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A Critical Appraisal of Two Measures for Pressure Ulcer Assessment

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Abstract

Pressure ulcers are recognized as serious problems across health care settings, leading to poor patient outcomes and increased costs for health care organizations. The prevalence of pressure ulcers is estimated to be between 9 and 30% of the patient population. The treatment of pressure ulcers can increase both direct and indirect patient care hours up to 50% and cost as much as $70,000 per ulcer. Assessment of pressure ulcer status and healing presents a challenge to nurses, having the primary responsibility for evaluation of pressure ulcers. This challenge is complicated by the lack of a standardized method of measurement of wound healing in pressure ulcers. Two tools for measurement of pressure ulcer wound healing are the Bates-Jensen Wound Assessment Tool (BWAT) and the Pressure Ulcer Score of Healing (PUSH). The developmental history, psychometric properties, scoring and score interpretation, subject burden, and use of the tools were analyzed for usefulness in the clinical and research settings. The BWAT and PUSH tools provide valid and reliable means of assessment of pressure ulcer characteristics and prediction of wound healing. Use of a wound healing

measurement tool provides a means for quantifying outcomes. Further, wound healing measurement tools supply a framework for nursing education of wound management. Most importantly, a systematic method for the assessment of pressure ulcers and wound healing lays the foundation for selection of treatment modalities and prevention strategies, outcomes management, determination of third party reimbursement, and increased precision of data for research.

Keywords: pressure ulcer, pressure wound, wound healing, Pressure Ulcer Scale of Healing (PUSH), Pressure Sore Status Tool (PSST), Bates-Jensen Wound Assessment Tool (BWAT)

A Critical Appraisal of Two Measures for Pressure Ulcer Assessment

Pressure ulcers are a serious problem across all healthcare settings for persons who are disabled and immobile, leading to significant consequences related to health care outcomes and costs for health care organizations. The prevalence of pressure ulcers is estimated to be between 9 and 30 percent of patients in hospitals and nursing homes.[1] Further, 85 percent of persons with spinal cord injuries develop pressure ulcers during their lifetime.[2] It is estimated that the treatment of pressure ulcers can increase direct patient care hours up to 50 percent. Treatment costs can range from $10,000 to $70,000 per ulcer.[3] Multiple methods of pressure ulcer wound measurement have been utilized, including rulers, tracings, photography, ultrasonography, volumetrics, molding material, stereophotography, and structured light.[4] Assessment of pressure ulcer status and healing presents an ongoing challenge to nurses, as there is no universal means of measurement to date. Nurses, having the predominate responsibility for the ongoing evaluation of pressure ulcers and wound care outcomes, need a systematic, efficacious method of assessment of pressure ulcer status and healing. The purpose of this article is to systematically examine two current measures of assessing wound healing in pressure ulcers and their efficacy in clinical and research practice.

Review of Common Measures for Assessment of Pressure Ulcers

Numerous historical methods of evaluating pressure ulcers have been used to determine status, appearance, and healing. Systematic attempts to develop a standardized tool for the assessment of pressure ulcer healing are documented as far back as 1961 with the Criterion Measure for Decubitus Observations.[5] Verhonik developed a criterion-based measurement tool that included the following categories: size, color, skin tone, skin condition, drainage, sensation, and infectious process. The color of the ulcer was determined by comparing to a color scale that contained at least 100 colors of various hues. As one might imagine, Verhonik reported difficulty using the color scale. Nevertheless, the significance of

this tool must be recognized as one of the first attempts to objectively evaluate pressure ulcer healing and greatly influenced future wound research and instrument development.

