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DEVELOPMENT AND RELIABILITY TESTING OF THE ANDROID-BASED BRADEN SCALE IN PREDICTING PRESSURE INJURY INCIDENTS IN STROKE PATIENTS

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ABSTRACT

Pressure injuries can cause complications for individuals treated in hospitals, prolonging treatment and rehabilitation, reducing quality of life, causing pain, and increasing mortality rates. Therefore, it is essential to use a scale to assess the risk of pressure injuries and determine appropriate preventive interventions. One commonly used instrument is the Braden Scale. Although the Braden Scale has been validated and has shown reliability, it has not been implemented on smartphones in Indonesia. The objective of this study is to develop an Android-based Braden Scale and test its validity in predicting pressure injuries in stroke patients. This research employs a quantitative method with a prospective cohort approach. The sampling technique used is consecutive sampling, a type of non-probability sampling. The study sample consists of 42 respondents for validity testing and 6 respondents for reliability testing between observers and experts. The study uses a Test-Retest approach with Spearman correlation testing. The research results showed a p-value of < 0.001, indicating a significant correlation between the Braden Scale scores on the 2nd and 3rd days of treatment. The Spearman correlation value of 0.901 indicates a strong positive correlation. Intra-Rater reliability analysis using the Intraclass Correlation Coefficient (ICC) between observers and experts for the paper-based Braden Scale was 0.94 (95% CI; 0.895 – 0.976), and for the Android-based Braden Scale, it was also 0.94 (95% CI 0.895 – 0.976). The Android-based Braden Scale is reliable in predicting the risk of pressure injuries in stroke patients. Based on the Intraclass Correlation Coefficient (ICC) analysis, it can be concluded that there is no difference in perception between observers and experts regarding the paper-based Braden Scale and the Android-based Braden Scale.

Keywords : Stroke., Android Braden Scale., Intra Rater reliability

INTRODUCTION

Stroke is a cause of immobilization that can lead to the risk of Pressure Injury. This aligns with the research conducted by Pratama, where out of 98 cases of Pressure Injury from January 2011 to December 2013, the most common diagnosis was stroke patients. [1]The prevalence of Pressure Injury ranges from 2.8% to 9% in acute care settings, with higher incidences reaching up to 23.9% in ICU patients, 8.5% in Long-Term Acute Care (LTAC), 3.6% to 59% in Long-Term Care (LTC), and 4.5% to 6.3% in home care. Suriadi stated that the incidence rate of Pressure Injury in Indonesia reached 33.3% in intensive care units, which is considerably high compared to the Pressure Injury incidence in ASEAN countries, ranging only from 2.1% to 31.3%. [2–5]

Pressure Injury can lead to complications for individuals treated in hospitals, prolong treatment and rehabilitation, reduce quality of life, cause pain, and increase mortality rates. [6,7] Mortality in patients with Pressure Injury reaches 67% compared to those with the same risk but without Pressure Injury, which is around 15%.[7]. Therefore, nurses need to make efforts to prevent the occurrence of Pressure Injury by detecting the risk factors for Pressure Injury. [8]

Based on this, it is crucial to use a scale to assess the risk of Pressure Injury and determine the risk of skin integrity damage and appropriate preventive interventions. One commonly used instrument is the Braden Scale. The Braden Scale is an assessment tool that helps nurses predict clients at risk of developing Pressure Injury. [9–11]Many studies have tested the validity and reliability of the Braden Scale. The results show that the validity and reliability of the Braden Scale are higher compared to other measuring instruments, namely the Norton scale and Waterlow scale. The NPUAP also recommends the Braden Scale as the best assessment tool for Pressure Injury risk, which is most effectively used to predict Pressure Injury. [12–15]One of the instruments that has been tested for its validity and reliability is the Braden Scale, but it has not been implemented on smartphones in Indonesia. The role of smartphones can be utilized in various fields. One area

greatly assisted by this technological advancement is in the field of health. [16]

The documentation of nursing care is still manual, so nurses have a significant potential for errors in practice. Nurses require a lot of time to record this nursing care, increasing their workload. This leads to the impact that the documented nursing care is also unsatisfactory; sometimes not all are recorded properly. The emergence of Android-based applications that are increasingly easy to use and access can greatly assist healthcare professionals in improving the quality of service. [17,18]

Communication issues are also a primary concern in healthcare services. Improving Android-based documentation can enhance communication efficiency among nurses. Android-based documentation aids in quickly finding information, thereby assisting in quick decision-making. An example of an Android-based application is the research conducted by Kim et al. (2015), where researchers developed a mobile prototype system named Sappire based on Android to assist nurses in skin assessment and documentation beside the bed. Sappire demonstrated the ability to support data capture based on standards and transfer nursing assessment data bedside while adding decision-support functions. [19] This study aims to develop an Android-based Braden Scale and test the validity of the Android-based Braden Scale in predicting Pressure Injury incidents in stroke patients.

