Office of Evidence Based Practice (EBP) – Critically Appraised Topic (CAT): Pressure Injury (PI) Risk Assessment Instrument

Specific Care Question

In the pediatric population which pressure injury (PI) risk assessment instrument (Braden Q, Braden QD, or SIRA+P) measures the risk of an injury most effectively?

Recommendations Based on Current Literature (Best Evidence) Only

Based on an expert review of current literature by the Department of EBP, a conditional recommendation is made for using either the Braden Q (children less than 8 years old) or the Braden QD (preterm to 21 years) to predict a PI in the pediatric population. We are unable to make any recommendation for the SIRA + P as diagnostic accuracy statistics were not reported for this instrument.

The overall certainty in the evidence for the Braden Q is low[a] as the two included meta-analyses reported a high level of heterogeneity though some of it was explained with subgroup analysis. The overall certainty in the evidence for the Braden QD is also low[a] however, it does show promise. If either of these instruments are adopted, standard work should be developed, implemented, and monitored to determine the diagnostic accuracy of this instrument for our patient population.

Literature Summary

Background. Pressure injuries (PI) in the pediatric population are typically a result of either pressure on a bony prominence or pressure in combination with a shearing injury (Puspitasari et al., 2020). Not only do PI cause pain, prolong hospitalization but this injury is associated with higher morbidity and mortality (Dreyfus et al., 2018). The prevalence rates for PI range between 1.4 to 35% (Razmus & Bergquist-Beringer, 2017) and the incidence rates of a hospital acquired PI range between 1.1 and 66% (McLane et al., 2004). This literature review was undertaken to identify a screening PI instrument that not only has the ability to classify patients at risk for a PI (sensitivity) but also the instrument must reduce missing patients that have PI risk (specificity). By identifying a sensitive and specific instrument nursing staff will be posed to plan appropriate patient care interventions. This review will summarize identified literature to answer the specific care question.

Study characteristics. The search for suitable studies was completed on December 29, 2020. B. Haney, BSN, RN, CWCN, WTA-C and J. Bartlett, PhD, RN reviewed the 96 titles and/or abstracts found in the search and identified[b] six studies believed to answer the question. After an in-depth review two meta-analyses (Chun et al., 2019; Liao et al., 2018) provided the diagnostic test accuracy analysis to answer the question related to the Braden Q and two single studies (Curley et al., 2018; Puspitasari et al., 2020) provided the diagnostic accuracy analysis of the Braden QD. The two meta-analyses (Chun et al., 2019; Liao et al., 2018) provided diagnostic accuracy statistics for a total of 12 unique studies (*N* = 2790). Six studies were found in both analyses. No literature was found that reported the diagnostic accuracy statistics for the SIRA + P instrument.

Diagnostic Test Accuracy of the Braden Q. Both meta-analyses performed an extensive literature search. Single studies were limited to English and Chinese languages (see qualitative analysis on pages 5 through 10). The meta-analyses authors' used either the QUADAS or QUADAS-2 to assess the quality of the included studies. The index test, Braden Q, was compared to the gold standard of either the National Pressure Ulcer Advisory Panel (NPUAP) or the European Pressure Ulcer Advisory (EPUA) guidelines and included Stage I through Stage IV. Both meta-analyses reported the pooled sensitivity, specificity, and area under the curve (AUC) (see Appendix A for an explanation of these findings). The EBP Department was unable to pool the findings between these studies.

Diagnostic Test Accuracy of the Braden QD. Two single studies reported the diagnostic test accuracy of the Braden QD. The index test for both studies was the Braden QD. One study used the National Pressure Ulcer Advisory Panel (NPUAP) as the comparator test (or gold standard) while the other study used the Braden Q. Both studies reported the sensitivity, specificity, and AUC. The EBP Department was unable to pool the findings between these studies.