A common method of evaluation is size measurement: determining length by width surface area, volume, tracings, planimetry, or photographic means.[6] These methods are generally easy to use, inexpensive, require little time to perform, and do not require extensive training of personnel. Tracings and photography also provide a permanent record for tracking. Despite ease of use, simple estimation of size is not always effective. The definition of the ulcer boundary is often misjudged: patient positioning, skin flexibility, and curvature of the anatomy may interfere with measurement,[7] and there can be high variability in use of measurement devices, reducing interrater reliability. When photography is used, camera position also may affect precision of measurement.[8] Finally, the health care worker must be cognizant of potential wound contamination as some of these methods require contact with the ulcer surface.[9]

Another method of evaluating pressure ulcers is wound staging, or measurement of the tissue depth and layer involvement in the wound bed. Wound staging describes severity. This measurement was first described as the Shea Scale,[10] followed by the 4-stage revised version of the Shea Scale developed by the National Pressure Ulcer Advisory Panel (NPUAP).[11] Stages of a wound were categorized by the amount of anatomical tissue loss: 1) stage I. intact skin with non-blanchable redness of a localized area usually over a bony prominence, 2) stage II, partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, 3) stage III, full thickness tissue loss with visible subcutaneous fat, and 4) stage IV, full thickness tissue loss with exposed bone, tendon, or muscle. Two new stages further described pressure ulcers that resist staging measurement: 1) Suspected Deep Tissue Injury, purple or maroon localized area of discolored intact skin or blood-filled blisters and 2) Unstageable, full thickness tissue loss in which the base of the ulcer is covered by slough and/or eschar.[12] Though the stages are effective determinants of pressure ulcer severity, the Shea Scale and the 4-stage system lack the ability to assess healing as pressure ulcer wounds do not heal “physiologically in reverse” according to measurement.[9]

Currently, two measures to assess pressure ulcers have been recognized as most effective for use in research and practice: the Bates-Jensen Wound Assessment Tool (BWAT), formerly known as the Pressure Sore Status Tool (PSST), and the Pressure Ulcer Score of Healing (PUSH). Waltz, Strickland and Lenz[13] suggest a process of evaluating existing tool properties. A rigorous examination of the tools was conducted to discover the background, developmental history, psychometric properties, scoring and score interpretation, subject burden, and tool use. Properties and usefulness of the tools for clinical practice and research were then compared as indicated in Figure 1.

Method

A systematic, critical review of clinical and research evidence related to the BWAT and PUSH was performed. A literature search was conducted electronically on Medline, CINAHL, PubMed, and Cochrane Library databases through the University of Texas at Arlington library. Additional references were found manually through personal journal subscriptions. In addition, reference lists of articles were reviewed to identify other relevant articles pertaining to pressure ulcer healing and measurement tools. Literature was restricted to publications in English, though international sources were included. The search produced forty-three sources, including sixteen clinical reports and twenty-seven research articles. All were reviewed and categorized according to the following areas for each tool: background, developmental history, psychometric properties, scoring and score interpretation, subject burden, and tool use. Properties and usefulness of the tools for clinical practice and research were then compared as indicated in Figure 1.

Key words for the search included: pressure ulcer, pressure wound, wound healing, Pressure Ulcer Scale of Healing (PUSH), Pressure Sore Status Tool (PSST), Bates-Jensen Wound Assessment Tool (BWAT).

The Bates-Jensen Wound Assessment Tool (BWAT)

Background on the BWAT

The work of Bates-Jensen was inspired by Verhonik's early work[5] to objectively assess pressure ulcers and the later efforts of Stotts and Cooper to develop an instrument to measure healing in open surgical wounds.[14] Conceptualizing the wound as a shoebox with walls, floor, edges and periphery, the floors and walls were evaluated for tissue condition and drainage; the edge was assessed for color and new tissue growth; and the peripheral tissue was assessed for continuity, discoloration, scars, and hair growth. No record of validity or reliability testing was found for the instrument of Stotts and Cooper. Knighton, Austin, Ciresi, and Butler developed a wound severity scoring system for classifying chronic wounds.[15] Seventeen parameters of the wound were described. A score was assigned from the subscales and a total score was obtained. Although no data on reliability and validity was reported, the idea to quantify the scores and compare scores over time intrigued Bates-Jensen. These first attempts to develop objective pressure ulcer assessments provided the starting point for the development of a tool that quantified descriptions of pressure sores and changes in status over time.

