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Validation of LPD Scale for the Assessment of Pressure Ulcer at Home

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Abstract

Objectives: This study was designed to test and validate the new LPD scale in a home care setting. The specific objectives are to validate the LPD scale for subjects cared for at home; and to compare LPD to the Braden scale for internal validity. **Method:** This multicenter, cross-sectional study was conducted in the domestic environment of subjects cared for Home Care services from North to South of Italy. Data collection lasted 8 months, between June 2018 and September 2020, and consisted of the simultaneous compilation of the new LPD, and the Braden scale. Home Care Expert nurses could interface with the recruited subjects and/or caregivers. The parameters considered to validate the new scale were sensitivity (Se), specificity (Sp), positive predictive values (PPV), odds ratio (OR), and the area under the receiver operating characteristic (ROC) curve. **Results:** Of the 679 recruited subjects, 63.2% were women, and more than 50% did not have a pressure ulcer. 48.2% of the sample aged over 85 years old; 69% was affected by multiple disease, and 76.6% took a lot of drugs. 91.6% of the subjects were affected by a partial or total functional dependency. Around 50% of subjects presented double incontinence, and 43% were conscious and collaborated. 85.4% of subjects lived in a healthy environment. The predictive validity parameters showed: Se 77.25%, Sp 84.04%, PPV 91.37%, and the area under the curve (AUC) 0.88% with a confidence interval (CI) 95%. These values mean a moderately accuracy of the test. **Conclusions:** The new LPD scale has demonstrated a good capacity for identifying the subjects at risk of pressure ulcer and had a better discriminatory power rather than Braden scale.

Keywords

Pressure Ulcers, Sores, Home Care, Validation, Measurement Scale

1. Introduction

Pressure ulcers are considered localized injuries, that affected the skin and the underlying skin layers, and that appeared in correspondence with a bone prominence, due to pression, in combination with cuts and/or friction [1].

The areas most affected are the sacrum (43%), the trochanter (12%), and the heels (11%) [2].

Pressure ulcers generally affect people over 65 years of age, with an increased morbidity, a compromised functionality, and skin integrity. Other factors that increase the risk include a lack of skin care, dehydration, poor diet, and urine or feces incontinence [3].

In clinical practice, the application of standardized pressure ulcers risk assessment scales is recommended. Indeed, early intervention is essential for those at risk of developing pressure sores [1] [2] [4] [5].

The progressive aging of the population has led to an increase in the incidence and prevalence of pressure ulcers. In fact, the subjects most likely to develop such lesions are those with multiple diseases and functional limitations. Such ulcers are a major problem, both in the hospital and in the home environment, from the point of view of human resources, materials, techniques, and especially costs [1] [2] [3]. The increase in prevalence and the incidence of pressure ulcers, related to the high cost of health care, are negative indicators of the quality of life and health care provided.

In the USA, in 2006, the Agency for Healthcare Research and Quality (AHRQ) calculated that, in a sample of 281,560 hospitalized patients, the mortality rate was 11.6% for those who developed the ulcer during hospitalization, while the mortality rate was reduced in the case of patients with preexisting ulcers (4.2%) or none (2.6%) [6].

In the USA, pressure ulcers affect more than 2.5 million people, most of them are older, with a serious impact on the annual health care system (from $9.1 billion to $11.6 billion) [6].

In Italy, a study conducted by Olivo commissioned by the Nursing Association for the Treatment of Skin Diseases (AISLeC) speaks of a prevalence rate of around 13% [7].

Other studies have estimated that the annual cost of treatment of ulcer patients with is about 1300 - 3100 million of dollars, while in Spain and in the UK the cost is around the 5.20% and the 3.20% of the health costs [8].

The tendency for cost-containment is to reduce institutionalization, keeping people at home. The high socio-economic impact has made the reduction of 50% of the prevalence of pressure ulcers one of the goals of Healthy People 2010 [9] [10].

Prevention measures are considered the most effective way to deal with this problem.

Preventing such ulcers is an indicator of the quality of care and the patient's safety; the first step to be taken in this area is to make an adequate risk assessment [1] [2] [3].

