

Research 101 is intended to make research understandable and help busy wound-care clinicians incorporate new knowledge into practice. Only by appraising new research and incorporating the best of it into practice can we ensure the wound-care field continues to move forward and improve the quality of care we provide individuals living with skin conditions.

Research 101: Wound Assessment Tools

By Pamela Houghton, PT, PhD

What Does “Validated” Mean?

A wound assessment tool is a specific part of your assessment that you use to objectively measure what is going on in the wound. Typically, using a wound assessment tool results in a score or numeric value that signifies a clinical change. But what clinical change you measure depends on how the tool was designed and validated. A wound assessment tool is distinct from a form or document that you use to guide your assessment of a patient with a wound. A comprehensive assessment should be an organized approach that includes questions and examinations that collectively help you decide the underlying cause(s) of the wound and wound etiology, the factors contributing to delayed healing and the

patient’s perspective and experience related to the wound. Using information obtained in this initial assessment, you will be able to plan an integrated, interprofessional care plan that assists the patient and helps heal the wound.

What does it mean to say, “This is a validated tool”? It means some research has been con-

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ducted to ensure the tool measures what it is intended to measure. Recognize, however, that



there are many types of validation studies. So, when you're told a tool is validated, the question you need to ask is this: "Validated to do what?"

Three common properties that are tested in validation studies are *reliability*, *validity* and *responsiveness*. Consult a previous review I have written to see formal definitions of each of these clinometric properties of assessment tools.¹

Reliability

Reliability is a property indicating that values you get when using the tool are reproducible. That is, you can rely on getting a similar value when repeating the measure on a wound that has not changed. Two types of reliability include *intrarater reliability* and *interrater reliability*. If a tool is known to have good intrarater reliability, you can expect that you will get a similar value if you repeat the assessment on the same wound. If a tool has good interrater reliability, you can be sure that a similar value will be obtained if you and your colleague apply the tool to the same wound.

When you are determining the reliability of a wound assessment tool, assessments using the tool are repeated over a short time period (later that day or within a few days) when the wound status has not changed and you expect similar results. Statistical expression of agreement between and within assessors is done using correlation coefficients (i.e., intraclass correlation coefficients [ICC]) with values ranging between 0.0 and 1.0. Values closer to 1.0 indicate better reliability. Some variation in the numbers will always exist. Correlation coefficients of 0.80 or

higher are considered excellent, whereas those less than 0.50 indicate that the tool is not very reliable, or there is poor agreement.² Less agreement (lower ICC values) is expected when comparing values from two assessors (interrater reliability) than those generated by the same assessor (intrarater reliability).

In general, the more clinical judgement is involved in the assessment, the more variability between assessments and lower ICC values will exist. Consistency is key to good reliability when using wound assessment tools.

Therefore, clear instructions and adequate training in applying the tool help standardize the approach of all assessors and minimize any guesswork.

Validity

Validity refers to the accuracy of the assessment tool, and demonstrates that a tool measures what it is intended to measure. There are different types of validity including content, concurrent and predictive validity.¹

Intrarater reliability is the extent to which the same rater obtains a similar rating on subsequent testing with the same instrument, when no change has occurred.

Interrater reliability is the extent to which two or more raters obtain similar ratings when measuring the same thing using the same instrument.

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Content validity is the most common type considered when developing an assessment tool. A panel of experts will confirm that the tool contains all the necessary components. To do so, they need to know the intended purpose of the tool and the type(s) of wounds it will be used to assess. The strength of this kind of validation study lies in the breadth and depth of expertise of the members of the panel.

Concurrent validity is a form of criterion-related validation and involves comparing results obtained using the new tool to an established tool commonly used in the field—or the existing “gold standard.” For example: if a tool is designed to detect wound healing (improvement), a reduction in wound

surface area is often used as a surrogate gold standard. Correlation coefficients such as Pearson R or Spearman Rho are used to express the extent of the association between values generated by the new tool and those of an established one. Higher values (R between 0.8 to 1.0) demon-

strate that a strong association exists between the two tests; in other words, as values derived from using the new tool increase, so do the values generated by the gold standard test.

Predictive validity is quite a distinct form of validity that is not always evaluated on wound assessment tools. A validation study that indicates an assessment tool has predictive validity shows that certain values obtained when using the tool

indicate a greater likelihood that a particular event or outcome will occur in the future. A commonly used tool that allows us to predict future events is the Braden Scale for Predicting Pressure Sore Risk, where values indicate whether patients are highly likely to develop a pressure ulcer.³ The future event that most clinicians wish you could predict is complete healing of the wound.