Summary by Outcome

Sensitivity, specificity and area under the curve for the Braden Q. Two meta-analyses (Chun et al., 2019; Liao et al., 2018) measured the sensitivity and specificity of the Braden Q, (N = 2790). Chun et al. (2019) reported a pooled sensitivity of 72%, 95% CI [0.60, 0.82], p = 0.0827, I^2= 46.4%, while Liao et al. (2018) reported a pooled sensitivity of 73%, 95% CI [0.67, 0.78], p = 0.0012, I^2= 65.7%. Chun et al. (2019) reported a pooled specificity of 60%, 95% CI [0.57, 0.63], p = 0.0000, I^2 = 96.8 %, while Liao et al. (2018) reported a pooled specificity of 61%, 95% CI [0.59, 0.63], p = 0.0000, I^2= 97.2%. Chun et al. (2019) and Liao et al. (2018) reported the AUC to be 69.18% and 71% which is low to moderate in diagnostic accuracy (AUC ≤50% indicates that a diagnostic test was worthless; between 50 and 70% indicates that the accuracy of the diagnostic test is low; between 70 and 90% indicates that the accuracy is moderate; and greater the 90% indicates a high accuracy in diagnosis (Mandrekar, 2010)). Reported forest plots can be found in the referenced meta-analyses.

Certainty of the evidence for sensitivity, specificity and area under the curve for the Braden Q. The certainty of the body of evidence was low based on four factors[a]: *within-study risk of bias*, *consistency among studies, directness of evidence*, and *precision of effect estimates*. The body of evidence was assessed to have not serious risk of bias, serious inconsistency, serious indirectness and not serious imprecision. Inconsistency was judged to be serious studies as the reported I^2 statistic was high. The reported I^2 statistic can be found in the qualitative analysis found later in this document. As one of the meta-analyses (Chun et al., 2019) only reviewed literature in which the population was in the Pediatric Intensive Care Unit (PICU), directness was judged to be serious.

Sensitivity, specificity and area under the curve for the Braden QD. Two single studies (Curley et al., 2018; Puspitasari et al., 2020) measured the sensitivity and specificity of the Braden QD. Curley et al. (2018) reported a sensitivity of 86%, 95% CI [0.76, 0.84] while Puspitasari et al. (2020) reported a sensitivity of 100%. The specificity reported, in the two studies (Curley et al., 2018; Puspitasari et al., 2020), was 59% and 40% respectively. Curley et al. (2018) and Puspitasari et al. (2020) reported the AUC to be 78% and 82.4%, respectively, which equates to a moderate diagnosing accuracy (AUC ≤50% indicates that a diagnostic test was worthless; between 50 and 70% indicates that the accuracy of the diagnostic test is low; between 70 and 90% indicates that the accuracy is moderate; and greater the 90% indicates a high accuracy in diagnosis (Mandrekar, 2010)).

Certainty of the evidence for sensitivity, specificity and area under the curve. The certainty of the body of evidence was low based on four factors[a]: *within-study risk of bias*, *consistency among studies, directness of evidence*, and *precision of effect estimates*. The body of evidence was assessed to have serious risk of bias, not serious inconsistency, serious indirectness and not serious imprecision. Curley et al. (2018) did not assess consecutive patients rather study participants were enrolled three days a week which led to the judgement of serious risk of bias. In addition, directness was judged to be serious as one of the study populations only came from the PICU (Puspitasari et al., 2020) with the other study (Curley et al., 2018) reporting a majority the study population assessed in the PICU (403/625, 64%).

Identification of Studies

Search Strategy and Results (see Figure 1)

Search: ("Pressure Ulcer Scale" OR ((Norton[tiab] OR Glamorgan[tiab] OR Braden[tiab]) AND ("pressure ulcer" OR "pressure injury")) OR "Braden Q" OR "Braden QD" OR SIRA+P) AND (child OR children OR pediatr* OR paediatr*)

Records identified through database searching n = 96

Additional records identified through other sources n = 0

Studies Included in this Review

Citation	Study Type
Curley et al. (2018)	Multicenter, prospective cohort study
Chun et al. (2019)	Meta-analysis
Liao et al. (2018)	Meta-analysis
Puspitasari et al. (2020)	Single center, prospective cohort study