Despite the large availability of scales to estimate the risk of pressure ulcers, very little is tailored for home care. There are at least 40 different assessment scales in the literature. The most common and well-known risk assessment tools in the literature are Norton scale, Gosnell scale, Knoll scale, Waterlow scale, Jones & Millman scale, Braden scale, Lowthian scale, Medley scale and Walsall scale [11].

The Braden Scale and the Norton Scale are widely used. The Norton dates back to the late 1950s [12] and is mainly aimed at institutionalized elderly people [13]. The Braden Scale is more recent and is considered the best one for validity and reliability because it focuses on empirical risk factors. In fact, it allows one to evaluate, through six variables, the factors involved in the formation of pressure ulcers [14]. The Braden scale was designed to detect precocious subjects suffering from pressure ulcers, in order to plan preventive interventions [14].

However, the validity and reliability of both scales have been tested for in institutional settings. Information about scale validity and reliability in noninstitutional settings, for example, at home, is not enough. Therefore, there is no evidence of a much better instrument designed specifically for home care.

No precise data are available on the Italian population of home-based subjects with a risk of skin ulceration; Data referring to the prevalence of pressure injuries in the hospital environment are very variable and should not be compared due to the different contextual variables in relation to the clinical setting, and do not constitute a statistical reference usable for this study.

Therefore, given the importance of the phenomenon, it becomes necessary to design pressure ulceration risk assessment tools that address specific aspects of home care.

Among the numerous risk assessment scales in the literature, Braden is the most widely used method to predict the risk of pressure ulcers risk in Italy, but it has only been performed in the clinical setting and not for home care [15].

Although the Braden scale is the most valid one, it does not have 100% sensitivity and specificity, so it is necessary to improve this instrument, adapting it to home nursing care.

Sensitivity and specificity represent the two reference epidemiological measures for assessing the validity of a risk assessment scale [14].

High sensitivity and high specificity are not the only key features to identify the most valuable tools. In fact, a risk assessment tool can only be valid if it has good predictive values, if it is easy to use, if it has precise definitions of terms, and if it is applicable in different contexts [14].

For these reasons, a new scale called the "LPD scale" (**Figure 1**) has been devised. It represents a pressure ulcer risk nursing assessment scale for home healthcare; it has been developed by the Laboratory EBNursing Studies of Padua University, involving members of a professional scientific association for wound care (AISLEC), for data collection.

It could be useful for nursing staff or caregivers to assess pressure sores of
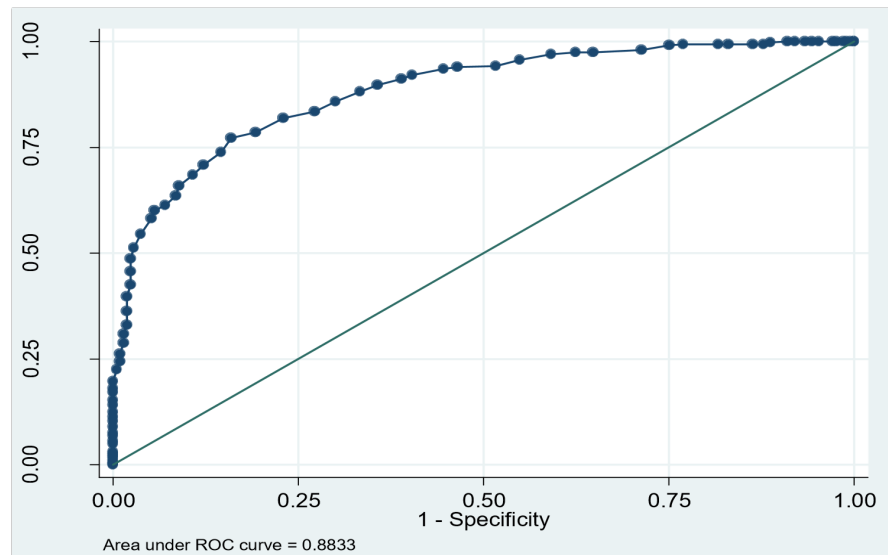
Area under ROC curve = 0.8833

Figure 1. Receiver operating characteristics (ROC) curve.

subjects who are cared for at home.

