6 Risk Assessment Scales for Predicting the Risk of Developing Pressure Ulcers

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Introduction

Currently, pressure ulcers are an important health problem, both for people with pressure ulcers and their caregivers and for health institutions and professionals. Therefore it is evident, with the knowledge acquired, that the best strategy to cope with this problem is to prevent it, since the majority of pressure ulcers (up to 95% according to some authors[1]) can be avoided, if the appropriate preventive measures are applied with adequate resources and within the correct context (such as clinical practice guidelines).

Nevertheless, pressure ulcer prevention is not costless, because it implies high expenditure, in equipment and human resources.[2,3] Thus there is a need to find assessment tools that can determine which patients require preventive measures and to what extent, and which patients can be spared these measures. It is feasible for experienced nurses to do the selection and apply preventive measures, according to their own clinical judgment. The issue is whether there are risk assessment tools that could be used (especially by less trained nurses or those who lack experience in managing these patients) that have the same success (or more) in detecting risk as expert clinical judgment. This is the main reason why different risk assessment scales have been proposed as tools to assess patients' risk of developing pressure ulcers.

We could define a pressure ulcer risk assessment scale (PURAS) as a tool that establishes a point scale according to a group of parameters regarded as risk factors for the development of pressure ulcers.

PURAS could be beneficial for patients. For example, Hodge et al.[4] and Bale et al. 1995[5] demonstrated that patients assessed using the Norton scale, received 76% more preventive measures than a control group not systematically assessed, and moreover that the allocation of pressure-relieving surfaces was optimized according to risk factors, thus reducing incidence. However, there is not a general use of assessment scales nationally or internationally. In the first national pressure ulcer prevalence study in Spain,[6] with professionals who answered a questionnaire about epidemiological data and preventive measures, a systematic use of PURAS was found in 72.8% of cases in hospital care, 60.31% in residential settings, and 59.5% in primary healthcare.

It is necessary to be aware of the usefulness of PURAS and what they are being used for. Simply using a PURAS without introducing the appropriate protocol on

prevention, which would support the necessary preventive measures according to their risk staging, has no effect on the reduction of pressure ulcer incidence. The use of scales must be followed by other preventive methods which would be much more effective if adequately prescribed according to the patient's risk. Therefore, PURAS must be settled in a protocol context for healthcare, extracted from evidence-supported procedures as developed by clinical practice guidelines, which in turn are a result of the best possible evidence. These should emanate from different worldwide investigation projects, not only in English, which would guarantee, when implementation is compulsory, that all professionals have the best knowledge, abilities, time, and resources for implementation in a scenario of continuous evaluation for quality in assistance.[7–9]

Hence, when a pressure ulcer prevention program is to be designed, one of the first steps, and therefore one of the most important, should be the selection of a PURAS.

Since Doreen Norton[10] first published her scale in 1962, more than 30 other scales have appeared in the scientific literature, plus a large number of modifications to some of them.[11–12]

Criteria for selection and implementation of any PURAS must have scientifically based arguments. In this chapter, we shall present the tools, and the scientific evidence for the use of the PURAS, and analyze in detail the most important scales, as well as the evidence and support behind them.

Scientific Evidence for the Use of Risk Assessment Scales for Pressure Ulcers

As mentioned above, in several clinical practice guidelines (CPG), we find recommendations for the use of PURAS based on the best scientific evidence available. Nevertheless, taking into account the lack, so far, of studies that compare clinical judgment with the use of scales, we have encountered some uncertainty as to the requirement for adopting a risk assessment scale rather than relying on the clinical judgment of individual nurses.

As basic methodological support, almost all CPGs are based on the systematic reviews made by Cullum et al. in 1995[12] and McGough in 1999.[13]

These reviews, and subsequent publications, consider that there is not enough evidence to demonstrate the effectiveness of risk evaluation scales in reducing the development of pressure ulcers, even though there is some evidence that supports the use of PURAS over and above clinical judgment on it own. We should take into account the risk of a possible publication bias in these publications and CPGs, since the sources on which they are based were written in English, and any other investigations published in other languages that could reinforce or refute some of these results have not been included or considered.

In a recent systematic review of papers published in four languages (English, Spanish, French, and Portuguese) made by Pancorbo et al.,[14] well-known statements have been confirmed, but it seems that some of the knowledge disseminated in the most recent publications on the issue are still not included in clinical practice guidelines.