Developmental History of the BWAT

The Pressure Sore Status Tool, (now known as the Bates-Jensen Wound Assessment tool), developed over several years.[16] Revisions have been discussed as recent as 2006 (unpublished). Bates-Jensen described the original tool's development in the context of three stages: domain identification, item generation, and instrument formation.[17] Her early work examined the domain of pressure sores; items generated included 15 pressure sore characteristics. In the original tool development, the author used a Delphi technique with a 20 member multidisciplinary team of wound experts to identify these characteristics.[6,17] A listing and description of the 15 pressure sore characteristics assessed are found in the tool. These characteristics included location and shape of the wound, size in centimeters squared, depth, appearance of edges, undermining or tunneling, necrotic tissue type and amount, exudate type and amount, surrounding skin condition, peripheral tissue edema and induration, granulation tissue appearance and epithelialization. Instructions on how to complete the tool were also included. Studies were then developed to confirm validity and reliability of the tool.[6,17] Bates-Jensen revised the tool in 2001 changing the name to the Bates-Jensen Wound Assessment Tool (BWAT), and added the category of "none" to those items that did not already have this score option.[18] In 2006, a method of indicating complete healing of the ulcer was added.

Psychometric Properties of the BWAT

Bates-Jensen described a two-stage approach to evaluating content validity.[17] First, the items on the instrument were developed using expert knowledge and literature review. Secondly, content specialists evaluated the quality of the items. A panel of nine well-known wound experts was recruited for this exercise. The Content Validity Index (CVI) was used to evaluate content validity, using a four point rating of not relevant, somewhat relevant, quite relevant and very relevant. Five questions regarding the theoretical and clinical appropriateness were asked for each of the 15 pressure ulcer characteristics. The panel judged the items to be relevant and valid with a CVI of at least .78, or seven out of nine in agreement with the content questions, with the exception of the item measuring wound depth, which was subsequently reworded. The average CVI for the tool was .91.

Criterion-based validity, both concurrent and predictive, were tested for the PSST.[19,20] Concurrent validity was evaluated in a long-term care setting, comparing the pressure sore stage with the depth item on the PSST for a Pearson Product Moment correlation coefficient of ($r=.91$, $p=.001$). In a later study, Bates-Jensen and McNees[19] found a relatively strong positive relationship between the staging score of the National Pressure Ulcer Advisory Panel (NPUAP) and the total PSST scores (Pearson Product Moment, $r=.55$, $p= .001$), which further validated the tool. Concurrent validity was evidenced once again in a large sample study conducted by Bates-Jensen[21] when testing a computer assessment system

that included the PSST. The total PSST scores versus Staging scores discriminated significantly between partial and full thickness wounds in addition to demonstrating a positive correlation between the Staging scores and the PSST scores.

Predictive validity was not addressed for the PSST until 1997,[21] though the tool included a wound status continuum scale that indicated wound regeneration to degeneration and instructions that the tool was to be administered over time. In a retrospective study of 90 healed ulcers, the PSST scores were highly correlated with time to healing at one week intervals. The mean initial score of the PSST was 23.74 (SD 7.5) and the mean stage score was 2.26 (SD .68). The first assessment PSST correlated with time to heal in weeks (r=.356, *p*=.001). The Stage score did not correlate significantly with time to heal by nine weeks, though. The Stage score did correlate significantly with the PSST total score (r=0.606, *p*=.001). Several individual items on the tool were found to correlate with time to heal: exudate type and amount, undermining, epithelialization, and induration. Predictive validity was again verified in Bates-Jensen's 1999 dissertation research with a sample of 143 pressure sores over six weeks.[22] Using survival analysis techniques, sensitivity in this sample was 61 percent for predicting a time to 50 percent healing if the wound improvement exhibited a 65 percent decrease in size of the wound at one week.