The LPD scale has been used to carry out a pilot study in 40 patients. The results have been compared with those of the Braden scale, resubmitted and discussed in an interdisciplinary one-day full immersion focus group, resulting in few rephrased descriptions and further general simplifications. Furthermore, the validity and reliability of the "LPD" scale has been tested in some Italian regions with a sample of 488 subjects, assisted in their homes. An excerpt of such a testing scale has been presented at the World Union of Wound Healing Societies (WUWHS) [16].

The "LPD" scale focuses on a few more factors, which have never been included in the most used scales. For example:

1) Attitude of the caregiver towards subjects assisted at home.

2) Hygiene of the subject's house.

On the LPD scale these two factors are thought to play some role in the co-causality of the skin ulcer.

2. Methods

The study adopts a multicenter and cross-sectional approach with a nonprobability sample. As a cross-sectional study, referral nurses from each participating center observed and measured patients enrolled in their center during the same period in the same standardized manner.

The study was conducted in the home environment of subjects cared for by home care nursing services. The target population consisted of patients at risk of pressure ulceration cared for at home by four recruitment centers located each in one region: Veneto (north-eastern Italy), Friuli (northern Italy) Marche (central Italy), and Puglia (southern Italy). The recruitment lasted from June 2018 to September 2020. Data collection was carried out by expert home care referral

nurses, members of the AISLeC (Nursing Association for the treatment of skin diseases), who voluntarily collaborated.

Sample inclusion and exclusion criteria: The inclusion criteria for the study were: a) Age ≥ 18 b) Any sex c) Presence of chronic diseases d) Partially or total functional dependence. The exclusion criteria: Age < 18 b) acute or terminal health situation c) community housing or sheltered residence with services provided by the municipality.

2.1. Recruitment

Recruiting was conducted through the identification of "Collaborating Centers" conducted by the AISLeC Association. In each of these centers, a reference nurse organized the local data collection, and other home care expert nurses participated as data collectors. They gave availability for taking on the commitment, with no remuneration, and with a work experience of at least two years.

2.2. Model Development and Variables of LPD Scale

In February 2009, a panel of clinicians and researchers with expertise in the practice and research of pressure ulcers from different institutional settings, gathered in Bologna for a two-day, full immersion consensus committee, liberally supported by COLOPLAST©. Panel members systematically reviewed articles and pertinent literature identifying a set of 14 discriminant variables for the specific assessment of the risk of pressure ulcers at home.

After that, a weighted model was elaborated, in order to estimate the level of risk.

Through a process of discussion and consensus, a first draft of a measurement tool was developed. The final draft was submitted to the panel members to reach the final consensus.

In 2010, the initial LPD scale, simplified and reduced to 12 variables, was tested for the first time in 40 patients cared for at home in different Italian regions.

In 2017, AISLeC and the Laboratory of Studies and EBNursing, considering the lack of a specific measurement tool to estimate the risk of pressure ulcers at home, jointly decided to resume the LPD scale and carry out a validation study.

The discriminant variables were grouped into the following sections:

1) Demography: Gender, age and the presence of ulcer.

2) Health status: Pathologies, therapy, nutrition, mental condition, person's behaviour, and skin trophism in the area at risk.

3) Functionality: Level of motricity, and incontinence.

4) Context: Hygiene in the environment, and the behavior of the caregiver.

2.3. Data Collection Methods

Data were collected from June 2018 and September 2020.

Data collection was carried out through field observation to detect empirical

data. The only tool available for Home Care Expert nurses was an interview; it consisted of a dialogue between nurses and patients and/or caregivers. The questions were posed following a trace, and the received answers were coded based on the variables to be measured on the two scales. In fact, the LPD scale was compiled by the Home Care Expert nurses along with the traditional Braden scale already in use, to compare the estimate provided by the two instruments.

Data collectors used "paper and pencil" to observe subjects and fill in both LPD and Braden scales.

The filled-up forms were sent to a project coordinator, and scannered in order to digitalize all data in RedCap, open access digital platform.

Lastly, the digitalized data were inputted into the project data file for statistical analysis.

Protection of the rights of correct information and free and conscientious consent to the participation has been implemented through two ways:

1) Home care expert nurses identified the person who met the recruitment criteria. The first home-made visit was prepared for the observation of the skin.

2) If Home Care Expert nurses were able to use a computer, the data were directly inserted into the Redcap platform; otherwise, they completed the paper form at home and then transferred it into an electronic grid.