From the first reviews (Cullum et al.[12] and McGough[13]) we show in Tables 6.1 and 6.2 the most important risk assessment advice for the CPGs and in Table 6.3 the latest review done by Pancorbo et al. concerning works on this subject.

Table 6.1. Clinical practice guidelines on pressure ulcer prevention with graded and hierarchy defined evidence

NICE: National Institute for Clinical Excellence: Pressure ulcers risk assessment and prevention (2001)[17]	**UIGNIRC:** University of Iowa Gerontological Nursing Interventions Research Center: Research dissemination Core. Prevention of Pressure Sore (2002)[21]
EPUAP: European Pressure Ulcer Advisory Panel: Guidelines on prevention for developing pressure ulcers (1999)[18]	**RNAO:** Registered Nurses Association of Ontario: The Nursing Best practice Guideline: Risk Assessment and Prevention of Pressure Ulcers (2002)[22]
AHCPR: Agency for Health Care Policy and Research: Pressure ulcers in adults: prediction and prevention. Clinical Practice Guideline (1992)[19]	**RCN:** Pressure ulcers risk assessment and prevention. Technical Report (2000)[23]
JBI: The Joanna Briggs Institute for Evidence Based nursing and Midwifery Best Practice: Pressure Sores. Part 1: Prevention of Pressure Related Damage (1997)[20]	

All references are evidence supported and adhere to the classification of Novell and Navarro-Rubio (1997)[15] and Gálvez Toro (2001),[16] so that they can be grouped on a three-category basis of evidence: grade A = high evidence; grade B = medium evidence; grade C = low evidence.

In some aspects we find a need for adequate evidence as a result of a lack of experimental work, which provides the best evidence, and we also face an ethical

Table 6.2. Recommendations review according to evidence level and sources

Recommendation	Evidence level[a]	Sources
The use of scales in risk assessment must be used as an aid, but not to replace clinical judgment.	A	NICE,[17] AHCPR,[19] EPUAP[18]
Risk assessment is more than just using a scale for it is not a mere protocolized assessment and should be flexible according to patients' needs.	C	EPUAP[18]
Risk assessment must be performed immediately after patient admission, even though this assessment could need more time to be completed if the information is not yet available.	C	EPUAP[18]
Risk must be reassessed periodically.	A	EPUPAP,[18] AHCPR,[19], JBI[20]
To assess risk, validated scales such as Braden or Norton can be used.	Braden: B	AHCPR,[19] JBI,[20] UIGNIRC,[21] RNAO[22]
	Norton: C	AHCPR,[19] JBI[20]
Patients with a Braden scale score equal to or lower than 16 in hospitals and equal to or lower than 18 in long-term facilities must be considered at risk.	B	UIGNIRC[21]
Risk assessment must be done by professionals trained in recognizing risk factors for developing pressure ulcers.	C	RCN[23]
If a risk assessment scale is used, it should be tested on the facility that is being applied.	C	RCN[23]
All risk assessment must be documented.	C	RCN,[23] NICE,[17] AHCPR,[19] JBI,[20] UIGNIRC,[21] RNAO[22]

[a]Grade A = high evidence; grade B = medium evidence; grade C = low evidence (Novell and Navarro-Rubio[15] and Gálvez Toro[16]).

Table 6.3. Main recommendations from systematic reviews of risk assessment scales for development of pressure ulcers

	Cullum et al.[12]	McGough[13]	Pancorbo et al.[14]
Presentation date	1995	1999	2004
Period included	1962–1994	1962–1997	1962–2003
Number of studies included	15	18	33
Conclusions	• There is no evidence that the use of PURAS in scheduling care reduces the incidence of pressure ulcer • There is great variability in predictive value among different scales as well as in the same scale • No scale seems better than another • There is little evidence to demonstrate that any PURAS is better than clinical judgment or that it improves patient outcomes	• There is no evidence that PURAS are effective in reducing PU incidence or improve preventive measures • There is little evidence that demonstrates that a PURAS is better than nurses' clinical judgment • No scale is more reliable than another in identifying patients at major risk, even though the Braden scale has been more investigated than others	• There is no evidence that the use of PURAS in clinical practice reduces PU incidence in patients • There is enough evidence for the use of preventive measures adequately using as screening criteria a PURAS • There is enough evidence to determine that the use of PURAS results in better preventive methodology • Braden and Norton scales are better than nurses' clinical judgment to predict the risk of patients developing pressure ulcers • The Braden scale has the best steadiness on sensitivity/specificity, and the best predictive ability regarding patients that can develop pressure ulcers • There is no evidence that clinical judgment by itself is able to predict risk for developing pressure ulcers in all patients

Source: Pancorbo Hidalgo et al.[14]

problem in the design of studies, because the control group are at risk of being deprived of the benefits of systematic risk assessment.

