**Standardising the classification of skin tears: validity and reliability testing of the International Skin Tear Advisory Panel (ISTAP) Classification System in 44 countries**

**SUMMARY**

***Background*** Skin tears are acute wounds that are frequently misdiagnosed and underreported. A standardised and globally adopted skin tear classification system with supporting evidence for diagnostic validity and reliability is required to allow assessment and reporting in a consistent way.

***Objectives*** To measure the validity and reliability of the International Skin Tear Advisory Panel (ISTAP) Classification System internationally.

***Methods***A multi-country study was set up to validate the content of the ISTAP Classification System through expert consultation in a two-round Delphi procedure involving 17 experts from 11 countries. An online survey including 24 skin tear photographs was conducted in a convenience sample of 1601 healthcare professionals from 44 countries to measure diagnostic accuracy, agreement, inter-rater reliability, and intra-rater reliability of the instrument.

***Results*** A definition for the concept of a “skin flap” in the area of skin tears was developed and added to the initial ISTAP Classification System consisting of three skin tear types. The agreement for differentiating type 1 from type 2 and 3 skin tears was 0.86 (95% CI 0.85-0.86), with a sensitivity of 88% and a specificity of 92%. Overall agreement was 0.79 (95% CI 0.79-0.80). The multi-rater Fleiss Kappa was 0.57 (95% CI 0.57-0.57). The Cohen’s Kappa measuring intra-rater reliability was 0.74 (95% CI 0.73-0.75).

***Conclusions*** The ISTAP Classification System is supported by evidence for validity and reliability. The outcome of this study is an important step forward towards a more systematic assessment and reporting of skin tears in clinical practice and research globally.

**Keywords:** Skin tear, Classification, ISTAP, Psychometric evaluation, Validity, Reliability

**INTRODUCTION**

Skin tears are common acute wounds with high potential risk of evolving into complex chronic wounds if not properly managed1-4. The International Skin Tear Advisory Panel (ISTAP) defines skin tears as “traumatic wounds caused by mechanical forces, including removal of adhesives. Severity may vary by depth (not extending through the subcutaneous layer)”5. They are reported across all healthcare settings and are predominantly found in the elderly, neonates, and the critically and chronically ill populations6, 7. Although skin tears can occur on any location of the body, they are particularly common on the upper and lower extremities5, 8, 9.

The prevalence of skin tears varies across countries, healthcare settings and patient populations5, 10. Studies report skin tear prevalence rates between 3.3-19.8% in acute care3, 11-17, 14.3% in palliative care18, 5.5-19.5% in the community19, 20, and 3.0-26.0% in long-term care1, 5, 21-28. Skin tear incidence rates vary between 2.2-92.0%, with highest incidence in long-term care facilities9, 23, 29-34. The variety in prevalence and incidence rates may in part be attributed to varying patient populations, differences in prevention and management practices, nurses’ knowledge and equipment, but can also be explained by the lack of a uniform method for assessment and documentation5, 35. A cross-sectional international study including 1127 healthcare professionals from 16 countries revealed significant problems with the assessment, classification and documentation of skin tears35. The majority of respondents (70%) reported issues with the assessment and documentation of skin tears in their settings, with an overwhelming majority (90%) preferring a simplified method. Eighty-one percent of respondents reported not using any tool or classification system for the classification of skin tears and 40% admitted to ignoring and not documenting any information about these wounds35. In addition, skin tears are often not recognised as unique wounds distinct from other wound types, making them frequently misdiagnosed and underreported5.

The lack of diagnostic accuracy results in delayed or inappropriate management, causing increased pain and suffering, delayed wound healing, infection, prolonged hospitalisation, and high health care costs, all negatively affecting the quality of care7, 26. In order to set appropriate treatment goals and optimise management from the earliest possible stage of care, the systematic assessment of skin tears using a valid and reliable international classification tool is recommended5.