Each RedCap electronic grid and paper form, including both LPD and Braden scale, was compiled with a unique code, which provided some information, such as the name of the recruiting center, the referent nurse, and the progressive number of the case observed in the recruitment center.

2.4. Data Analysis

Statistical analysis adopts descriptive tests for variables distribution with centrality and dispersion indices, in consideration of the description of the main aspects of the sample. To analyze the validity and predictive capacity of the scale, the Se, Sp, PPV, area under the ROC curve, and OR has been calculated through the association between each variable of the LPD scale variable and the presence or absence of ulcer in the recruited subjects, with the CI set at 95%.

The use of these analyses has allowed us to assess the internal and external validity of the LPD scale, consistent with the defined goals.

Subjects were classified according to classes of risk, both for LPD and Braden scale. While the Braden scale measures the risk from 6 to 23 points, and categorises results into four levels of risk, the LPD scale measures 0 to 11.6 points, and three levels of risk. To compare the levels of risk on the Braden scale, the number has been reduced to three, combining the two low-risk levels in just a single one.

To understand whether the variables on the LPD scale could be associated or not with the presence of ulcer, the sample has been divided into two subgroups: subjects with ulcer and those without ulcer. Moreover, to reduce the sample variability, only two out of four response modes have been taken into consideration for each variable; that is the extreme ones, aggregating the intermediates.

This analysis of these parameters allows us to determine the capacity of the LPD scale to assess pressure ulcers of patients cared for in their own homes by Home Care Expert nurses.

2.5. Ethical Consideration

The study was approved by institutional authorities with consensus number 42277/DS. Healthcare managers have indicated the contact persons authorized to collect the data. Subjects who were already patients followed by the service and who freely joined the study were recruited. An informative interview was carried out with each one and the signature of an informed consent form was obtained. Every precaution has been taken to guarantee the confidentiality of the data and the anonymity of the subjects.

3. Results

The recruited sample is made up of 679 subjects, treated at home by Home Care Expert nurses, and came from various Italian healthcare districts and from four Italian regions. The main characteristics of the sample are shown in Table 1.

The sample is composed of 250 (36.8%) males and 429 (63.2) females. Furthermore, 283 (41.7%) of the patients have at least one lesion, while 396 (58.3%) have none. The total of the recruited subjects falls within the following age groups: 71 (10.5%) are under 65, 79 (11.6%) are between 65 and 75, 202 (29.7%) are individuals between the ages of 76 and 85, the remaining 327 (48.2%) are over 85 years old.

From the point of view of health, 7 (1%) subjects have no pathology, 117 (17.2%) are affected by a single pathology, 471 (69.4%) from multiple ones, and 84 (12.4%) individuals have evolving pathologies.

However, in terms of therapy, 9 (1.3%) subjects do not take any drugs, 69 (10.2%) do take only one, 520 (76.6%) use associated therapies, and 81 (11.9%) take risk-associated therapy, such as drugs that altered skin metabolism.

The functional aspect of the subjects is represented by motricity and incontinence. 57 (8.4%) subjects are independent, 176 (25.9%) are able to change posture, 259 (38.1%) are able to move only the arts, while 187 (27.5%) are motionless. Furthermore, 94 (13.8%) subjects do not have incontinence, 96 (14.1%) occasionally have episodes of incontinence, 137 (20.2%) do have urinary or fecal incontinence, 352 (51.8%) subjects have both.

From the nutrition point of view, the weight of 433 (63.8%) subjects is included in the ideal weight, 92 (13.5%) subjects are obese, 145 (21.4%) are underweight and 9 (1.3%) are very obese.

Moreover, 294 (43.3%) individuals are conscious, 264 (38.9%) are confused, 103 (15.2%) are in a stupor, and 18 (2.7%) are in deep unconsciousness.

Subjects who have been active and involved are 257 (37.8%), 193 (28.4%) have not been very cooperative, 23 (3.4%) have had a refusal attitude, and 206 (30.3%) have not been interactive at all.

Table 1. Demography and health status of the sample.