This circumstance occurs in other similar situations within general nurse practice and specifically in chronic wounds, where ethically it becomes a predicament whether to switch from a low evidence type C to a higher type A. As a corollary, this implies that we should be very cautious about approaches based only on the evidence achieved from clinical trials; for low type evidence should be carefully analyzed and not disregarded, since in many cases this procedure is the only one that can ethically be chosen as an option.

Characteristics of the Ideal Scale

Several authors[8,11,19,23–28] have tried to emphasize the characteristics or requirements that the ideal scale should have, or in other words, the essential criteria of a PURAS which are, in particular, those to be considered necessary when evaluating and/or validating a scale. These aspects, listed in Table 6.4, could be:

1. High sensitivity. Defined as the ability of a test or scale to correctly identify those patients with an illness or condition among those at risk.
2. High specificity. Is the ability of the test or scale to correctly identify those patients without an illness or condition among those not at risk.

Table 6.4. Characteristics of the ideal PURAS

High sensitivity
High specificity
Good predictive value
Ease of use
Clear and definite criteria
Applicable to different healthcare settings

Source: Torra i Bou.[11]

3. Good predictive value. It may be positive: those patients with an ulcer who had been assessed as "at risk" among those who do develop an ulcer; or it may be negative: those patients without an ulcer who had been assessed as "not at risk" among those who do not develop an ulcer.
4. Ease of use, for all professionals regardless of their experience.
5. Precise definition of terms, which means that criteria must be clear and well defined in order to avoid, as much as possible, inconsistency among different nurses using the scale.
6. Applicable to the different clinical settings where ulcers appear or to those patients at risk; varying from home to residential care, hospitals or geriatric and pediatric units and intensive care.

Using these criteria we shall examine different risk assessment scales for developing pressure ulcers. It is important to consider the large number of existing scales and that new scales appear every so often (for example Fragment, Cubbin–Jackson); therefore we are only going to take into account the most important ones and the ones with valid literature.

Norton Scale

The Norton scale was the first PURAS described in the scientific literature. It was developed by Norton et al.[10] in 1962 during an investigation on geriatric patients, and has been used worldwide. The scale considers five parameters, mental status, incontinence, mobility, activity, and physical condition, and has a four-point scoring scale, 4 being the best situation for each parameter and 1 the worst (Table 6.5). This assessment scale has an inverse scoring so lower values designate higher risk. Originally a cutoff point of 14 or less implied a moderate risk of developing pressure ulcers and 12 or less indicated a high risk. Later, in 1987, Norton proposed its modification setting the cutoff point at 16.[29]

Table 6.5. The Norton scale

Physical state	Mental state	Activity	Mobility	Incontinence
4 Good	4 Alert	4 Walks	4 Complete	4 None
3 Weak	3 Apathic	3 Walks with assistance	3 Slightly limited	3 Occasional
2 Ill	2 Confused	2 Wheelchair bound	2 Very limited	2 Mainly urinary
1 Very ill	1 Stupor	1 Bed bound	1 Immobile	1 Double incontinence

Source: Norton.[29]

Table 6.6. Norton scale validation studies

Authors and publication year	Type of facility	Sample size	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Norton et al., 1962[10]	Geriatric center	250	63%	70%	39%	86%
Roberts and Goldstone, 1979[30]	Hospital	64	92%	61%	37%	96%
Newman and West, 1981[30]		88	83%	63%	14%	98%
Goldstone and Roberts, 1980[32]	Hospital	64	92%	61%	—	—
Goldstone and Goldstone, 1982[33]	Hospital (traumatology)	40	89%	36%	53%	80%
Lincoln et al. 1986[34]	Hospital	50	0%	94%	—	—
Smith, 1989[35]	Hospital (traumatology)	101	60%	31%	—	—
Stotts, 1988[36]	Hospital (cardiovascular surgery and neurosurgery)	387	16%	94%	—	—
Wai-Han et al., 1997[37]	Geriatric center	185	75%	67%	9%	98%
Pang and Wong, 1998[38]	Hospital (rehabilitation)	138	81%	59%	33%	93%
García et al., 1999[39]	Hospital	3030	89%	81%	21%	99%
Schoonhoven et al., 2002[40]	Hospital	1229	46%	60%	7%	94%