To date, three skin tear classification tools have been developed36-38. The Payne-Martin Classification System grades skin tears based on the extent of tissue loss, measured as a percentage36. In 2007, Carville *et al.* established and psychometrically tested the Skin Tear Audit Research (STAR) Classification System which was developed as a modified version of the Payne-Martin scale, additionally including skin/flap colour distinction37. However, both systems were found to be complex for use in clinical practice and neither of them gained widespread acceptance.7, 39 In addition, the Payne-Martin Classification System has never been evaluated on its psychometric properties5. In an effort to fulfil the need for a user-friendly and simple classification tool35, an ISTAP consensus panel developed and psychometrically tested the ISTAP Classification System which categorises skin tears as type 1 (no skin/flap loss), type 2 (partial skin/flap loss) or type 3 (total skin/flap loss)38, 39. The ISTAP tool classifies skin tears based on the severity of “skin flap” loss, but does not provide a definition of a “skin flap”. In their best practice document, developed in 2018, the ISTAP panel indicated a need for standardised terminology in order to avoid confusion5. Since 2013, the ISTAP Classification System has been translated and its psychometric properties were measured in Denmark40, Sweden41, French Canada10, and Brazil42. It is acknowledged that further psychometric testing with larger samples of healthcare professionals across settings and countries is required39.

The aim of this study was to evaluate the validity and reliability of the ISTAP Classification System internationally.

**METHODS**

The study consisted of two phases. Phase 1 was a study to validate the content of the ISTAP Classification System through expert consultation in a two-round Delphi procedure. Phase 2 included the measurement of the psychometric properties of the instrument. Diagnostic accuracy, agreement, inter-rater reliability, and intra-rater reliability were measured.

**Phase 1. Design and content validation of a definition for the concept of a “skin flap” in skin tears**

Following the development of the ISTAP best practice document5, a definition of a “skin flap” was proposed to be added to the current ISTAP classification tool. A first proposal of a definition was developed by the core team of this study based on a literature review. A two-round Delphi procedure was conducted to collect feedback and to achieve consensus on the proposed definition. The expert panel consisted of 17 international key opinion leaders based in Australia (n=1), Belgium (n=1), Canada (n=3), Chile (n=1), Italy (n=1), Japan (n=1), South Africa (n=1), Switzerland (n=1), the United Arab Emirates (n=1), the United Kingdom (n=2), and the United States of America (n=4). All were executive board members of the International Skin Tear Advisory Panel (ISTAP). In the first Delphi round, the experts were invited to provide comments on the proposed definition. The feedback was summarised and a new proposal was developed. In the second round, the experts were asked for approval and/or additional comments on the revised definition.

**Phase 2. Psychometric evaluation of the ISTAP Classification System**

The aim of this phase was to examine diagnostic accuracy, inter-rater reliability, intra-rater reliability and agreement of the ISTAP Classification System. An online survey including 24 photographs of skin tears was developed using the software package LimeSurvey®. A second survey was sent to the participants one week after completion of the first survey. This survey (re-test) included the identical 24 photographs in a different random order to reduce potential bias. No feedback was provided between the test and re-test. Both English language surveys were translated into 15 languages by native speakers with extensive content expertise to allow data collection in 44 countries. Participants in the survey were invited to categorise the photographs using the ISTAP Classification System. Diagnostic accuracy was evaluated by comparing the classifications of the participants with those of three experts in skin integrity research as reference standard (KLB, KVDB & DB). Inter-rater reliability and agreement was measured within the ratings of the participants. Intra-rater reliability and agreement with one week interval between ratings was calculated for all participants who completed both the first and the second survey.

*Participants*

Data were collected between September and November 2018 in a convenience sample of healthcare professionals in 44 countries. The sample included healthcare professionals within the network of the study team and a selection of major wound care organisations such as the World Council of Enterostomal Therapists (WCET), Nurses Specialized in Wound, Ostomy and Continence Canada (NSWOCC), Wounds Canada, Wounds Australia, Tissue Viability Society (TVS), Wound, Ostomy and Continence Nurses Society (WOCN), Wound Healing Association of Southern Africa (WHASA), Saudi Chapter of Enterostomal Therapy (SCET), and V&VN Wound Expertise.