Bates-Jensen described the methodology for determining reliability for the PSST in detail.[17,21] After receiving training on the tool, two certified, experienced wound experts rated 20 pressure ulcers on ten patients in the acute care setting using the PSST. The ratings were taken at two intervals, one and one-half hours apart. The interrater reliability was high for rating occurrences at .91 and .92, respectively. Kappa coefficients were greater than .75. The intrarater estimates among the nurses were .97. Bates-Jensen also tested reliability in the long term setting. A multidisciplinary group including Physical Therapists, Licensed Vocational Nurses, and Registered Nurses assessed 16 pressure ulcers two hours apart. Interrater reliability yielded a mean of .78 and intrarater reliability averaged 0.89.[17]

Scoring and Score Interpretation of the BWAT

In the BWAT, 13 characteristics of pressure ulcers are scored using a Likert-type scale (1 being the best attribute of the characteristic and 5 being the worst). Item subscores are added to obtain a total score. The scores range from 13-65 with the higher number demonstrating a worse condition of the wound. Location and shape are not scored. Bates-Jensen recommended that pressure ulcers be scored at weekly intervals. Prediction of the rate of healing could be obtained by adding the difference in size of the wound at week one to the change of the total score at week one, thus predicting time (weeks) to 50 percent closure.[21]

Subject Burden of the BWAT

Discrepancies in rater scores between experts and staff indicate the need for training to use the BWAT as an instrument in practice or research. Bates-Jensen indicated that a 30 minute training session is needed.[18] Woodbury, Houghton, Campbell, and Keast[6] calculated that the PSST takes 10-15 minutes to complete per wound due to the number of items.

Summary of Use of the BWAT

The BWAT has been used across all health care settings both for clinical use and research. A computer system version was developed in conjunction with ConvaTec.[19,20] A more recent assessment of a computerized system using the PSST in a context of telemedicine was conducted by Bolton, et al.[23] This study measured healing outcomes when using standardized pressure ulcer care protocols and demonstrated that the tool can be used effectively in a clinical setting. A photographic tool was developed using the wound characteristics of the PSST (BWAT).[8] The BWAT has been used in research to determine the prevalence, assessment, and treatment of pressure ulcers among homecare patients, wounds in cancer patients, and pain management in patients with pressure ulcers.[24-26] The BWAT has also been used as the assessment tool for data collection to determine the efficacy of new treatment modalities.[2] The tool's use as the "gold standard" provided concurrent validity in other instrument development.[27]

The Pressure Ulcer Scale for Healing (PUSH)

Background on the PUSH

During the National Pressure Ulcer Advisory Panel's (NPUAP) Fourth National Conference in 1995, several recommendations emerged in regard to pressure ulcer classification, including the following: 1) pressure ulcer staging should not be used to determine treatment outcome, 2) pressure ulcers should not be reverse staged, 3) parameters other than staging should be used to determine wound healing, and 4) there should be further study of available tools. The NPUAP convened a task force to address the issue of reverse staging encouraged by the Center for Medicare & Medicaid Services (CMS)/Medicare for documentation in the long term care setting as well as the other recommendations. This set the stage for the development of the Pressure Ulcer Scale for Healing (PUSH).[18]