Studies Not Included in this Review with Exclusion Rationale

Citation	Reason for exclusion
Foster et al. (2017)	Sensitivity and specificity were not reported, gold standards employed were Neonatal Skin Risk Assessment Scale, Braden Q, and Braden
Kottner et al. (2014)	Study did not report the pooled statistics

Methods Used for Appraisal and Synthesis

[a]The GRADEpro Guideline Development Tool (GDT) is the tool used to create the Summary of Findings table(s) for this analysis

[b]Rayyan is a web-based software used for the initial screening of titles and / or abstracts for this analysis (Ouzzani, Hammady, Fedorowicz & Elmagarmid, 2017).

[c]The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram depicts the process in which literature is searched, screened, and eligibility criteria is applied (Moher, Liberati, Tetzlaff, & Altman, 2009).

[a]GRADEpro GDT: GRADEpro Guideline Development Tool (2015). McMaster University, (developed by Evidence Prime, Inc.). [Software]. Available from gradepro.org.

[b]Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan-a web and mobile app for systematic reviews. *Systematic Reviews, 5*(1), 210. doi:10.1186/s13643-016-0384-4

[c]Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097 **For more information, visit www.prisma-statement.org.**

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Acronyms Used in this Document

Acronym	Explanation
AUC	Area under the curve
CAT	Critically Appraised Topic
EBP	Evidence Based Practice
EPUA	European Pressure Ulcer Advisory
NPUAP	National Pressure Ulcer Advisory Panel
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QUADAS	Quality Assessment of Studies of Diagnostic Accuracy