*Photographs*

Twenty-four skin tear photographs (obtained with informed consent from patients to be applied for research purposes) were selected and categorised by three experts in skin integrity research (Table 1). The set equally represented the three types of skin tears and included three photographs from patients with a darkly pigmented skin. There was 100% consensus between the raters in categorising the photographs (reference standard). Sample size calculation was performed by the statistical software package R43 using the function CI3Cats in the kappaSize package (version 1.2)44, 45. The confidence interval-based method was used to determine the number of photographs needed to examine inter-rater reliability with three outcome categories. A minimum of 22 photographs was required, based on an anticipated ĸ-value of 0.6539, an expected lower bound for a two-sided 100(1-α)% confidence interval of 0.48, an expected upper confidence limit of 0.8, and the proportions per skin tear type (type 1=0.33, type 2=0.33, type 3= 0.34).

*Ethical considerations*

This study was performed in accordance with the ethical guidelines of the Declaration of Helsinki and approved by the Ethics Committee of Ghent University Hospital (B670201836271). All participants received written information about the purpose and procedure before the start of the study. Confidentiality and anonymity of the participants were guaranteed. Return of a completed survey was considered as consent to participate.

*Data analysis*

Diagnostic accuracy, agreement, inter-rater reliability and intra-rater reliability were analysed.

Summary measures of overall and specific agreement were calculated based on the comparison between the participants’ ratings and the reference standard. The summary measures were the estimated mean with 95% confidence interval (CI), the estimated median value with the interquartile range (IQR), and the 2.5th and 97.5th percentile. In order to calculate diagnostic accuracy, three binary measures were considered: type 1 versus type 2 and 3, type 2 versus type 1 and 3, and type 3 versus type 1 and 2 skin tears. Diagnostic accuracy was assessed by summary measures for sensitivity and specificity of each rater to the reference standard.

Inter-rater reliability amongst raters was assessed using the multi-rater Fleiss Kappa. Reference standard scores were not included in the analysis. Intra-rater reliability and agreement were examined by comparing the first and second ratings of the same photographs for participants who completed both the first and the second survey. Summary measures of Cohen’s Kappa, overall and specific agreement were calculated for each individual rater.

Kappa coefficients criteria by Landis and Koch were applied (<0.00=Poor; 0.00-0.20=Slight; 0.21-0.40=Fair; 0.41-0.60=Moderate; 0.61-0.80=Substantial; 0.81-1.00=Almost perfect)46. All statistical analyses were performed in R (version 3.5.1)43. The concordance function in the R-library ‘raters’ (version 2.0.1) was used to obtain Fleiss Kappa and 95% CIs, and the kappa2 function in the R-library ‘irr’ (version 0.84.1) for calculating Cohen’s Kappa.

**RESULTS**

**Phase 1. Design and content validation of a definition for the concept of a “skin flap” in skin tears**

The Delphi process resulted in the following definition of a “skin flap” associated with the condition of a skin tear: *“A flap in skin tears is defined as a portion of the skin (epidermis/dermis) that is unintentionally separated (partially or fully) from its original place due to shear, friction, and/or blunt force. This concept is not to be confused with tissue that is intentionally detached from its place of origin for therapeutic use e.g. surgical skin grafting.”*. The three categories of the initial ISTAP tool have remained unchanged. The ISTAP Classification System including the newly developed “skin flap” definition is presented in Figure 1.

**Phase 2. Psychometric evaluation of the ISTAP Classification System**

*Characteristics of the participants*

A total of 1601 participants (89.4% female, mean (SD) age: 41.2 (12.2) years) completed the first survey (test) of which 952 (59.5%) completed the second survey (re-test). Table 2 provides an overview of the sample demographics.

*Diagnostic accuracy and agreement*

The diagnostic accuracy and agreement between the ratings of the participants and the reference standard are presented in Table 3. The average overall agreement was 0.79 (95% CI 0.79-0.80). The mean specific agreement ranged from 0.75 (95% CI 0.74-0.75) for type 2 to 0.76 (95% CI 0.76-0.77) for type 3 to 0.86 (95% CI 0.85-0.86) for type 1 skin tears. A higher overall agreement was found in participants who considered themselves as proficient or expert (0.82 (95% CI 0.81-0.83)), participants with a master’s degree (0.81 (95% CI 0.79-0.82)), and participants that were familiar with the use of the ISTAP Classification System (0.82 (95% CI 0.81-0.83)). A mean sensitivity of 88% (95% CI 0.87-0.88) and a mean specificity of 92% (95% CI 0.92-0.93) were found for differentiating type 1 from type 2 and 3 skin tears. Slightly lower sensitivity and specificity rates were observed for differentiating type 2 from type 1 and 3 skin tears, and type 3 from type 1 and 2 skin tears.