Developmental History of the PUSH

The task force reviewed the research literature on the critical parameters of wound assessment and existing tools and guidelines used to monitor pressure ulcer healing. These included the Agency for Health Care Policy and Research (AHCPR) Guidelines for the Prevention of Pressure Ulcers, the recommendations of the Wound Healing Society, and the PSST tool. The validity of 11 specific clinical measurement items common across the assessment methods were examined using empiric evidence from studies of wound healing. Criteria set for the evaluation of the tools were validity, reliability, responsiveness, and clinical practicality.[9,28] Using the statistical methods of principal component analysis, regression, and hierarchal modeling, the following three parameters emerged most significant measures to monitor pressure ulcer healing: length times width in size, exudate amount (subscores-none, light, moderate, and heavy), and tissue type (subscores-necrotic tissue, slough, granulation tissue, epithelial tissue, and closed).[29] Subsequently, the PUSH tool was presented at the Fifth National Conference of the NPUAP in 1997. Small group discussions, including practitioners from all health care settings, provided input in the definition of the pressure ulcer characteristics, scoring, and directions for use to be included in the final PUSH tool.[30,31]

Psychometric Assessment of the PUSH

A review of the literature and expert opinion of the task force established content validity. No mention was made of whether experts other than the nine-member NPUAP task force participated in the content validation process. No CVI was obtained.[31]

Five tests for predictive validity were found in the literature. Bartolucci and Thomas examined 11 characteristics of healing on 37 pressure ulcers by comparing scores every two weeks for eight weeks using principal component analysis.[29] A model of the three characteristics for the proposed tool was derived from the analysis. The model was then retested on a new sample and performed similarly on a group of 13 pressure ulcers.[32] The model explained 55 to 65 percent of the variance at weeks 0 through 8; the results demonstrated significant discrimination among the time points. Stotts et al. obtained similar results of predictability in a sample of 103 subjects with pressure ulcers.[31] Using principal components analysis, the researchers found that the variables of surface area, exudates amount, and surface appearance accounted for 58 to 74 percent of the wound healing variance over a ten week period. Additional results from this initial study indicated that the existing five wound size categories of the PUSH tool did not account for larger sizes of pressure ulcers. The tool was then revised to allow for a greater length times width category, utilizing dectiles (10 divisions of size) instead of the original quintiles. The tissue type category was also modified to include necrotic tissue. A concurrent pilot study conducted by the Stotts group, involving a larger data base of 269 patients included in the National Pressure Ulcer Long-

Term Care Study, addressed the changes in the tool. When retested on the 269 wounds, multiple regression indicated improved sensitivity of PUSH score related to healing time using the revised components of the tool. Again, principal component analysis reiterated the PUSH variables of surface area, exudate amount and tissue type as the best model for determining pressure ulcer healing, accounting for up to 57 percent of the variance over a twelve week period in the second group.[31]

There is apparently no report of concurrent validity validation of the PUSH tool found in the literature and no reliability testing in the original studies. However, high interrater reliability of the PUSH tool was confirmed by Gardner, Frantz, Bergquist, and Shin during a research study in a long term care setting.[33] Researchers and staff collecting assessments received training until 90 percent agreement with the expert was obtained. The level of agreement was checked periodically and remained above 90 percent.

Scoring and Score Interpretation of the PUSH

The items in the PUSH tool indicate whether a pressure wound is getting better or worse over time. Size is measured by length times width rated on a scale of 0-10; the lower the number, the smaller the wound. The size ranges are listed on the tool for ease of use. Exudate describes the amount: 0= none, 1= light amount, 2 =moderate amount, and 3 = heavy amount. Tissue type ranges from 0 to 4: closed, epithelial tissue, granulation tissue, slough, and necrotic tissue, respectively. The subscores are added to arrive at the total score. The range of total scores is 0-17, with the lower the score the better. The total scores are compared at intervals to provide an indication of healing. The total scores can be plotted on a graph for a visual of wound healing. Subscores are not assessed individually to predict healing.[18]

Subject Burden of the PUSH

Although the PUSH tool consists of only three items, training is estimated to take 50 minutes due to the complexity of the subscales. Once training is complete, scoring takes approximately five minutes per wound.[6] A study was conducted to determine the ease of use and perceived utility of the instrument.[34] It was found to be reliable, easy to learn, and useful in measuring wounds.