Variables	Classes of risk	Sample	
		n = 679	%
Ulcer	Present	283	41.7
	Absent	396	58.3
Total		679	100
Gender	Male	250	36.8
	Female	429	63.2
Total		679	100
Age	<65	71	10.5
	65 - 75	79	11.6
	76 - 85	202	29.7
	>85	327	48.2
Total		679	100
Comorbidities	None	7	1.0
	Single	117	17.2
	Multiple	471	69.4
	In discomfort	84	12.4
Total		679	100
Therapy	None	9	1.3
	Single	69	10.2
	Multiple	520	76.6
	Risk correlated	81	11.9
Total		679	100
Motricity	Independent	57	8.4
	Changed posture	176	25.9
	Only arts	259	38.1
	Motionless	187	27.5
Total		679	100
Incontinence	Absent	94	13.8
	Occasional	96	14.1
	Urinary or fecal	137	20.2
	Mixed	352	51.8
Total		679	100
Nutrition	Standard	433	63.8
	Obese	92	13.5
	Underweight	145	21.4
	Very obese	9	1.3
Total		679	100

Continued

Mental status	Conscious	294	43.3
	Confused	264	38.9
	In a stupor	103	15.2
	Comatose	18	2.7
Total		**679**	**100**
Behavior	Cooperative	257	37.8
	Not much cooperative	193	28.4
	Refusal	23	3.4
	Passive	206	30.3
Total		**679**	**100**
Skin trophism	Eutrophic	198	29.2
	Dry cute	192	28.3
	Kidneutical (scar)	83	12.2
	Wet cute	206	30.3
Total		**679**	**100**
Hygiene in the environment	Appropriate	580	85.4
	Poor	66	9.7
	Lacking	22	3.2
	Very defective	11	1.6
Total		**679**	**100**
Caregiver's behavior	Adequate	577	85.0
	Not adequate	66	9.7
	Inadequate	14	2.1
	Absent	22	3.2
Total		**679**	**100**

Taking into account the skin trophism in the area at risk, 198 (29.2%) subjects have a normal skin in all its aspects, the skin of 192 (28.3%) individuals appears dehydrated and desquamated, 83 (12.2%) have scar tissue, and 206 (30.3%) have a constant wet skin, due to contact with urine, feces, and exudate.

Concerning the two environmental variables that refer to the home environment, the results show that 580 (85.4%) were clean and tidy and the lack of hygiene was only reported for 22 (3.2%) times.

The quality of the assistance received by the subject is represented by the behavior of the caregiver, from the point of view of mobilization, nutrition, hygiene and care of the person, and administration of the drugs.

Such behaviour is appropriate in 577 (85%) cases, is not much appropriate 66 (9.7%) times, is inappropriate in 14 (2.1%) cases, and 22 (3.2%) times the subject's care completely lacks.

Table 2. Analysis of odds ratio for LPD scale.

		With ulcer	Without ulcer	Total	OR (95% CI)
Age	<65	145	182	327	1.5 (2.55-0.88)
	>85	24	47	71	
	Total	169	229	398	
Comorbidities	None	44	40	84	0.4 (2.17 - 0.07)
	In discomfort	5	2	7	
	Total	49	42	91	
Therapy	None	27	54	81	0.4
	Risk correlated	5	4	9	(1.61 - 0.10)
	Total	32	58	90	
Motricity	Independent	95	92	187	2.8
	Motionless	15	42	57	(5.37 - 1.46)
	Total	110	134	244	
Incontinence	Absent	164	188	352	1.4
	Mixed	36	58	94	(2.22 - 0.88)
	Total	200	246	446	
Nutrition	Standard	5	4	9	2
	Very obese	163	270	433	(7.53 - 1.88)
	Total	168	274	442	
Mental status	Conscious	9	9	18	2.1
	Comatose	92	202	294	(5.45 - 0.81)
	Total	101	211	312	
Behaviour	Cooperative	114	92	206	2.7
	Passive	80	177	257	(3.93 - 1.85)
	Total	194	269	463	
Skin trophism	Eutrophic	120	86	206	4.1
	Wet cute	50	148	198	(6.23 - 2.70)
	Total	170	234	404	
Hygiene in the environment	Appropriate	9	2	11	6.7
	Very defective	233	347	580	(31.25 - 1.44)
	Total	242	349	591	
Caregiver's behaviour	Adequate	9	13	22	1
	Absent	223	354	577	(2.37 - 0.42)
	Total	232	367	599	

Table 2 shows the sample divided into two subgroups, those with lesion and those without, in relation to the variables of LPD, and its relative odds ratio (OR) with a 95% CI.