*Inter- and intra-rater reliability*

The multi-rater Fleiss Kappa for the entire group of participants was 0.57 (95% CI 0.57-0.57; Table 4). Inter-rater reliability was higher in more experienced healthcare professionals. The mean Cohen’s Kappa representing the intra-rater reliability was 0.74 (95% CI 0.73-0.75) and the average overall agreement was 0.83 (95% CI 0.82-0.84; Table 5). Higher mean specific agreement rates were found compared to the first time of assessment, ranging from 0.78 (95% CI 0.77-0.79) for type 2 to 0.83 (95% CI 0.82-0.84) for type 3 to 0.86 (95% CI 0.85-0.87) for type 1 skin tears.

**DISCUSSION**

Although skin tears are unique and highly prevalent wounds, they are often under-recognised, misdiagnosed and poorly reported in clinical practice. Best practice includes early and accurate identification, classification, documentation, and the application of an evidence-based treatment protocol5. A standardised and globally accepted skin tear classification system is needed to support consistent assessment and reporting6, 7. This study aimed to evaluate the validity and reliability of the ISTAP Classification System internationally.

Content validity of the ISTAP Classification System including the newly developed “skin flap” definition was established by a panel of 17 international experts. After a two-round Delphi process, consensus was achieved about the definition for the concept of a “skin flap” in skin tears. The development of such definition for the area of skin tears is important because this concept may be interpreted differently depending on one’s educational background42. In the field of reconstructive surgery, for example, a “skin flap” is considered a mass of tissue intentionally detached from its original place to be used for grafting for wound repair and organ reconstruction47, 48. A clear, internationally accepted definition of a “skin flap” associated with the condition of a skin tear should help to eliminate confusion and to facilitate best practice5.

In this study, psychometric properties of the ISTAP Classification System were examined in a sample of 1601 healthcare professionals from 44 countries. The results indicate a high level of agreement and diagnostic accuracy for differentiating between the three types of skin tears when healthcare professionals apply the ISTAP tool on presented photographs. Differences in classifications were primarily limited to distinguishing between type 2 and type 3 skin tears, which is similar to the findings of Källman *et al.* (2018)41. The high level of agreement may reflect the ease of use of the tool39. Inter-rater reliability was found to be ‘moderate’ to ‘substantial’ according to the interpretation by Landis and Koch. Similar results were reported in previous studies10, 39-41. The results showed a ‘substantial’ to ‘almost perfect’ level of intra-rater reliability and agreement. Diagnostic accuracy, agreement and reliability rates may have been higher if live situations instead of photographs were used to classify skin tears. In order to be able to accurately classify a skin tear, the wound must be cleansed, necrotic tissue debrided, and the skin flap re-approximated where possible, which might be difficult to observe in photographs5, 38. Skin assessment in clinical practice, video recordings, or the exclusive use of photographs in which the skin flap, if viable, has been re-approximated could possibly offer a better alternative.

In general, we found higher reliability and agreement rates in more experienced and higher educated healthcare professionals. As skin tears have a complex aetiology, extensive knowledge and experience are required to correctly identify and classify these wounds5. Sufficient and adequate education and training of healthcare professionals may enhance the reliability of skin tear assessment. In 2006, a randomised controlled trial including 1217 nurses was conducted to assess the effectiveness of a training program on pressure ulcer classification skills49. The results of this study revealed a significant improvement in pressure ulcer identification and classification skills after attending the training program based on the Pressure Ulcer Classification (PUCLAS) education tool. In line with the PUCLAS tool, the development of an (e-learning) education tool for skin tear identification and classification that can be easily implemented by educators and healthcare organisations might facilitate learning and improve skills. Further research is needed to evaluate whether, and to what extent, education and training of (future) healthcare professionals would improve skin tear assessment and classification skills.