Summary of Use of the PUSH

The PUSH tool has not been widely used to date. Among the eight studies reviewed for this paper, the tool has limited use in clinical practice and research. In three separate studies, the tool was used as a determinant of pressure ulcer healing among acute hospital patients and long term care residents who received nutritional supplements compared with those who did not receive the supplements.[35-37] The lower PUSH score in the studies indicated healing at a faster rate in those receiving supplements. Gunes and Eser used the PUSH tool to determine the effectiveness of two types of dressings.[38] Wound healing over time was confirmed by the PUSH tool when assessing the effectiveness of low level laser therapy.[39]These studies demonstrated the ability of the PUSH tool to confirm the efficacy of wound care interventions thus affecting patient outcomes. Three separate studies monitored the healing of different types of wounds.[39-41] Hon et al.[40] followed 98 patients with pressure ulcers, diabetic ulcers and venous ulcers. The researchers validated the tool in these wound type groups; after four weeks, PUSH scores decreased significantly between baseline and follow up measurements of wounds. In addition, a strong correlation existed between the total PUSH scores and surface area (length times width size) in all three wound types, ($r = .66$, $p < .01$). Ratliff and Rodeheaver[41] extrapolated from the literature that the three parameters of healing in the PUSH tool (surface area, exudate, and tissue type) are useful for monitoring all wounds types. Measurements of venous wounds in 27 persons were taken over a two month period. The researchers demonstrated a decrease in PUSH scores in healing ulcers and an increase in scores in non healing wounds over time, thus substantiating their hypothesis that the PUSH tool could measure venous ulcers. More validation studies are needed for diabetic and venous ulcers. Pompeo utilized the PUSH tool to develop a system wide program for a group of long term, acute care hospitals to capture outcomes data for wound healing.[42]

Conclusion

Use of a wound healing measurement tool provides a means for quantifying outcomes in clinical pressure ulcer care and in research. Furthermore, such tools supply a framework for nursing education pertaining to management of patients with pressure ulcers. A systematic method for the assessment of pressure ulcers and wound healing is the foundation for development and selection of treatment modalities, prevention strategies, outcomes management, and determination of third party reimbursement.[17,43] The use of a tool to measure wound healing outcomes is vital for nurses responsible for patients with pressure ulcers. Both the BWAT and the PUSH tools demonstrate thoughtful and thorough design during tool development.

The BWAT has been in use for many years; reliability as well as concurrent and predictive validity have been repeatedly demonstrated. The rigor of validating the items in the tool has been meticulously described and a CVI established.

Though many wound care experts worked on developing the PUSH tool, the CVI was not reported. Another factor to consider is sensitivity to wound size; the greater size range of the BWAT allows for a greater sensitivity to decreases in wound size in the larger pressure wounds. Nurses' time is valuable; a tool that can be utilized both for assessment and as an indicator of wound healing is an advantage of the BWAT.

Drawbacks of the BWAT are the length of the tool, time to complete, and degree of skill required to use. However, once learned the systematic assessment is an advantage, especially in terms of electronic documentation, treatment management, and precision in research data. The Bates-Jensen Wound Assessment Tool is also an effective means of assessing and determining the degree wound healing consistently. However, validation among all wound types is still needed for this tool.

Though many wound experts worked on developing the PUSH tool, neither CVI nor concurrent validity have been reported. The PUSH tool is limited for use as an assessment tool for documentation due to the few number of wound characteristics measured. For instance, only the amount of exudate is included in the PUSH tool; the character of exudate, used as an index of infection, is not included as a characteristic of wound healing. Another deterrent for the use of the PUSH tool is the sensitivity to wound size; the largest size for the PUSH score is >24 cm while the largest size subscore on the BWAT is >80 cm. The greater size range of the BWAT allows for a greater sensitivity to decreases in wound size in the larger pressure ulcers. In addition, there is a lack of wound assessment characteristics in the PUSH instrument, thus its use to comprehensively manage treatment of a pressure ulcer and/or for precision of data in research are limited. The authors of the PUSH tool have acknowledged these limitations.[28-30,32]