Responsiveness

This property reflects the ability of a tool to detect a change in wound status. Tools that measure this can help you decide whether the wound is getting better or worse.¹ For a wound assessment tool to be responsive, it should contain only features that are known to change as the wound heals. Another common name for a wound assessment tool that is responsive is an *outcome measure*. Validation studies that show a tool is responsive should involve collecting data from a study group with a defined type(s) of wound and over time (e.g., four to 12 weeks). A wound assessment tool that is responsive should be able to detect a significant difference between scores obtained when the tool is applied to a group of wounds that are healing (improving) and another group that are staying the same over time. Another way to confirm a tool is responsive, or that it can detect change in wound status, is to use

a tool in a controlled clinical trial with active and sham treatments and show a significant difference between values derived from each.

Unfortunately, it is common in wound care practice to use wound assessment tools that are not very sensitive to changes in wound status (i.e., they have not been shown to be responsive). If you use an assessment tool that is not designed to be responsive, you will not be able to readily detect deterioration or improvements in wound

Content validity is the extent to which an empirical measurement reflects a specific domain of content.

Criterion-related validity is the extent of relationship between the results obtained using a measuring instrument and those obtained by a well-established criterion measure, which is a more accurate measure or gold standard.

Predictive validity is a form of criterion validity in which the measurement instrument is validated against a criterion measure that is obtained in the future.

Responsiveness, or sensitivity to change, is the ability of a measuring instrument to detect a real change due to treatment effect occurring over time and not due to measurement error.

Resources

Photodigital planimetry to evaluate changes in wound surface area

Wendelken ME, Berg WT, Lichtenstein P, et al. Wounds measured from digital photographs using photodigital planimetry software: validation and rater reliability. *Wounds*. 2011;23(9):267–75.

Acetate tracing to measure wound surface area

Etris MB, Pribble J, LaBrecque J. Evaluation of two wound measurement methods in a multi-center, controlled study. *Ostomy Wound Manage*. 1994;40(7):448.

DESIGN to assess pressure ulcer severity and monitors healing

Sanada H, Moriguchi T, Miyachi Y, et al. Reliability and validity of DESIGN, a tool that classifies pressure ulcer severity and monitors healing. *Journal of Wound Care*. 2004;13(1):13–18.

Leg Ulcer Measurement Tool (LUMT)

Woodbury MG, Keast DH, Campbell KE, et al. Leg Ulcer Measurement Tool (LUMT). Development and Validation. 2nd Annual World Union of Wound Healing Societies, Paris, France. July 8–13, 2004.

Braden Pressure Ulcer Risk Assessment tool

Braden B, Bergstrom N. Clinical utility of the Braden scale for predicting pressure sore risk. *Decubitus*. 1989;2(3):44–46, 50–51.

U of Texas Wound Classification Systems for diabetic foot ulcers

Oyibo SO, Jude EB, Tarawneh I, et al. A comparison of two diabetic foot ulcer classification systems: the Wagner and the University of Texas wound classification systems. *Diabetes Care*. 2001;24(1):84–8.

Percentage area reduction after 4 weeks (PAR-4)

Cardinal M, Eisenbud DE, Phillips T, et al. Early healing rates and wound area measurements are reliable predictors of later complete wound closure. *Wound Rep Reg*. 2008;16:19–22.

status, and you cannot be confident that you will observe when the wound is getting better or worse. It will take a large amount of change in scores on the assessment tool to indicate to you that the wound is changing or to determine if your treatment is working. This will result in delays in re-evaluation or changes to treatment.

A lot of time is spent by busy clinicians completing wound assessment that do not inform clinical decisions about treatments. Clearly, it is important to match the right tool to a particular clinical scenario.

Different Tools, Different Objectives

To determine if a validated tool suits your purposes, the first question to ask is what the tool was designed to do. In general, wound assessment tools serve one of three main purposes. While it would be nice if we had one tool to

satisfy all these objectives, this is seldom possible. Most wound assessment tools are designed with just one of the following purposes in mind:⁴

- to describe or categorize what the wound looks like (e.g., NPUAP, CEAP, Inlow)
- to evaluate whether the wound is improving or deteriorating—whether your treatment plan is working (e.g., wound surface area reduction measured using acetate tracing, DESIGN-R, LUMT)
- to predict whether the wound will change or heal at some point in the future (e.g., percentage wound area reduction in the first four weeks of treatment [PAR-4])

The Bates Jensen Wound Assessment Tool

The Bates Jensen Wound Assessment Tool (BWAT) was designed to fully describe all aspects of a wound and is commonly used in clinical practice across Canada. The BWAT represents a modifica-