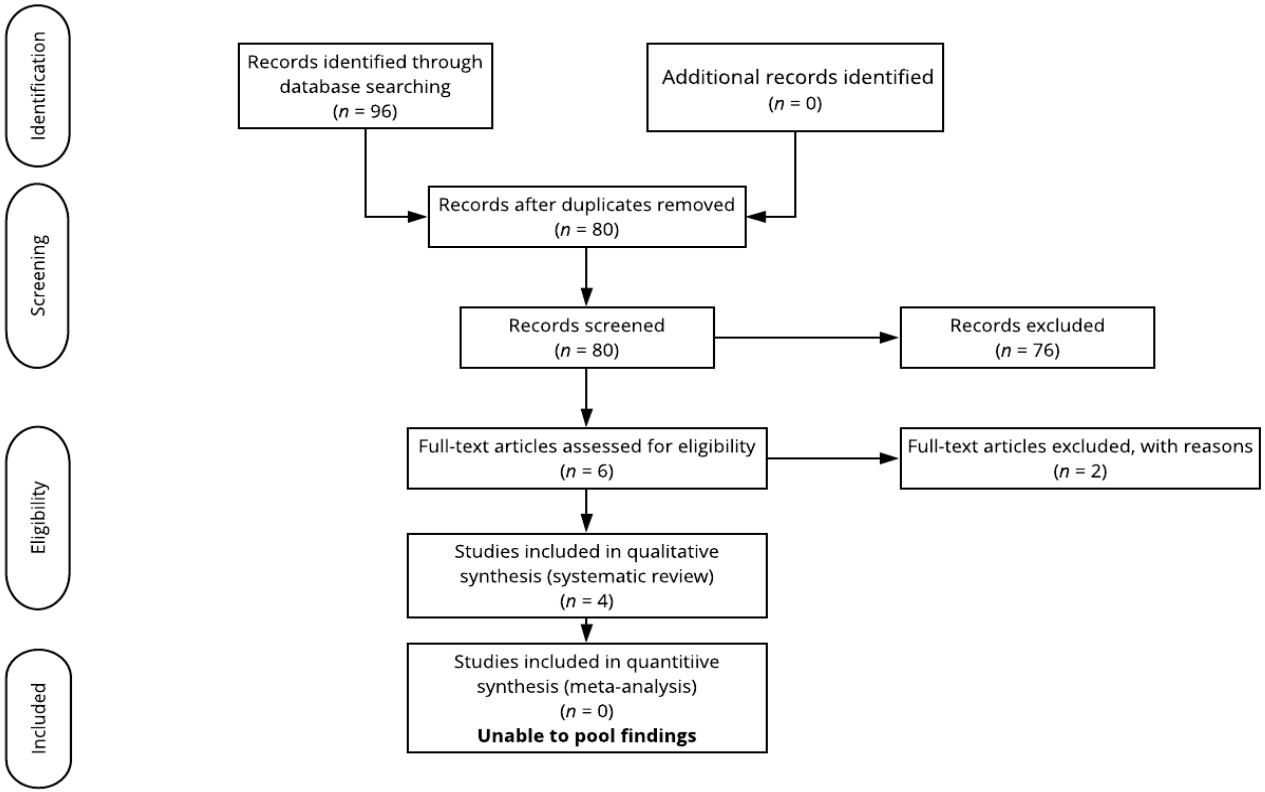

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRIMSA)[c]

Chun et al. (2019)

Design	Diagnostic Quantitative Synthesis and Meta-analysis
Objective	Objectives: This study aimed to evaluate the predictive efficacy of the Braden Q Scale for the assessment of pediatric pressure ulcer risk in the pediatric intensive care unit (PICU). Outcomes of interest: sensitivity (SEN), specificity (SPE), positive likelihood ratio (PLR), negative likelihood ratio (NLR), diagnostic odds ratio (DOR), summary receiver operating characteristics (SROC), Q index
Methods	**Protocol and registration.** Not reported. **Types of studies.** Cohort (3 English; 4 Mandarin Chinese) **Participants.** Patients younger than 18 years while in the PICU with no pressure ulcers present at time of admission. **Index tests.** No comparison. **Target Condition(s).** Development of pressure ulcers. **Reference Standards.** The definition and staging of PU must have followed clear standards such as published guidelines by National Pressure Ulcer Advisory Panel (NPUAP), European Pressure Ulcer Advisory Panel (EPUAP), or other organizations. **Information sources.** PubMed, Cochrane Library, Embase, China National Knowledge Infrastructure (China), VIP Chinese Medical Journal Database (China), and Wanfang Med Online (China). Search period was database inception to October 2017. **Search.** Keywords: pressure ulcer/decubitus ulcer/pressure injury/skin ulcer/bed sores, risk assessment/assessment scale/Braden Q, and pediatric/childrens. Search strategy combined subject words and free words that were supplemented by hand searching and document tracing. The search formula adopted the Boolean logic method, and the search words were linked by "AND" or "OR." Reviewers selected published and unpublished articles written in Chinese or English. The database searches and study selections were conducted independently by two reviewers. **Study Selection.** After independently evaluating the quality of all the articles, the evaluators compared their screening and evaluation results. When a disagreement occurred, the two evaluators discussed the issues until they reached consensus or asked a third party to decide whether to include the article. **Data collection process.** Authors, year, study country, population age and sex, sample (including total sample size and the proportion of the sample with PU, stage I PU, medical device-related (MDR) PU), Braden Q Scale cut-off score, the included heart diseases, PU reference standard

	and outcome index for the Braden Q Scale prediction [truepositive number (TP), false-positive number (FP), false-negative number (FN), true-negative number (TN)] were extracted and summarized descriptively in one table by one reviewer. A second reviewer checked the data for all studies.
	
	Methodological quality (Risk of Bias). Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) was used to evaluate the methodological quality of the included papers using Review Manager 5.3 software. QUADAS-2 consists of four domains: patient selection, index test(s), reference standard, flow, and timing. All four domains were evaluated for the risk of bias, and the first three were evaluated for clinical applicability. The relevant landmark issues included in each part were rated on three levels: "yes," "no," and "unclear." The articles were graded "high," "low," and "unclear" in terms of risk of bias and clinical applicability. Two evaluators independently evaluated each included article using these criteria.
	