MATERIALS AND METHODS

Location and Research Design

This research was conducted at RSUP DR. Wahidin Sudirohusodo, RS Pelamonia, and RS Labuang Baji in South Sulawesi. This study employed a prospective approach.

Population and Sample

The population in this study consisted of all stroke patients treated at RSUP DR. Wahidin Sudirohusodo, RS Pelamonia, and RS Labuang Baji during the study period. Sampling was done selectively according to the inclusion criteria until the available sample size was sufficient.

Data Collection Method

Data were obtained by conducting interviews related to respondents' demographic data and health status. Pressure injury risk was measured using the paper-based Braden Scale and Android-based Braden Scale on the 2nd and 3rd days of treatment.

Data Analysis

The research results were processed using IBM SPSS Statistics 22 with univariate statistical analysis. Univariate analysis was conducted using descriptive statistics presented in frequency distribution tables to determine the characteristics of the respondents and describe each research variable. This was followed by reliability testing using the Intraclass Correlation Coefficient (ICC) and Spearman Correlation Test.

RESULT

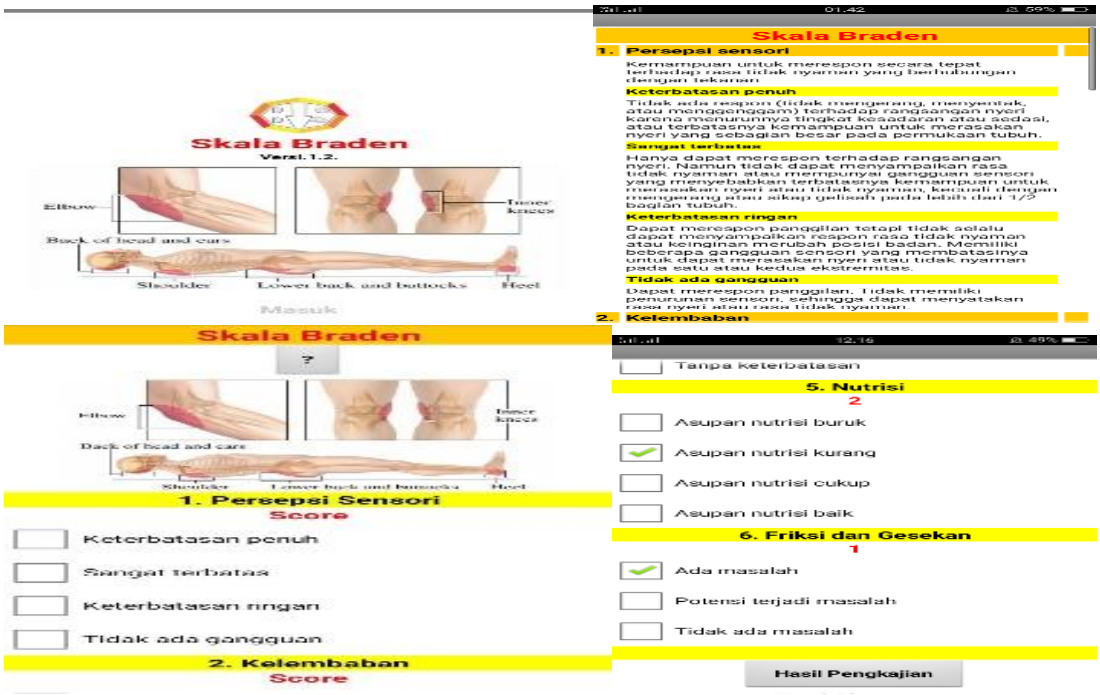

Figure 1: Display of the Android-Based Braden Scale Application

Table 1: Respondent Demographic Analysis

Variable	Total	
	n = 42	%
Age (Years)		
(mean, ± SD)	61,05	±11,54
– Early adulthood (26 – 35 years)	0	0
– Late adulthood (36 – 45 years)	4	9,5
– Early elderly 46 – 55 years)	9	21,5
– Late elderly (56 – 65 years)	13	35,7
– Seniors (>65 years)	33	33,3
Gendere		
– Female	19	45,2
– Male	23	54,8
Education		
– Elementary School	20	47,6
– Junior High School	5	11,9
– High School	9	21,4
– Bachelor's degree	7	16,7
– Master's degree	1	2,4
Tribe		
– Bugis	17	40,5
– Makassar	16	38,1
– Toraja	8	19
– Jawa	1	2,4
Marital status		
– Married	34	81
– Widow	8	19
– Widower	0	0
– Single	0	0
Work		
– Housewife	17	40,5
– Retiree	6	14,3
– Farmer	4	9,5
– Civil Servant (PNS)	7	16,7
– Military	1	2,4
– Unemployed	1	2,4
– Entrepreneur	6	14,3