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* Based on the physical properties of Hydrofiber® Technology as demonstrated *in-vitro*.^{1,2} 1. Waring MJ, Parsons D. Physico-chemical characterisation of carboxymethylated spun cellulose fibres. *Biomaterials*. 2001;22:903-912. 2. Walker M, Hobot JA, Newman GR, Bowler PG. Scanning electron microscopic examination of bacterial immobilisation in a carboxymethylcellulose (AQUACEL®) and alginate dressings. *Biomaterials*. 2003;24(5):883-890.



tion of the former Pressure Sore Status Tool (PSST) in that it can be used on more than just pressure ulcers. This 14-item tool evaluates all aspects of the wound, including per ulcer skin, granulation tissue and necrotic tissue, using a 1–5 scale and total BWAT score derived from total scores between 14 and 70, with lower scores indicating better wound appearance.⁵

The former PSST was developed with input from a large panel of experts.⁶ Validation studies indicate that in addition to having good content validity, the PSST has excellent intra- and interrater reliability when used by experienced wound-care clinicians.⁷ There are very detailed instructions for using the BWAT, and Harris and colleagues created a pictorial guide to help novice clinicians.⁸ While the BWAT is often used to detect changes in wound status, results have been mixed: significant differences in healing between groups and over time have,^{9,10} and have not^{11–12} been detected using total PSST/BWAT scores. A descriptive tool like the BWAT that is made up of numerous items is not set up to be an outcome measure. Rather, based on how the BWAT was developed and validated, it is best used for initial assessment, as a way to fully describe wound appearance at a point in time.

The Pressure Ulcer Scale for Healing

The Pressure Ulcer Scale for Healing (PUSH) was developed by the NPUAP panel and is available via their [weblink](#).¹³ An assessment with this tool can be completed in five minutes and focuses on three aspects of the wound: the amount of wound

exudate, the proportion of granulation and necrotic tissue in the wound base, and wound size as measured by a ruler placed

in head-to-toe direction. The first version of the PUSH had many more items that described all aspects of wound appearance; however, through pilot test-

Examples of Validated Tools Used in Wound Care

National Pressure Ulcer Advisory Panel (NPUAP) Pressure Injury Stages

NPUAP Pressure Injury Staging, 2016. www.npuap.org/resources/educational-and-clinical-resources/npuap-pressure-injury-stages/.

International Working Group on the Diabetic Foot (IWGDF) Risk classification system

Monteiro-Soares M, Boyko EJ, Ribeiro J, et al. Risk stratification systems for diabetic foot ulcers: a systematic review. *Diabetologia*. 2011;54(5):1190–1199.

The Clinical-Etiological-Anatomical-Pathological (CEAP) classification system for people with Chronic Venous Insufficiency (CVI)

Kistner RL, Eklof B, Masuda EM. Diagnosis of chronic venous disease of the lower extremities: The “CEAP” classification. *Mayo Clin Proc*. 1996;71:338–345.

Eklof B, Tuthford RB, Bergan JJ, et al. Revision of the CEAP classification for chronic venous disorders: Consensus statement. *J Vasc Surg*. 2004;40:1248–1252.

ing, during which the PUSH tool was applied to a group of patients’ wounds over time, most items were found to not change as the wound healed, and therefore were eliminated.¹⁴ While the PUSH was originally designed to measure healing of pressure ulcers, it has been shown to effectively detect wound healing in other types of wounds.¹⁵

Photography Wound Assessment Tool

The Photographic Wound Assessment Tool (PWAT) was originally created by taking six components of the PSST that could be evaluated using a two-dimensional wound photograph.¹⁶ It was later revised to have eight items with a total PWAT score of zero indicating a completely healed wound.¹⁷ A validation study involving images taken from more than 300 wounds showed that the latest version of

The validation studies for the **PUSH** focused on the property of responsiveness, and as such this tool is the best example of a validated outcome measure for detecting wound healing over time.

the PWAT has excellent intra-reliability and good interrater reliability, provided assessors had completed one to two hours of training and followed

instructions consistently.¹⁷ Excellent agreement also has been shown between PWAT scores derived using digital wound images and those

The **PWAT** is available online¹⁹ and is ideal if wound-care consultants are using digital images to help frontline clinicians identify changes in wound status and determine if wound treatments are working.


from bedside assessments.¹⁷ Total PWAT scores have been shown to progressively decrease as the wound heals and have been used in clinical trials to detect changes in wound appearance over time and significant differences between control and active treatment groups.¹⁸

Table 1: Validity of Common Tools

	Content Validity	Reliability	Responsiveness
BWAT	X	X	
PUSH	X		X
PWAT		X	X

X indicates positive results from validation studies.

Conclusion

This article is intended to help clinicians recognize that research studies are designed to validate different aspects of a wound assessment tool. With the right knowledge and training, clinicians will use the right tool for the right purpose in each situation. 

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