In the field of pressure ulcers, the National Pressure Ulcer Advisory Panel (NPUAP)50 and European Pressure Ulcer Advisory Panel (EPUAP)51 classification systems are widely used for the classification and documentation of pressure ulcers52, 53. To support the assessment of incontinence‐associated dermatitis (IAD), the Ghent Global IAD Categorization Tool (GLOBIAD) has been developed and globally validated in 201754. In line with the GLOBIAD, NPUAP and EPUAP classification systems, the systematic assessment and reporting of skin tears using a valid and reliable international classification tool is recommended5. The results of this study show that skin tear photographs can be assessed in a valid and reliable way based on the ISTAP Classification System. In the context of our study, the ISTAP Classification System including the “skin flap” definition has been translated into 15 languages and disseminated across 44 countries, encouraging global awareness and implementation39. It should be considered to integrate the ISTAP tool into the (electronic) medical record so that consistent documentation is guaranteed and more accurate skin tear prevalence and incidence data are obtained. Furthermore, the common use of the ISTAP Classification System to support skin tear assessment and documentation will facilitate and standardise communication, benchmarking, clinical audits and research6, 7, 16.

*Strengths and limitations*

Our study was a global validation study including a large number of international experts and healthcare professionals with different backgrounds across a variety of settings and countries. This increases the generalisability of our findings and may contribute to global awareness and implementation of the ISTAP Classification System. A main limitation of this study might be the use of photographs which only provide a static, two-dimensional image of the wound. Assessment in clinical practice might allow a more holistic evaluation involving additional factors such as the cause of the wound, accurate flap visualisation, partial/full-thickness, health status, wound history, and dependency for daily living activities5, 40. Whether skin tear assessment in clinical practice is more accurate than with photographs is yet to be established. Furthermore, we only included photographs of skin tears, but it is well known that skin tears are frequently incorrectly diagnosed as other lesions, such as pressure ulcers7, 39. Therefore, it would be recommended to also include photographs of other wound types in future validation studies to evaluate whether the differential diagnosis between skin tears and other types of lesions can be made. Another limitation might be that there were only three photographs of darkly pigmented skin included, which may limit the applicability of our findings to all skin phototypes.

**CONCLUSIONS**

The global validation of the ISTAP Classification System is a major step forward towards a more systematic assessment and reporting of skin tears in clinical practice and research. The ISTAP Classification System seems to be a valid, reliable, and easy-to-use tool for classifying skin tears according to their severity level. The ISTAP tool is available in 15 languages, which may enhance global implementation.

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**FIGURE LEGENDS**

**Figure 1.** The International Skin Tear Advisory Panel (ISTAP) Classification System

**Table 1. Classification of the photographs by three experts**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Type** |  | **Number of photographs a** | |  |
|  |  |  | *Non-pigmented skin* | *Pigmented skin* | **Total** |
| 1 | No skin/flap loss |  | 8 | 0 | 8 |
| 2 | Partial skin/flap loss |  | 5 | 3 | 8 |
| 3 | Total skin/flap loss |  | 8 | 0 | 8 |
|  |  | **Total** | 21 | 3 | **24** |

a The set of 24 photographs used in both survey 1 (test) and survey 2 (re-test) was identical.