	Additional analyses. A priori, the I^2 test and Q test were used to determine whether there was heterogeneity among the studies.
	• The fixed-effect model was used if $p > 0.01$ and $I^2 < 50\%$, there was no heterogeneity, and the fixed-effect model was used.
	• The random effects model (REM) was used with subgroup analyses to eliminate as much heterogeneity as possible if $P < 0.01$ and I^2 indicated heterogeneity using the following cut offs:
	  ○ the I^2 was between 25% but < 50%, the heterogeneity was considered low;
	  ○ the I^2 was between 50% but < 75%, some heterogeneity existed;
	  ○ the I^2 was > 75%, high heterogeneity was present.
	• If significant clinical heterogeneity was identified inclusion criteria would be reviewed, if the source could not be identified, a descriptive analysis would occur.

Results	**Study Selection.** **Number of articles identified based on inclusion criteria:** $N = 141$ **Full-text articles assessed for eligibility:** $n = 26$ **Studies included in synthesis:** $n = 7$ **Synthesis of results.** • Pooled sensitivity = 0.72, 95% CI [0.60, 0.82], $p = .0827$, $I^2 = 46.4\%$ • Pooled specificity = 0.60, 95% CI [0.57, 0.63], $p = .0000$, $I^2 = 96.8\%$ • Pooled positive LR = 1.69, 95% CI [1.18–2.42), $p = .0002$, $I^2 = 76.7\%$ • Pooled negative LR = 0.62, 95% CI [0.40, 0.94], $p = .1897$, $I^2 = 31.2\%$ • Pooled diagnostic OR = 3.34, 95% CI [1.47, 7.61], $p = .0802$, $I^2 = 46.8\%$ • The corresponding SROC curve with AUC was 69.18%. • The Q index was 0.6464.

	Methodological quality of included studies (Risk of Bias). Overall, most of the studies were identified as having high quality or a low risk of bias across the four domains evaluated by the QUADAS-2. The Spearman's correlation coefficient was −0.018, *p* value = 0.969, showing no threshold effect. Heterogeneity was influenced by population age, the Braden Q cut-off score, the subjective judgment of visual inspection employed as the PU reference standard used by the National Pressure Ulcer Advisory Panel and the European Pressure Ulcer Advisory Panel, and the inclusion of heart disease patients.
Discussion	**Summary of evidence.** The AUC of the SROC curve indicated that the Braden Q Scale had low to moderate accuracy for predicting pediatric PU risk in the PICU (AUC ≤50% indicates that a diagnostic test was worthless; between 50 and 70% indicates that the accuracy of the diagnostic test is low; between 70 and 90% indicates that the accuracy is moderate; and >90% indicates that the diagnostic accuracy is high). Further research is needed to define utility in specific age groups and disease states. Due to significant heterogeneity, subgroup analyses were performed based on age and Braden Q Scale cut-off score. • Pooled SEN, SPE, DOR, and AUC were higher for the 21 days to 8 years of age group (*n* = 4): ○ Pooled sensitivity = 0.75, 95% CI [0.60, 0.86], *p* = .015, I^2= 71.5% ○ Pooled specificity = 0.68, 95% CI [0.64, 0.71], *p* = .0000, I^2 = 97.2% ○ Pooled diagnostic OR = 6.83, 95% CI [2.96, 15.74], *p* = .334, I^2 = 11.8% ○ The corresponding SROC curve with AUC was 78.54%. • Pooled SEN, SPE, DOR, and AUC of the ≤ 16 point group were higher than those of the >16 group (*n* = 3): ○ Pooled sensitivity = 0.76, 95% CI [0.59, 0.89], *p* = .006, I^2= 80.7% ○ Pooled specificity = 0.71, 95% CI [0.68, 0.75], *p* = .0000, I^2 = 97.7% ○ Pooled diagnostic OR = 11.84, 95% CI [4.40, 31.85], *p* = .913, I^2 = 0% ○ The corresponding SROC curve with AUC was 84.32%. • The total pooled results indicated that as the Braden Q Scale score decreased, its predictive efficacy increased, but the overall predictive accuracy remained at a moderate level. Limitations include subjective nature of PU diagnosis and staging and heterogeneity of patient populations.
Funding	Not reported.