In order to evaluate the validity of the LPD scale, in direct comparison with the Braden scale, the distribution of the classes of risk of both instruments has been analyzed. This distribution is shown in Table 3.

Regarding LPD, 188 (27%) subjects are part of the low-risk class, 180 (26%) of the medium, and 315 (47%) of the high class. On the Braden scale, 159 (23%) individuals are considered low-risk, 57 (8%) at medium, and 467 (69%) at high-risk.

Subsequently, a comparison between the three classes of risk of both scales has been conducted. The comparisons are shown in Table 4.

Results about categorization by risk in Table 4. show that 115 (17%) subjects are considered at low risk, 25 (3.7%) at medium risk, and 296 (43.6%) individuals seem to be at high risk according to LPD and Braden scale.

Figure 1 shows the probability of obtaining a real positive result in the class of subjects at risk of pressure ulcer (Se), and the probability of obtaining a false positive result in the class of non-risk subjects (1 - Sp). This relationship is represented by the conjunction of the points.

The parameter worths estimating is represented by the area under the curve, which is 0.88.

Table 3. Distribution of classes of risk by the two instruments.

Scale distribution	Range	Frequency (n = 679)
LPD	Low (0 - 3.1)	185 (27.3%)
	Medium (3.2 - 4.2)	180 (26.5%)
	High (>4.2)	314 (46.2%)
Total		679 (100%)
Braden	Low (>16)	156 (23%)
	Medium (=16)	57 (8%)
	High (<16)	466 (69%)
Total		679 (100%)

Table 4. Cross-comparison between Braden and LPD's three classes of risk.

LPD Scale	Braden			Total (n = 679)
	Low	Medium	High	
Low	115 (17%)	22 (3.2%)	48 (7%)	185 (27.2%)
Medium	33 (4.9%)	25 (3.7%)	122 (18%)	180 (26.5%)
High	8 (1.2)	10 (1.5%)	296 (43.6%)	314 (46.3%)
Total	156 (23%)	57 (8.4%)	466 (68.6%)	679 (100%)

4. Discussion

The recruited sample is mainly characterized by women (63.2%); at the time of data collection, more than 50% of the subjects did not present any ulcer.

The most representative age of the sample is older than 85 years (48.2%); only this value equals the sum of the other age classes. The characteristics of the sample are similar to those of Bergquist [14], who reported a sample consisting of 1.711 non-hospitalized subjects, aged over 60 years old, who did not have pressure ulcers at the beginning.

In a study conducted by Park-Lee [17], it emerges that in 2004 the 11% of U.S. nursing home residents had pressure ulcers. Subjects who were more likely to have pressure ulcers were men, with an age of 64 years. Furthermore, a moderate percentage of subjects (69%) was affected by multiple pathologies, with the consequence of taking numerous drugs (76.6%).

Regarding the level of motricity, only 8.4% of the subjects were able to move independently, the remaining 91.6% reported a partial or total functional dependency. In a study conducted by Lindgren [18], immobility has resulted that it represents an important risk factor for the development of pressure ulcer among adult patients.

The same results also emerged in a study conducted in the 1990 by Allman [19]. In fact, risk factors associated with pressure ulcer were activity or mobility limitation, incontinence, abnormalities in nutritional status, and altered consciousness. Furthermore, more than half of the subjects (51%) have urinary and fecal incontinence; this represents one of the main risk factors for developing pressure ulcers [16] [17].

According to Smelzer [20], the nutritional aspect, seen as nutritional deficiencies or metabolic diseases such as diabetes mellitus, is also responsible for the appearance of such ulcers too; in this case, 64% of subjects respect the standard weight.

From a study conducted by Brandeis [21] it emerged that factors associated with the formation of pressure ulcers at home were ambulation difficulty, fecal incontinence, diabetes mellitus, and difficulty feeding yourself.

Regarding mental status, 43% of the subjects appeared conscious and 38% collaborated. The cognitive aspect is very important and needs to be evaluated before taking a therapeutic plan [6] [15].