Source: Created by the authors from data in Torra i Bou,[11] Cullum et al.,[12] and McGough.[13]

The Norton scale is quite easy to use[24] and has been widely validated[9,30–40] (Table 6.6). Mean values are:

- sensitivity 66% (range 0–92%);
- specificity 65% (range 31–94%);
- predictive positive value 27% (range 7–53%);
- predictive negative value 93% (range 80–99%).

As such, it displays some inconveniences that may limit its clinical effectiveness. The main deficiencies are:

1. It does not have a functional definition of the applied parameters.
2. It does not consider nutritional factors.
3. It does not take into account frictional forces on the skin surface.

Many scales have been derived from the Norton scale, adding other parameters to the five original ones. Among them are the following:

- *The Gosnell scale* (1973) includes five parameters: mental status, incontinence, activity, mobility, and nutrition (which tends to substitute the general state condition of the original scale drawn up by Doreen Norton), plus three further parameters without point scales: vital signs, skin appearance, and medication. Scoring is also inversely depicted and similar to the Norton scale.[41]
- *The Ek scale* (1987), or modified Norton scale, has seven elements, the basic Norton scale plus two nutritional parameters: food and liquid ingestion. It has been used in Scandinavia and submitted to several studies.[42]
- In Spain there are several modifications of the Norton scale, for example *the Nova-4 scale*[43,44] created by a group of nurses from the Institut Català de la Salut

Table 6.7. Validation studies of scales based on the Norton scale

Scale	Authors and publication year	Type of center	Sample size	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Gosnell	Gosnell, 1973[41]	Geriatric center	30	50%	73%	—	—
Nova- 4	García Fernández et al., 1999[43]	Hospital	187	84%	54%	43%	67%
EMINA	Fuentelsalz, 2001[48]	Hospital	673	77%	72%	17%	98%

(ICS—Catalan Health Institute) and the *Norton scale modified by the INSALUD* (Instituto Nacional de la Salud—Spanish National Health Institute).[45,46] The *EMINA scale* (2001) is an improvement of the Nova-4 scale in which the direction of the scale was changed so that a higher score means higher risk with an added functional definition for each parameter to assist its use.[47]

Validation data for these scales are shown in Table 6.7.

Waterlow Scale

This scale was designed by Judy Waterlow, in the UK in 1985, as an outcome from a study on pressure ulcer prevalence, where she found that the Norton scale did not classify within the "at-risk" group many patients who in time developed pressure ulcers.[48] After reviewing the factors which arise in the etiology and pathogenesis of pressure ulcers, Waterlow presented a scale with six subscales—height/weight relationship, continence, skin appearance, mobility, age/sex, appetite—and four categories of other risk factors (tissue malnutrition, neurological deficit, surgery, and medication) (Table 6.8).

Table 6.8. The Waterlow scale

Weight/size relationship:	**Skin type and visual aspect of risk areas:**	**Sex/Age:**	**Special risks:**
0. Standard	0. Healthy	1. Male	**Tissue malnutrition:**
1. Above standards	1. Frail	2. female	8. Terminal/cachexia
2. Obese	1. Dry	1. 14–49 years	5. Cardiac insufficiency
	2. Edematous	2. 50–64 years	6. Peripheral vascular insufficiency
3. Below standards	1. Cold and humid	3. 65–74 years	2. Anemia
	2. Alterations in color	4. 75–80 years	1. Smoker
	3. Wounded	5. Over 81 years	
Continence:	**Mobility:**	**Appetite:**	**Neurological deficit:**
0. Complete, urine catheter	0. Complete	0. Normal	5. Diabetes, paraplegic, ACV
1. Occasional incontinence	1. Restless	1. Scarce/feeding tube	
2. Urine catheter/fecal incontinence	2. Apathy	2. Liquid intravenous	**Surgery:**
3. Double incontinence	3. Restricted	3. Anorexia/Absolute diet	5. Orthopedic surgery below waist
	4. Inert		5. Over 2 hours in surgery
	5. On chair		
			Medication:
			4. Steroids, cytotoxics, anti-inflammatory drugs in elevated dosage