**Table 2. Demographics of the participants**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Test** | |  | **Re-test** | |  |
| *n* | 1601 | |  | 952 | |  |
|  | n | % |  | n | % |  |
| **Gender** |  |  |  |  |  |  |
| Female | 1432 | 89.4 |  | 853 | 89.6 |  |
| **Age** |  |  |  |  |  |  |
| Mean (SD) in years | 41.2 (12.2) | |  | 42.1 (11.7) | |  |
| **Age** |  |  |  |  |  |  |
| < 30 years | 361 | 22.5 |  | 177 | 18.6 |  |
| 30 - 39 years | 387 | 24.2 |  | 244 | 25.6 |  |
| 40 - 49 years | 383 | 23.9 |  | 238 | 25.0 |  |
| ≥ 50 years | 470 | 29.4 |  | 293 | 30.8 |  |
| **Role** |  |  |  |  |  |  |
| Student Nurse | 39 | 2.4 |  | 13 | 1.4 |  |
| Nurse assistant | 26 | 1.6 |  | 12 | 1.3 |  |
| Nurse | 745 | 46.5 |  | 416 | 43.7 |  |
| Head nurse | 61 | 3.8 |  | 44 | 4.6 |  |
| Nurse specialist | 644 | 40.2 |  | 404 | 42.4 |  |
| Educator | 45 | 2.8 |  | 34 | 3.6 |  |
| Researcher | 21 | 1.3 |  | 15 | 1.6 |  |
| Other | 16 | 1.0 |  | 10 | 1.1 |  |
| Missing | 4 | 0.2 |  | 4 | 0.4 |  |
| **Education** |  |  |  |  |  |  |
| Undergraduate | 417 | 26.0 |  | 241 | 25.3 |  |
| Bachelor's degree | 633 | 39.5 |  | 352 | 37.0 |  |
| Master's degree | 475 | 29.7 |  | 310 | 32.6 |  |
| Doctoral degree | 73 | 4.6 |  | 49 | 5.1 |  |
| Other / unknown | 3 | 0.2 |  | 0 | 0.0 |  |
| **Work experience in health care** |  |  |  |  |  |  |
| < 5 years | 306 | 19.1 |  | 147 | 15.4 |  |
| 5 - 10 years | 287 | 17.9 |  | 171 | 18.0 |  |
| 11 - 20 years | 360 | 22.5 |  | 239 | 25.1 |  |
| > 20 years | 648 | 40.5 |  | 395 | 41.5 |  |
| **Current work setting** |  |  |  |  |  |  |
| Local hospital | 546 | 34.1 |  | 323 | 33.9 |  |
| Teaching / university hospital | 425 | 26.5 |  | 251 | 26.4 |  |
| Magnet hospital | 55 | 3.4 |  | 21 | 2.2 |  |
| Nursing home | 116 | 7.2 |  | 68 | 7.1 |  |
| Community care | 243 | 15.2 |  | 162 | 17.0 |  |
| Education | 93 | 5.8 |  | 59 | 6.2 |  |
| Clinical research | 20 | 1.2 |  | 15 | 1.6 |  |
| Industry / commercial | 9 | 0.6 |  | 5 | 0.5 |  |
| No work / student | 41 | 2.6 |  | 24 | 2.5 |  |
| Other | 50 | 3.1 |  | 24 | 2.5 |  |
| Missing | 3 | 0.2 |  | 0 | 0.0 |  |
| **Expertise in skin tears a** |  |  |  |  |  |  |
| Novice | 219 | 13.7 |  | 112 | 11.8 |  |
| Advanced Beginner | 261 | 16.3 |  | 138 | 14.5 |  |
| Competent | 389 | 24.3 |  | 229 | 24.1 |  |
| Proficient | 400 | 25.0 |  | 252 | 26.5 |  |
| Expert | 332 | 20.7 |  | 221 | 23.2 |  |
| **Wound care module b** |  |  |  |  |  |  |
| Completed | 869 | 54.3 |  | 540 | 56.7 |  |
| **Observation of skin tears in practice c** |  |  |  |  |  |  |
| None | 216 | 13.5 |  | 127 | 13.3 |  |
| < 5 times a week | 989 | 61.8 |  | 602 | 63.2 |  |