According to some prevalence studies, the area that is most at risk of injury is the sacrum area, but lesions can also occur in altered areas, such as the heel, hip, ischium, shoulder, spinous process, ankle, toe, head, or face [10] [14].

Closely related to incontinence, it is the appearance of the skin in the exposed area; in most cases (30.3%) it is humid due to frequent contact with urine, stool and exudate.

Regarding the environmental status, almost all subjects (85.4%) lived in a healthy and tidy environment, within which the presence of a caregiver provided adequate patient care.

OR analysis shows the correlation between each LPD scale variable and the

presence or absence of pressure injury in the sample.

The statistically significant variables, related to the risk of pressure ulcer, with a 95% CI are:

1) Motricity level

2) Nutrition

3) Attitude of the Subject

4) Skin trophism

5) Environmental Hygiene

It can be seen that the variables considered to be associated with the risk of pressure ulcer in the OR analysis are not statistically important; but other variables, which were not considered associated with the risk, are significant [22] [23] [24].

Furthermore, it is strange that incontinence is not considered significant, statistically speaking, as it is closely related to the skin trophism of the area at risk of ulceration. However, the results obtained confirm what was shown in the studies of Lindgren, Allman, and Brandeis [18] [19] [21].

Concerning the distribution of risk classes, 185 subjects (27.3%) fall within the low range of the LPD scale; but only 156 (23%) are considered in the same risk severity as Braden, which means that 29 subjects are not considered at low risk on both instruments. The average risk class points to a more significant difference, as 180 of them (26.5%) are considered medium risk by the LPD scale and only 57 (8%) are considered equally by Braden.

The number of high-risk subjects is different on the two scales: LPD considers 314 (46.2%), while Braden 466 (69%).

Comparing the risk classes on the two scales, it can be observed that subjects who fall into the same risk categories on both scales are 436 (64.21%): 115 (17%) subjects are considered low risk for both LPD and Braden, only 25 (3.7%) subjects are included in the same medium risk class, and 296 (43.6%) subjects are considered high risk for pressure ulcer. As regards the validation of the LPD scale, the classification model would be optimal if it maximized both sensitivity and specificity at the same time [25] [26].

However, this is not possible: increasing the value of the specificity decreases the false positive values, but increasing the false negative ones means a decrease in sensitivity. In this relation there is a trade-off between the two scales [27] [28].

The AUC corresponds to 0.88 with a 95% CI; considering the classification of the discriminating capacity of a test, proposed by Swets [28], the test itself can be defined as moderately accurate.

To maximize the sensitivity and specificity values, the optimal cut-off corresponds to 3.8 (rather than 3.2 as indicated by the LPD scale).

In fact, the definition of the new cut-off allows us to obtain a sensitivity of 77.25%, a specificity of 84.04%, and a positive predictive value of 91.37%.

5. Limitations

Sampling has adopted a non-probabilistic model, but with a significant size in

comparison to the target population; therefore, it may be that with a larger sample result will not necessarily be different.

As regards the variables of the LPD scale, the intermediate values are to be checked carefully as they are more interpretable by the observer, while on the extreme values agreement is easier between observers. It would be appropriate to carry out a further study with double-blind observation.

6. Conclusions

Pressure ulcers are a very common condition, especially in elderly people, with chronic diseases and reduced self-sufficiency. They are considered negative prognostic elements involved in increasing morbidity and mortality. Prevention and proper risk assessment play a key role in nursing, regardless of the setting in which the subject is cared for. The most appropriate method to carry out preventive interventions is the use of specific tools, useful to assess the level of risk. Among the tools that are used traditionally in hospitalized subjects, the most common is the Braden scale.

The LPD scale represents an innovative tool designed to assess the risk of pressure ulcer in home-cared subjects. The subjects involved are evaluated in the environmental context in which they live; considering the presence and attitude of the caregiver, and the hygiene of the setting, these variables have not been considered by other scales so far.

The validation of the LPD scale has shown a good capacity to identify subjects at risk of pressure ulcer, with a better discriminatory power versus the Braden scale.

Future research should investigate the relative weight of environmental variables in relation to the health status and characteristics of skin injury. The use of double-blind observers is recommended to better test the reliability of the instrument and of the observation methods.

Declaration of Interest

The authors decline any competing interests.

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