Whichever tool is chosen for use in a clinical or research setting, familiarity with the background, developmental history, psychometric properties, scoring and score interpretation, subject burden, and previous use of the tool inspires the health care practitioner's confidence in the ability to predict and determine conditions related to pressure ulcer wound healing, make appropriate clinical decisions for wound care management, provide the necessary documentation for third party payment, and increase precision of data for research. Future considerations for research include: continued validation of pressure ulcer assessment tools across all health care practice and research settings, reliability studies of in multidisciplinary health care workers when using tools, use of the tools in clinical settings, comparisons of assessment tools, and use of wound healing tools to determine efficacy of new wound care treatments.

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Figure 1. Comparison of Characteristics for Usefulness in Clinical Practice and Research of the BWAT and PUSH Tools for Pressure Ulcer Assessment

Characteristic	BWAT	PUSH
Background	Developed by Barbara Bates-Jensen, 1990	Developed by National Ulcer Advisory Panel taskforce, 1997
Developmental history	20 multidisciplinary experts using Delphi technique	Expert review of existing tools
Psychometric properties	Reliability: test- retest (K=0.89); interrater reliability: multidisciplines Kappa=0.78; nurses =0.97 Content Validity: Content Validity Index from panel of 9 experts 0.91 Concurrent Validity: Comparison with Shea Scale with depth item (r=0.91, p=.001)	Reliability: not reported at time of development; >90% interrater reliability reported in a 2005 study Content Validity: review of literature and expert opinions; no CVI reported Concurrent validity: not

	Comparison with NPUAP staging score (r=.55, p=.001) Predictive Validity: two studies 1997 and 1999 verified PSST scores correlated significantly with time to heal	reported Predictive Validity: Statistical model. 5 studies conducted validate sensitivity of scores to healing time.
Scoring and score interpretation: items, score, range	Items:15 items • location • shape • size • depth • wound edges • undermining or tunneling • necrotic tissue type • necrotic tissue amount • exudate type • exudate amount • surrounding skin condition • peripheral tissue edema • peripheral tissue induration • granulation tissue epithelialization Score response:13 items scored	Items: 3 items • surface area • exudate amount • tissue appearance Score response: LxW (0-10); exudate amount (0-3); Tissue type (0-4) Subscales summed to get total score. Scores are compared at intervals to indicate healing; scores may be plotted on a

	on 5 point Likert scale (excluding location and shape); items then summed Range: 13-65 Lower score is better	graph on the tool Range:0-17 Lower score is better
Subject burden	30 minute training 10-15 minutes to complete tool	50 minutes training 5 minutes per ulcer to score
Tool use	• Used in developing computerized system for telemedicine • Photographic tool developed using tool's characteristics • Pressure ulcer assessment in homecare, cancer, nursing home patients • Determine efficacy of new treatment modalities • Provided concurrent validity in other instrument	• Used as a determinate of healing in studies of nutritional supplements in acute care and long term care patients • Effectiveness of wound dressings • Studies are being conducted for use of the tool in diabetic and venous ulcers • Development of a hospital

	development	system program to monitor pressure ulcer outcomes
Strengths and Limitations	Strengths: • Been in use 20 years in a variety of health care settings • Reliability and validity demonstrated • CVI determined • High sensitivity to decreases in wound size due to greater size range • Can be used as assessment tool and an indicator of wound healing Limitations: • Tool is long • Requires a degree of skill to use • Validation needed for use on other wound types	Strengths: • Been in use 13 years in a variety of health care settings • Developed by nationally recognized experts • Tool validated in several studies • Ease of use in the clinical setting to predict healing • Tool is being studied for use on other Being validated on other wound types Limitations: • Limited for use as an assessment tool due to few items on tool • Decreased sensitivity to larger wound sizes