Scoring: Over 10 points: at risk. Over 16 points: high risk. Over 20 points: very high risk.
Source: Waterlow.[50]

Table 6.9. Waterlow scale validation studies

Authors and publication year	Type of center	Sample size	Sensitivity	Spacificity	Positive predictive value	Negative predictive value
Smith, 1989[35]	Orthopedic surgery	101	73%	38%	—	—
Edwards, 1995[49]	Primary care	31	100%	10%	7%	100%
Pang and Wong, 1998[38]	Hospital (rehabilitation)	138	95%	44%	29%	97%
Westrate et al., 1990[50]	Hospital (ICU)	594	80.9%	28.5%	8.9%	94.5%
Boyle and Green, 2001[51]	Hospital (ICU)	314	100%	13%	—	—
Schoonhoven et al., 2002[40]	Hospital	1229	89%	22%	7%	97%

Even though it is an Anglo-Saxon scale, it has an incremental positive scoring, considering a patient "at risk" with a score of 10 or higher. The validating data of this scale are shown in Table 6.9.

Mean values are:

- sensitivity 89% (range 73–100%);
- specificity 29% (range 10–44%);
- positive predictive value 14% (range 7–29%);
- negative predictive value 98% (range 97–100%).

Waterlow's scale is used in the UK, but it has not been widely implemented. Main appraisals are:

1. It tends to classify into the "at-risk" group more patients than those actually at risk.
2. It is complex to apply because of the large number of parameters that need to be evaluated.
3. It determines women with higher risk than men.

A study has been recently published of a simplified Waterlow scale with four subscales (appetite, continence, skin integrity, and age) and a category (cancer diagnosis) which offers an improved grading on sensitivity and specificity compared with the original scale.[52]

Braden Scale

The Braden scale was designed in 1985 in the USA, as part of a research project in residential care settings, to deal with some of the limitations of the Norton scale.[53] Barbara Braden and Nancy Bergstrom established their scale (Figure 6.1) via a conceptual scheme[54,10] (Figure 6.2) where they documented, ordered, and set relationships of facts on pressure ulcers, laying down the basis of a PURAS.[55]

The Braden scale has six subscales: sensory perception, skin exposure to humidity, physical activity, mobility, nutrition, friction and shear turning into skin damage, with a functional term definition to be checked for each of these subscales. In Figure 6.2 we can see that three subscales are measuring features related to

strong and prolonged exposure to pressure, while the others are related to tissue tolerance.

The Braden scale is an inverse scoring tool, which means that the lower score implies major risk, with a range varying from 5 to 23 points. Patients "at risk" are those with scores equal to or below 16 points on this scale; 15–16 is "low risk," 13–14 "moderate risk," and between 5 and 12 "high risk." Table 6.10 shows the results of more than a dozen works for validation of the Braden scale in different care settings, varying from hospitals for acute patients to long-term facilities, including intensive care, nursing homes for the elderly, and home care.[56–67] According to these studies, mean sensitivity is 74% (range 27–100%); specificity is 69% (19–95%); positive predictive value is 43% (8–77%); and negative predictive value is 90% (71–100%).

As can be seen, this scale is the most validated by scientific literature, having the best evidence for to its usefulness, being very sensitive and specific. The main problem is its difficulty of use, for it requires more training than the Norton scale.

