observe each lesion without any time limit. Participants returned the survey in a closed envelope to a member of the research team. Only fully completed surveys were accepted for analysis. The data collection period was June 1-30, 2017.

Data Analysis

The statistical analysis was performed using the Epidat 4.2 program (Santiago de Compostela, Coruña, Spain). The de-

scriptive analysis included demographic variables such as age and years of experience, expressed by means and standard deviations, and other data such as hospital areas in which RNs worked were presented as frequencies and percentages. The percentage of agreement observed for each image and category was calculated according to the classification previously established by the panel of experts. The chi-square test was used to assess differences between the responses of the RNs and students and the influence of training within the past 2 years. This study is reported following STROBE Statement checklist requirements (see Supplemental Digital Content 2, available at: <http://links.lww.com/JWOCN/A63>). 

RESULTS

Of the 440 surveys distributed to hospital RNs on the units and third-year nursing students, 314 completed surveys were returned during the study period. Of these, 199 (63.38%) were from the RNs and 115 (36.62%) from the nursing students. The response rates were 62.18% and 95.8%, respectively. The hospital unit providing the highest response rate was the ED, with 36 completed surveys, representing 18% of the

TABLE 2.
Hospital Nurses' Profile: Nursing and Hospital Areas

Area	n (%)
Adult hospital wards	58 (29)
Oncology and Internal medicine	16 (8)
Pulmonary and Internal medicine	13 (6.5)
Cardiology	11 (5.5)
General surgery	10 (5)
Trauma	8 (4)
Emergency department	36 (18)
Outpatient clinic/consultations	30 (15)
Surgical areas	23 (11.50)
Intensive care unit	15 (7.5)
Psychiatry	12 (6)
Pediatrics	7 (3.5)
Dialysis	6 (3)
Radiology	2 (1)
Rotating/multiple units	6 (3)
Unknown	4 (2)
Overall	199 (100)

sample of nurses. Table 2 shows the distribution of the surveys obtained per hospital areas.

Demographic information shows that 84.39% of the participants were female, with almost identical percentages for hospital nurses and students. The average age of the total sample was 33.77 ± 10.17 years, with 38.94 ± 8.09 years for RNs and 24.939 ± 6.80 years for students. The average length of experience of the nurses was 14.63 ± 7.77 years.

The photograph most frequently classified in accordance with the judgment of the panel of experts for both groups

was no. 12 MASD, with 91.4% ($n = 287$) observed agreement. In contrast, photograph 1, which was also classified by the panel of experts as an MASD, obtained only 15.61% ($n = 49$) observed agreement, the lowest value of the sample. Among RNs, the level of agreement was only 11.62% ($n = 23$). Table 3 shows the frequency and percentage of responses classified by RNs and students compared with the judgment of the panel of experts, for each of the photographs evaluated.

The analysis by type of PI shows considerable variability in the levels of agreement (Table 4). Stage 1 PIs obtained the highest agreement with expert opinion by both RNs (85.60%; $n = 339$) and students (84.05%; $n = 195$). Substantially lower percentages of level of agreements were obtained for the unstageable PIs (47.92%; $n = 301$), MASD (53.50%; $n = 336$), and mixed-etiology wounds/lesions (38.37%; $n = 241$). Statistically significant differences were found between RNs and students in the degree of observed agreement for unstageable injuries, for wounds of mixed etiology, and for the total number of lesions evaluated.

For the RNs, 62.12% ($n = 112$) stated they had received no type of training in PI prevention or management in the last 2 years. All the university students confirmed that they had received training in this field during their studies. Table 5 shows the percentages of responses in concordance with the judgment of the panel of experts by training. Having received training was statistically significantly associated with the degree of agreement with the experts' classifications for photographs 1, 3, 5, 10, and 13.

DISCUSSION

The aim of this study was to determine the degree of accuracy with which RNs and third-year university students classified PIs and other skin damage and lesions, according to currently accepted practice. Results revealed a high degree of response variability. In some cases, there were low levels of agreement with expert opinion, possibly because certain lesions such as mixed etiology and deep-tissue injury of PIs and other lesions