| 5 -10 times a week | 322 | 20.1 |  | 183 | 19.2 |  |
| > 10 times a week | 74 | 4.6 |  | 40 | 4.2 |  |
| **Experience ISTAP tool d** |  |  |  |  |  |  |
| No previous experience | 1143 | 71.4 |  | 650 | 68.3 |  |
| **Language e** |  |  |  |  |  |  |
| Arabic | 8 | 0.5 |  | 3 | 0.3 |  |
| Chinese | 146 | 9.1 |  | 72 | 7.6 |  |
| Czech | 112 | 7.0 |  | 61 | 6.4 |  |
| Danish | 18 | 1.1 |  | 12 | 1.3 |  |
| Dutch | 295 | 18.4 |  | 216 | 22.7 |  |
| English | 381 | 23.8 |  | 195 | 20.5 |  |
| French | 70 | 4.4 |  | 55 | 5.8 |  |
| German | 109 | 6.8 |  | 62 | 6.5 |  |
| Hebrew | 62 | 3.9 |  | 35 | 3.7 |  |
| Italian | 31 | 2.0 |  | 15 | 1.6 |  |
| Japanese | 54 | 3.4 |  | 46 | 4.8 |  |
| Portuguese | 47 | 2.9 |  | 37 | 3.9 |  |
| Spanish | 70 | 4.4 |  | 45 | 4.7 |  |
| Swedish | 56 | 3.5 |  | 35 | 3.7 |  |
| Turkish | 141 | 8.8 |  | 63 | 6.6 |  |
| **Country of work** |  |  |  |  |  |  |
| Australia | 82 | 5.1 |  | 50 | 5.3 |  |
| Austria | 5 | 0.3 |  | 4 | 0.4 |  |
| Belgium | 175 | 10.9 |  | 128 | 13.4 |  |
| Botswana | 2 | 0.1 |  | 1 | 0.1 |  |
| Brazil | 3 | 0.2 |  | 1 | 0.1 |  |
| Canada | 122 | 7.6 |  | 89 | 9.3 |  |
| Chile | 69 | 4.3 |  | 45 | 4.7 |  |
| China | 148 | 9.2 |  | 74 | 7.8 |  |
| Colombia | 1 | 0.1 |  | 0 | 0.0 |  |
| Costa Rica | 2 | 0.1 |  | 0 | 0.0 |  |
| Cyprus | 1 | 0.1 |  | 1 | 0.1 |  |
| Czech Republic | 105 | 6.6 |  | 58 | 6.1 |  |
| Denmark | 19 | 1.2 |  | 12 | 1.3 |  |
| Germany | 105 | 6.6 |  | 58 | 6.1 |  |
| India | 1 | 0.1 |  | 0 | 0.0 |  |
| Indonesia | 3 | 0.2 |  | 1 | 0.1 |  |
| Iran | 2 | 0.1 |  | 0 | 0.0 |  |
| Ireland | 2 | 0.1 |  | 2 | 0.2 |  |
| Israel | 62 | 3.9 |  | 35 | 3.7 |  |
| Italy | 31 | 1.9 |  | 15 | 1.6 |  |
| Japan | 54 | 3.4 |  | 46 | 4.8 |  |
| Jersey | 1 | 0.1 |  | 0 | 0.0 |  |
| Kenya | 2 | 0.1 |  | 1 | 0.1 |  |
| Malaysia | 1 | 0.1 |  | 0 | 0.0 |  |
| Malta | 3 | 0.2 |  | 2 | 0.2 |  |
| Mauritius | 1 | 0.1 |  | 0 | 0.0 |  |
| Namibia | 2 | 0.1 |  | 1 | 0.1 |  |
| the Netherlands | 125 | 7.8 |  | 89 | 9.3 |  |
| Norway | 1 | 0.1 |  | 1 | 0.1 |  |
| Philippines | 3 | 0.2 |  | 3 | 0.3 |  |
| Portugal | 50 | 3.1 |  | 39 | 4.1 |  |
| Saudi Arabia | 1 | 0.1 |  | 1 | 0.1 |  |
| Singapore | 2 | 0.1 |  | 1 | 0.1 |  |
| Slovakia | 6 | 0.4 |  | 3 | 0.3 |  |
| South Africa | 56 | 3.5 |  | 24 | 2.5 |  |
| Sri Lanka | 1 | 0.1 |  | 0 | 0.0 |  |
| Sweden | 56 | 3.5 |  | 35 | 3.7 |  |
| Switzerland | 2 | 0.1 |  | 1 | 0.1 |  |
| Taiwan | 2 | 0.1 |  | 2 | 0.2 |  |
| Thailand | 1 | 0.1 |  | 0 | 0.0 |  |
| Turkey | 141 | 8.8 |  | 63 | 6.6 |  |
| United Arab Emirates | 9 | 0.6 |  | 3 | 0.3 |  |
| United Kingdom | 33 | 2.1 |  | 10 | 1.1 |  |
| United States of America | 108 | 6.7 |  | 53 | 5.6 |  |