Patient's Name_____ Evaluator's Name_____ Date of Assessment

SENSORY PERCEPTION ability to respond meaning-fully to pressure-related discomfort	**1. Completely Limited** Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation OR limited ability to feel pain over most of body.	**2. Very Limited** Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness OR has a sensory impairment which limits the ability to feel pain or discomfort over ½ of body.	**3. Slightly Limited** Responds to verbal commands, but cannot always communicate discomfort or the need to be turned OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	**4. No Impairment** Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort				
MOISTURE degree to which skin is exposed to moisture	**1. Constantly Moist** Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	**2 .Very Moist** Skin is often, but not always moist. Linen must be changed at least once a shift.	**3. Occasionally Moist:** Skin is occasionally moist, requiring an extra linen change approximately once a day.	**4. Rarely Moist** Skin is usually dry, linen only requires changing at routine intervals.				
ACTIVITY degree of physical activity	**1. Bedfast** Confined to bed.	**2 . Chairfast** Ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	**3. Walks Occasionally** Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	**4. Walks Frequently** Walks outside room at least twice a day and inside room at least once every two hours during waking hours.				
MOBILITY ability to change and control body position	**1. Completely Immobile** Does not make even slight changes in body or extremity position without assistance.	**2 .Very Limited** Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	**3. Slightly Limited** Makes frequent though slight changes in body or extremity position independently.	**4. No Limitation** Makes major and frequent changes in position without assistance.				
NUTRITION usual food intake pattern	**1. Very Poor** Never eats a complete meal. Rarely eats more than ⅓ of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement OR is NPO and/or maintained on clear liquids or IV's for more than 5 days	**2. Probably Inadequate** Rarely eats a complete meal and generally eats only about ½ of any food offered. Protein intake incudes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement OR receives less than optimum amount of liquid diet or tube feeding.	**3. Adequate** Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) per day. Occasionally will refuse a meal, but will usually take a supplement when offered OR is on a tube feeding or TPN regimen which probably meets most of nutritional needs.	**4. Excellent** Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.				
FRICTION & SHEAR	**1. Problem** Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures or agitation leads to almost constant friction.	**2. Potential Problem** Moves feebly or requires minimum assistance. During a move skin probably slides to some extent against sheets, chair, restraints or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	**3. No Apparent Problem** Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair.					

 Total Score

Figure 6.1 The Braden scale for predicting pressure sore risk.

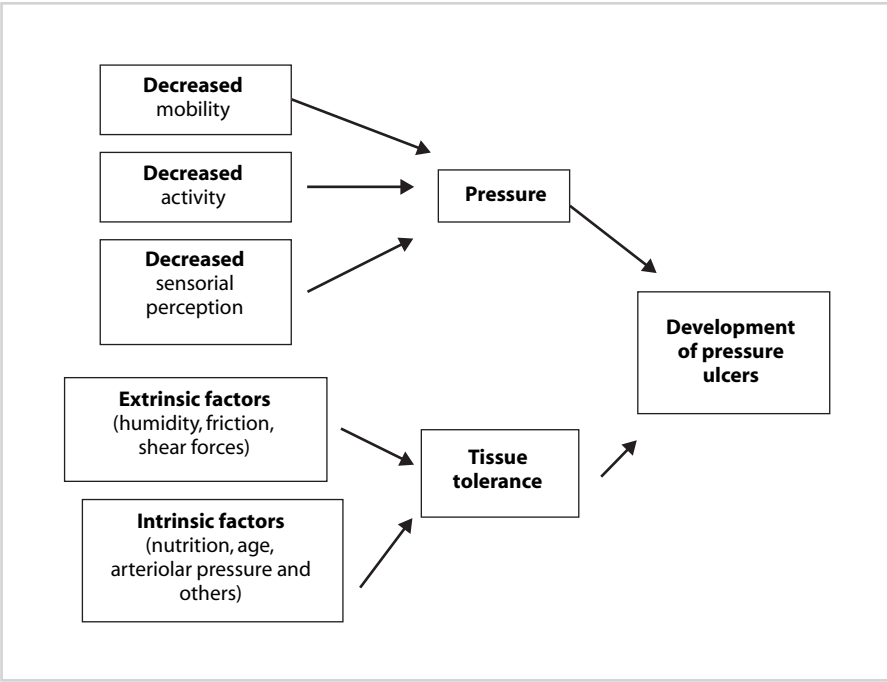

Figure 6.2 Concept diagram for the development of pressure ulcers. (From Braden and Bergstrom.[54] Reprinted from *Rehabilitation Nursing* 12: 9, with permission of the Association of Rehabilitation Nurses, 4700 W. Lake Avenue, Glenview, IL 60025-1485. Copyright © 1987.)