Liao et al. (2018)

Design	**Diagnostic Quantitative Synthesis Meta-analysis**
Objective	To determine the overall predictive accuracy of the Braden Q scale in hospitalized children.
Methods	**Protocol and registration.** The protocol was not registered. A protocol was established and published in supplementary information.

	Study inclusion criteria. • Assessed the predictive accuracy of Braden Q scale for pressure ulcers in pediatric patients, including children, infant, or newborns • Provided sufficient information to construct two-by-two contingency tables for individual study subjects or included sufficient data to calculate these factors **Study exclusion criteria.** • Participants older than 18 years old • Review, duplicate or expert opinions • Modified Braden Q was used and not the complete original Braden Q • The reported outcome include pressure ulcers and other wounds that can not know the exact incidence of pressure ulcer **Participants.** • Majority in pediatric intensive care units **Index tests –** Braden Q scale; cut-off ranged from 15 to 21 **Target Condition (s).** Pressure ulcers **Reference Standards.** Pressure ulcer diagnoses were based on National Pressure Ulcer Advisory Panel (NPUAP) and European Pressure Ulcer Advisory (EPUA) guidelines and included Stage I through Stage IV **Information sources.** • Cochrane Library (1996 to July 2018) • Medline (1996 to July 2018) via PubMed platform • Embase (1996 to July 2018) • CINAHL (1996 to July 2018) via EBSCO platform • SinoMed (1996 to July 2018) • CNKI (1996 to July 2018) • Wangfang (1996 to July 2018) • VIP (1996 to July 2018) • Additional studies were identified through hand-searching references of the identified studies. • Publication language was limited to Chinese and English. • Paper publication was limited to between 1996 and 2018 **Search.** Keywords: ('child' or 'infant' or 'paediatric'), ('pressure ulcer' or 'pressure sore' or 'bed sore' or 'decubitus' or 'pressure injury') and ('assess*' or 'predict*' or 'scale'). Mesh terms and free words were combined for use according to different databases.

Study Selection.
- Two reviewers individually assessed the quality of studies using QUADAS-2
- Disagreements were resolved by a third reviewer determining whether to include the article

Data collection process.
- The two reviewers extracted the studies independently
- Data extracted: first author, year of publication, country, study setting, sample size, cut-off value, PU staging system, mean age of participants and predictive validity index, such as sensitivity, specificity, TP, FP, TN and FN. In the presence of multiple cut-off values in a study, the values that have the best sensitivity and specificity were chosen.

Methodological quality (Risk of Bias).
- Risk of bias was judged according to signaling questions in each domain of QUADAS-2. The four domains are patient selection, index test, reference standard and flow of patients through the study and timing of the index tests.
- Disagreements were resolved by a third reviewer

Synthesis of results.
- Data were processed using MetaDiSc version 1.4
- Heterogeneity was determined by threshold effect using the Spearman correlation coefficient
- Q-test of diagnostic odds ratio was used to determine heterogeneity caused by non-threshold effect
- Pooled sensitivity and specificity and area under the curve (AUC) of summary receiver operation characterisitics (SROC) were calculated to assess the predictive accuracy of the Braden Q scale
- Random-effects modeling was used for the pooled analysis
- Publication bias was inspected via Deeks' funnel plot of the diagnostic odds ratio against the study size using Stata software version 14.0

Results

Study Selection.