a Expertise in relation to the assessment and management of skin tears (based on the levels

of proficiency defined by Patricia Benner55). b Completion of a recognised wound care module.

c Estimated number of observed skin tears in practice (average a week). d Previous experience

with using the ISTAP Classification System. e Languages in which the ISTAP Classification

System and the online survey were translated.

**Table 3. Diagnostic accuracy and agreement with reference standard – 1601 raters**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **mean (95% CI)** | **median (IQR)** | **2.5th and 97.5th percentile** |
| Po a | 0.79 (0.79-0.80) | 0.83 (0.75-0.88) | 0.42-0.96 |
| Ptype 1 b | 0.86 (0.85-0.86) | 0.89 (0.80-0.94) | 0.43-1.00 |
| Ptype 2 b | 0.75 (0.74-0.75) | 0.78 (0.67-0.88) | 0.31-0.94 |
| Ptype 3 b | 0.76 (0.76-0.77) | 0.80 (0.71-0.88) | 0.32-1.00 |
| **Type 1 vs 2+3** |  |  |  |
| Sensitivity | 0.88 (0.87-0.88) | 0.88 (0.88-1.00) | 0.38-1.00 |
| Specificity | 0.92 (0.92-0.93) | 0.94 (0.88-1.00) | 0.69-1.00 |
| **Type 2 vs 1+3** |  |  |  |
| Sensitivity | 0.77 (0.76-0.77) | 0.75 (0.62-0.88) | 0.25-1.00 |
| Specificity | 0.86 (0.86-0.87) | 0.88 (0.81-0.94) | 0.56-1.00 |
| **Type 3 vs 1+2** |  |  |  |
| Sensitivity | 0.74 (0.73-0.75) | 0.75 (0.62-0.88) | 0.25-1.00 |
| Specificity | 0.91 (0.90-0.91) | 0.94 (0.88-1.00) | 0.62-1.00 |

Type 1, no skin/flap loss; Type 2, partial skin/flap loss; Type 3, total skin/flap loss; 95% CI,

95% confidence interval; IQR, interquartile range. a Overall proportion of agreement.

b Proportion of specific agreement.

**Table 4. Inter-rater reliability – 1601 raters**

|  |  |
| --- | --- |
|  | **ĸ (95% CI)** |
| Total sample (*n=1601)* | 0.57 (0.57-0.57) |
| **Expertise in skin tears**  Novice (*n=219)* | 0.43 (0.42-0.43) |
| Advanced Beginner (*n=261)* | 0.56 (0.56-0.56) |
| Competent (*n=389)* | 0.57 (0.57-0.57) |
| Proficient (*n=400)* | 0.62 (0.62-0.62) |
| Expert (*n=332)* | 0.64 (0.64-0.64) |
| **Education**  Undergraduate (*n=417)* | 0.55 (0.55-0.55) |
| Bachelor’s degree (*n=633)* | 0.58 (0.57-0.58) |
| Master’s degree (*n=475)* | 0.59 (0.59-0.59) |
| Doctoral degree (*n=73)* | 0.53 (0.52-0.53) |
| **Experience ISTAP tool**  Previous experience (*n=458)* | 0.64 (0.64-0.64) |
| No previous experience *(n=1143)* | 0.55 (0.55-0.55) |

ĸ, Fleiss Kappa coefficient; 95% CI, 95% confidence interval.

**Table 5.** **Intra-rater reliability and agreement – 952 raters**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **mean (95% CI)** | **median (IQR)** | **2.5th and 97.5th percentile** |
| ĸ a | 0.74 (0.73-0.75) | 0.75 (0.68-0.87) | 0.31-0.94 |
| Po b | 0.83 (0.82-0.84) | 0.83 (0.79-0.92) | 0.54-0.96 |
| Ptype 1 c | 0.86 (0.85-0.87) | 0.89 (0.82-0.94) | 0.54-1.00 |
| Ptype 2 c | 0.78 (0.77-0.79) | 0.82 (0.71-0.89) | 0.39-0.95 |
| Ptype 3 c | 0.83 (0.82-0.84) | 0.86 (0.78-0.92) | 0.50-1.00 |

Type 1, no skin/flap loss; Type 2, partial skin/flap loss; Type 3, total skin/flap loss; 95% CI, 95%

confidence interval; IQR, interquartile range. a ĸ, Cohen’s Kappa coefficient. b Overall proportion of

agreement. c Proportion of specific agreement.