Table 6.10. Validation of Braden scale studies

Authors and publication year	Type of center	Sample size	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Bergstrom, Braden et al., 1987[55]	Hospital	99	100%	90%	70%	97%
Bergstrom, Braden et al., 1987[55]	Long-term hospital	100	100%	64%	25%	100%
Bergstrom et al., 1987[56]	Intensive care	60	83%	64%	61%	85%
Langemo et al., 1991 [57]	Hospital	190	64%	87%	47%	93%
Bergstrom and Braden, 1992[58]	Nursing home	200	97%	19%	77%	71%
Salvadalena et al., 1992[59]	Hospital	99	40%	70%	23%	79%
Barnes and Payton, 1993[60]	Hospital	361	73%	91%	33%	91%
Braden and Bergstrom, 1994[61]	Nursing home	102	79%	74%	54%	90%
Ramundo, 1995[62]	Home care	48	100%	34%	21%	100%
Capobianco and McDonald, 1996[63]	Hospital	50	71%	83%	63%	88%
Halfens, 1997[64]	Hospital	320	74%	70%	30%	94%
Pang and Wong, 1998[38]	Hospital (rehabilitation)	138	91%	62%	37%	96%
Vap and Donahue, 2000[65]	Long-term hospital	555	27%	95%	53%	74%
Schoonhoven et al., 2002[40]	Hospital	1229	43%	68%	8%	95%
Seongsook et al., 2004[66]	Hospital (ICU)	125	97%	26%	37%	95%

Source: Created by the authors using data from Torra i Bou,[11] Cullum et al.,[12] and McGough.[13]

PURAS in Intensive Care Patients

The constant increase in knowledge about PURAS has led to deep and interesting debates about the need for specific tools for complex and special clinical situations, as in the case of patients in intensive care units (ICU) or pediatric patients.

For intensive care units there is wide disagreement in the literature about the use of general scales. Thus, some works stress the use of PURAS such as the Braden scale in ICU neurological patients[67,68] and cardiological surgery patients,[69,70] others propose a modification of the cutoff point for ICU traumatology patients,[71] and still others emphasize the value of the Waterlow scale,[51] while there is another group that is quite unconvinced of it.[52]

There are also PURAS specifically designed for ICU patients such as the Cubbin–Jackson scale,[51,72] which appeared in 1991 as a modification of the Norton scale; the Cornell Ulcer Risk Score,[73] the 1995 Sunderland scale,[74,75] and the Birty Pressure Risk Assessment scale.[76] Nevertheless none has validation and they are scarcely mentioned in the literature. There have been attempts to validate some such as the Decubitus Ulcer Potential Analyzer (DUPA), a modified version of the Gosnell, Norton, and Braden scales, which sensitivity wise, shows lower scores than the Braden scale on the same patients.[71]

As a further addition of specific factors on existing scales, Halfens et al.[77] underline that including variables such as blood circulation to the Braden scale does not improve its sensitivity or specificity, while Séller et al.[78] conclude that there are no specific risk factors for ICU patients that would justify the design of a PURAS exclusively for them. Therefore, many ICU professionals look at tissue damage rather than using different scales when deciding on preventive measures.[79]

PURAS in Pediatric Patients

Pressure ulcers in pediatric patients are gaining significance. Baldwin,[80] in a review on pressure ulcers in pediatric patients, found that there were 22 works published in English since 1972. Waterlow,[81] in her 1997 study of children at risk of developing pressure ulcers, considered that available PURAS were not appropriate for pediatric patients, especially babies. In 1998 Cocket published the Pediatric Pressure Sore Risk Assessment,[82] a PURAS for pediatric patients that has not yet been validated. Willock et al. later wrote an interesting review[83] about the inadequacy of using PURAS intended for adults in children, mentioning the Cocket scale and three others (Bedi A (1993), Olding L (1998) and Pickersgill J (1997)), so far not validated or at least with no published validation.

In 1996 Quigley and Curley published the Braden Q scale, which is a revised version of the Braden scale for pediatric use.[84] Recently Curley et al.[85] published a paper where they validate a modified Braden Q scale that consists of three subscales for the Braden Q scale, mobility, sensory perception, and perfusion/tissue oxygenation, with a cutoff point of 7; sensitivity was 92% and specificity 59%, values quite similar to those on the Braden scale for adults.

Summary

- Risk assessment scales for the development of pressure ulcers (PURAS) are tools that aid a nurse's clinical judgment in order to identify patients at risk and apply preventive measures.
- Risk assessment must be done soon after admittance and periodically repeated or when the clinical condition of the patient changes significantly.
- The ideal PURAS must have high sensitivity and specificity, good predictive value, clear definition of terms, and should be easy to use.
- Currently, the PURAS that offer the best validation are the Braden scale, closely followed by the Norton scale.

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