Number of articles identified: *N* = 1731

Full-text articles assessed for eligibility: *n* = 31

- **Studies included in qualitative synthesis:** *n* = 11

Synthesis of results.

	value	95% CI	I^2
Sensitivity	0.73	0.67, 0.78	65.7%
Specificity	0.61	0.59, 0.63	97.2%
Diagnostic OR	3.47	2, 6.01	61.7%
Summary ROC	71% $\pm$ 1%		
Cochran Q	26.13 (p = 0.0036)		

	Methodological quality of included studies (Risk of Bias). • None of the 11 studies fulfilled all the QUADAS-2 quality criteria • The most frequent risks of bias were patient selection and index test
Discussion	The AUC of the SROC curve indicated that the Braden Q had moderate accuracy for predicting pediatric PU risk (AUC ≤50% indicates that a diagnostic test was worthless; between 50 and 70% indicates that the accuracy of the diagnostic test is low; between 70 and 90% indicates that the accuracy is moderate; and >90% indicates that the diagnostic accuracy is high). It is unknown how predictive the Braden Q is when used on patients external to the PICU as only two of the 11 included studies included these patients.
Funding	No funding sources were disclosed.

Qualitative Review of Single studies

Curley et al. (2018)

A. Risk of Bias	
Patient Sampling	Purpose: to describe the development and initial testing of the Braden QD Scale to predict both immobility-related and medical device–related pressure injury risk in pediatric patients Design: multicenter, prospective cohort study Recruitment: sites screened for eligible participants 3 times per week (Monday, Wednesday, Friday) Sample size: *N* = 625 Inclusion criteria: • preterm to 21 years of age • on bedrest for at least 24 hours from hospital admission with a medical device attached to or traversing their skin or mucous membrane (bedrest was operationalized per developmental age; specifically, infants not being held, toddlers not cruising, or children not walking per usual) Exclusion criteria: patients with a pre-existing pressure injury or a do-not-resuscitate order
Was a consecutive or random sample of patients enrolled?	No
Was a case-control design avoided?	Yes
Did the study avoid inappropriate exclusions?	Yes
Could the selection of patients have introduced bias?	High risk

B. Concerns regarding applicability	
Patient characteristics and setting	Country: USA Dates: March 25, 2013 to July 15, 2015 Enrollment stratifcation: Age, pt/type (medical/surgical or cardiovascular) and unit type (PICU or ward; each site limited enrollment to 25 subjects in the following age groups: preterm to 42 weeks, 43 weeks to 12 months, 13 months to 5 years, 6 to 12 years and 13 to 21 years; Critically ill patients were limited to 50% of each age group Demographics: • *Age at enrollment* ○ Preterm to < 1 mo, *n* = 109; Hospital acquired PI (HAPI) positive *n* = 7 ○ 1 mo to 8 y, *n* = 325; HAPI positive *n* = 24 ○ 9 y to 21 y, *n* = 191; HAPI positive *n* = 29 • *Gender*, Male *n* = 334; HAPI positive *n* = 29 • *Race/ethnicity* ○ Non-hispanic, white *n* = 418; HAPI positive *n* = 39 ○ Hispanic/Latino of any race *n* = 103; HAPI positive *n* = 7 ○ Non-hispanic, black *n* = 46; HAPI positive *n* = 1 ○ Multiracial *n* = 15; HAPI positive *n* = 1 Other *n* = 36; HAPI positive *n* = 1 • *Hospital admission characteristics* ○ Cardiovascular diagnosis *n* = 279; HAPI positive *n* = 27 ○ Medical/surgical diagnosis *n* = 346; HAPI positive *n* = 22 ○ Enrolled from PICU *n* = 403; HAPI positive *n* = 44
Are there concerns that the included patients and setting do not match the review question?	Low concern
Index tests	Braden Q
A. Risk of Bias	
Were the index test results interpreted without knowledge of the results of the reference standard?	Yes
If a threshold was used, was it pre-specified?	No
Could the conduct or interpretation of the index test have introduced bias?	Low risk