TABLE 3.
Distribution of Responses to Photographs^a

	Stage 1 Pressure Injury	Stage 2 Pressure Injury	Stage 3 Pressure Injury	Stage 4 Pressure Injury	Unstageable or SDTI	MASD	Mixed Etiology	I Don't Know
Photograph 1	6 (1.91%)	99 (31.53%)	50 (15.92%)	1 (0.32%)	1 (0.32%)	49 (15.61%)	92 (29.30%)	4 (1.27%)
Photograph 2	0	16 (5.10%)	169 (53.82%)	80 (25.48%)	30 (9.55%)	0	0	11 (6.05%)
Photograph 3	2 (0.64%)	30 (9.55%)	98 (32.21%)	11 (3.50%)	8 (2.55%)	25 (7.96%)	119 (37.9%)	9 (2.87%)
Photograph 4	0	2 (0.64%)	14 (4.46%)	234 (74.52%)	50 (15.92%)	0	1 (0.32%)	3 (0.96%)
Photograph 5	0	7 (2.23%)	83 (26.43%)	54 (17.20%)	146 (46.50%)	2 (0.64%)	0	15 (9.84%)
Photograph 6	30 (9.55%)	227 (72.29%)	20 (6.37%)	3 (0.96%)	16 (5.10%)	0	3 (0.96%)	8 (2.55%)
Photograph 7	273 (86.94%)	18 (5.73%)	1 (0.32%)	0	0	5 (1.59%)	7 (2.23%)	5 (1.59%)
Photograph 8	3 (0.96%)	76 (24.20%)	210 (66.88%)	11 (3.50%)	2 (0.64%)	1 (0.32%)	1 (0.32%)	7 (2.23%)
Photograph 9	261 (83.12%)	2 (0.64%)	2 (0.64%)	0	0	28 (8.92%)	12 (3.82%)	6 (1.91%)
Photograph 10	2 (0.64%)	34 (10.83%)	59 (18.79%)	7 (2.23%)	8 (2.55%)	51 (16.24%)	122 (38.85%)	23 (7.34%)
Photograph 11	1 (0.32%)	0	3 (0.96%)	236 (75.16%)	61 (19.43%)	1 (0.32%)	1 (0.32%)	4 (1.27%)
Photograph 12	10 (3.18%)	1 (0.32%)	0	1 (0.32%)	0	287 (91.40%)	8 (2.55%)	1 (0.32%)
Photograph 13	0	3 (0.96%)	33 (10.51%)	109 (34.71%)	155 (49.36%)	0	1 (0.32%)	8 (2.55%)
Photograph 14	22 (7.01)	272 (86.62%)	10 (3.18%)	0	0	0	4 (1.27%)	3 (0.6%)

Abbreviations: MASD, moisture-associated skin damage; SDTI, suspected deep-tissue injury.

^aIn bold, answers agreed with the panel of experts.

TABLE 4.
RNs' and Nursing Students' Concordance With the Panel of Experts

	Overall	RNs	Nursing Students	P
Stage 1 pressure injury	534 (85.03%)	339 (85.60%)	195 (84.05%)	.598
Stage 2 pressure injury	499 (79.45%)	309 (78.03%)	190 (81.89%)	.247
Stage 3 pressure injury	379 (60.35%)	231 (58.33%)	142 (61.20%)	.479
Stage 4 pressure injury	470 (74.84%)	309 (78.03%)	161 (69.39%)	.016
Unstageable or SDTI	301 (47.92%)	205 (51.76%)	96 (41.37%)	.012
MASD	336 (53.50%)	214 (54.04%)	122 (52.58%)	.724
Mixed etiology	241 (38.37%)	164 (41.41%)	77 (33.18%)	.041
Overall	2760 (62.78%)	1771 (63.88%)	983 (60.52%)	.026

Abbreviations: MASD, moisture-associated skin damage; SDTI, suspected deep-tissue lesion.

were unfamiliar to the RNs and students taking part in our survey. This finding raised concerns, as misclassification in clinical practice can result in the planning and provision of care that is not appropriate, thereby slowing the patient's recovery or reducing the effectiveness of the intervention, especially in immobile or frail individuals.¹⁸⁻²⁰

Photographs are commonly used and internationally accepted for the evaluation and classification of PIs and MASD, both in clinical practice and in education; however, this method is not without problems.²² An image lacking clinical information on the evolution of the wound or skin damage and providing no information on the clinical context will frequently be insufficient evidence with which to accurately interpret the etiology or healing prognosis. Lack of context can generate inconsistencies in the classification even when performed by experts.²¹ The levels of agreement obtained in our study were lower than those reported in previous research. The study conducted by Defloor and Schoonhoven²³ with a sample of 44 PI experts found 94.1% total agreement, with a high concordance between evaluators ($\kappa = 0.8$). A study conducted in Spain by Valls-Matarín and colleagues¹⁷ found 67% total agreement (95% confidence interval, 63.6-70.1) in a sample of 56 RNs working on an ICU. In our study, participants **was**

more diverse, including RNs from most hospital areas, some of whom had infrequent encounter with the lesions in the study and did not have recent education in PI management. Educational interventions have been shown to be effective in enhancing the ability to assess injuries according to photographs.²⁴⁻²⁸

To our knowledge, the study presented in this article is the first in which RNs and students have been jointly evaluated. In fact, there were few differences between the assessments made by the students and by the working nurses, who in general encountered the same difficulties with identifying certain skin damage such as MASD. However, there were exceptions regarding stage 4 PIs, unstageable PIs, and wounds of mixed etiology, in which cases we found significant differences between the two groups' assessments. However, these wounds were some of the most complex to identify by means of photographs.

It is in the classification of the most complex lesions (stage 4 PIs, unstageable PIs, and mixed-etiology lesions) where statistically significant differences with the experts' opinions were found between the survey responses made by RNs and were potentially influenced by the lack of education received during the last 2 years. Recent training is of crucial importance in the application of evidence-based wound care practices and

TABLE 5.
Concordance With the Panel of Experts According to Education/Training in the Last 2 Years

	No Education (N = 123)	Formal Education During Degree (N = 3)	Continuous Education/Face-to-Face (N = 41)	Continuous Education, Distance (N=20)	Postgraduate (N = 3)	P
Photograph 1	5 (4.1%)	0 (0%)	10 (24.4%)	6 (30%)	1 (33.3%)	.000
Photograph 2	69 (56.1%)	2 (66.7%)	23 (56.1%)	8 (40%)	2 (66.7%)	.695
Photograph 3	35 (28.5%)	0 (0%)	28 (68.3%)	11 (55%)	0 (0%)	.000
Photograph 4	101 (82%)	3 (100%)	26 (63.4%)	14 (70%)	2 (66.7%)	.104
Photograph 5	50 (40.7%)	2 (66.7%)	34 (82.9%)	10 (50%)	2 (66.7%)	.00
Photograph 6	82 (66.7%)	2 (66.7%)	32 (78%)	15 (75%)	1 (33.3%)	.403
Photograph 7	108 (87.8%)	3 (100%)	36 (87.8%)	19 (95%)	3 (100%)	.789
Photograph 8	73 (59.3%)	2 (66.7%)	28 (66.3%)	15 (75%)	2 (66.7%)	.650
Photograph 9	96 (78%)	2 (66.7%)	37 (90.2%)	18 (90%)	3 (100%)	.266
Photograph 10	47 (38.2%)	1 (33.3%)	26 (63.4%)	10 (50%)	1 (33.3%)	.077
Photograph 11	92 (74.8%)	3 (100%)	38 (92.7%)	14 (70%)	2 (66.7%)	.100
Photograph 12	117 (95.1%)	3 (100%)	40 (97.6%)	20 (100%)	3 (100%)	.797
Photograph 13	56 (45.5%)	1 (33.3%)	30 (73.2%)	12 (60%)	3 (100%)	.011
Photograph 14	104 (84.6%)	3 (100%)	37 (90.2%)	17 (85%)	3 (100%)	.765

impacts the effectiveness of the wound prevention and management.²⁹ This lack of training among a large proportion of the RNs who took part in our study could help explain the low levels of agreement with the experts' opinions for some photographs.

Strengths and Limitations

The wide variety of backgrounds of the RNs and student nurses provides a representative view of the acute care nursing population that is a key indicator (wound classification) for patient safety. We believe this study presents clear evidence of the importance of training in the assessment and classification of PIs, skin damage, and other lesions; however, the cross-sectional survey method did not allow us to establish cause-effect relationships among the variables studied. In addition, the variability observed between the RN and student responses for the different photographs, even within the same category of injury, suggests that the results may vary depending on the photographs used. The use of standardized instruments for assessing these PIs and other wounds could reduce the level of variability and enhance the internal validity of future studies. However, the selection process of photographs was based on the collaboration of expert nurses and consensus obtained in this process supports the initial validity of the results obtained.

CONCLUSIONS

These study findings highlight the difficulties often encountered in classifying PIs and other skin lesions, both for students and for RNs working in an acute care hospital. This lack of accuracy in the classification of skin damage should be given serious consideration in the design or reorientation of ongoing continuing education for nursing and in the current provision of university education programs for students.

ACKNOWLEDGMENTS

The authors acknowledge the expertise of GAUPP of the Health Service of the Balearic Islands, Spain, and GNEAUPP, Spain. This study received a nursing research award from College of Nursing of the Balearic Islands.

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