B. Concerns regarding applicability	
Are there concerns that the index test, its conduct, or interpretation differ from the review question?	Low concern
A. Risk of Bias	
Target condition and reference standard(s)	National Pressure Ulcer Advisory Panel
Is the reference standards likely to correctly classify the target condition?	Yes
Were the reference standard results interpreted without knowledge of the results of the index tests?	Yes
Could the reference standard, its conduct, or its interpretation have introduced bias?	Low risk
B. Concerns regarding applicability	
Are there concerns that the target condition as defined by the reference standard does not match the question?	Low concern
A. Risk of Bias	
Flow and timing	Two different assessment teams evaluated, within 6 hours of each other, enrolled study participants 3 times per week for 2 full weeks, then weeky for 2 more weeks; only pts with an identified HAPI received the reference standard
Was there an appropriate interval between index test and reference standard?	Unclear
Did all patients receive the same reference standard?	No
Were all patients included in the analysis?	Yes
Could the patient flow have introduced bias?	Unclear risk

Puspitasari et al. (2020)

A. Risk of Bias	
Patient Sampling	Purpose: to test the validity and reliability of the Braden QD scale Design: prospective cohort Recruitment: consecutive sampling between January 1, 2019 and April 5, 2019 Sample size: *N* = 51 Inclusion criteria: • children between 1 and 18 years • bedridden for at least 23 hours • pts were in the PICU Exclusion criteria: none identified
Was a consecutive or random sample of patients enrolled?	Yes
Was a case-control design avoided?	Yes
Did the study avoid inappropriate exclusions?	Unclear
Could the selection of patients have introduced bias?	Unclear risk
B. Concerns regarding applicability	
Patient characteristics and setting	Country: Indonesia Dates: January 1, 2019 and April 5, 2019 Demographics: • *Age at enrollment* ○ Infant (1 month to 1 year), *n* = 19 ○ Toddler (1 to 3 years), *n* = 8 ○ Pre-school (3 to 6 years), *n* = 8 ○ School-age (6 to 12 years), *n* = 7 ○ Adolescence (12 to 18 years), *n* = 9 • *Gender*, Male *n* = 38 • *Race/ethnicity* Authors did not report
Are there concerns that the included patients and setting do not match the review question?	High concern
Index tests	Braden QD

A. Risk of Bias	
Were the index test results interpreted without knowledge of the results of the reference standard?	Unclear
If a threshold was used, was it pre-specified?	Unclear
Could the conduct or interpretation of the index test have introduced bias?	High risk
B. Concerns regarding applicability	
Are there concerns that the index test, its conduct, or interpretation differ from the review question?	High concern
A. Risk of Bias	
Target condition and reference standard(s)	Braden Q
Is the reference standards likely to correctly classify the target condition?	Yes
Were the reference standard results interpreted without knowledge of the results of the index tests?	Unclear
Could the reference standard, its conduct, or its interpretation have introduced bias?	High risk
B. Concerns regarding applicability	
Are there concerns that the target condition as defined by the reference standard does not match the question?	Unclear concern
A. Risk of Bias	
Flow and timing	The authors did not provide when the two assessments were performed.
Was there an appropriate interval between index test and reference standard?	Unclear
Did all patients receive the same reference standard?	Yes
Were all patients included in the analysis?	Yes
Could the patient flow have introduced bias?	Unclear risk

References

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Appendix A

Terms in Tests of Diagnostic Accuracy

Term	Acronym	Definition
Sensitivity	(SnNout) Sn	When a test has a high sensitivity, a negative result rules out the diagnosis
Specificity	(SpPin) Sp	When a test has a high specificity, a positive result rules in the diagnosis
Likelihood ratio for a positive test result	LR+	For a positive test result LR (+) shows how much the odds increase for the presence of disease in cases with a positive result. The highest (LR+) is desired.
Likelihood ratio for a negative test result	LR-	For a negative test result LRFor a negative test result (LR-) shows how much the odds decrease for the presence of disease in cases with a negative result. The lowest (LR-) is desired.
Predictive value, positive	PV+	The probability of having the disease in a subject with a positive test result
Predictive value, negative	PV-	The probability of not having the disease in a subject with a negative test result
Area Under the Curve	AUC	The ability of a test to predict the desired outcome. An ACU of .5 indicates the test has a 50:50 chance of making the correct diagnosis. A higher AUC is desired.

Nordenstrom (2007)