Based on Table 1, the average age of respondents is 61.05 years with a standard deviation of 11.54 years. Four respondents (9.5%) are in the late adulthood age group (36 – 45 years), 9 respondents (21.5%) are in the early elderly age group (46 – 55 years), 9 respondents (21.5%) are also in the early elderly age group (46 – 55 years), 13 respondents (21.5%) are in the late elderly age group (56 - 65 years), and 33 respondents (33.3%) are seniors (>65 years). A total of 17 respondents (45.2%) are female, and 23 respondents (54.8%) are male. Most respondents have an elementary education, approximately 20 respondents (47.6%), and work as housewives, around 17 respondents (40.5%).

Table 2: Health Status Analysis

Variable	Total	
	n = 42	%
Medical History		
– Diabetes Mellitus	1	2,4
– Hypertension	23	54,8
– Hypertension and Diabetes Mellitus	12	28,6
– Hypertension and Heart Disease	3	7,1
– None	3	7,1
History of Stroke		
– Yes	11	26,2
– None	31	73,8
History of Smoking		
– Yes	22	55,4
– None	20	47,6
Diagnosis		
– HS	12	28,6
– NHS	30	71,4
Systolic		
(mean, ± SD)	159,95	±24,13
– Normal	3	7,1
– Pre Hipertensi	3	7,1
– Hipertensi Stage 1	11	26,2
– Hipertensi Stag 2	25	59,6
Diastolic		
(mean, ± SD)	91,07	±10,09
– Normal	7	16,7
– Pre Hipertensi	0	0
– Hipertensi Stage 1	25	59,5
– Hipertensi Stag 2	10	23,8
Random Blood Sugar		
(mean, ± SD)	149,21	±67,82
– Normal	26	61,9
– Prediabetes	9	21,4
– Diabetes	7	16,7
Hemoglobin		
(mean, ± SD)	13,013	±2,06
– >13	8	19
– 13-17	29	69
– <17	5	12
Hematocrit		
(mean, ± SD)	39,17	±8,26
– >37	12	28,6
– 37-48	26	61,9
– <48	4	9,5
Total Cholesterol		
(mean, ± SD)	193,74	±59,52
– Optimal	26	61,9
– Intermediate	7	16,7
– High	9	21,4

Based on table 2, the majority of respondents have a history of hypertension, around 23 respondents (54.8%). Most respondents have a history of smoking, about 22 respondents (55.4%). The majority of respondents have been diagnosed with NHS, approximately 30 respondents (71.4%). The average systolic blood pressure is about 159.95 with a standard deviation of 24.13, and the average diastolic blood pressure is about 91.07 with a standard deviation of 10.09. The average Random Blood Sugar is 149.21 with a standard deviation of 67.82, the average Hemoglobin is 13.01 with a standard deviation of approximately 2.06, and the average Total Cholesterol is 193.74 with a standard deviation of 59.52.

Table 3 Results of Test-Retest Reliability Analysis for Braden Scale Android

	Braden Scale Android Care on Day 2
Braden Scale Android Care on Day 3	r = 0,909 *p*< 0,001 n = 42

Table 4 Results of Intraclass Correlation Coefficient (ICC) Analysis for Braden Scale Android

	Observer
Expert	r = 0,94 *p*< 0,001 n = 6

In the study, a Test-Retest approach was used with Spearman correlation testing. The research results showed a p-value of < 0.001, indicating that there is a significant correlation between the Braden Scale Android scores on Day 2 of care and the Braden Scale Android scores on Day 3 of care. The Spearman correlation coefficient value of 0.901 indicates a positive correlation with strong correlation strength. The results of the Intraclass Correlation Coefficient (ICC) analysis between the observer and expert for the paper-based Braden scale were 0.94 (95% CI; 0.895 – 0.976), and for the Android-based Braden scale, it was 0.94 (95% CI 0.895 – 0.976).

DISCUSSION

The aim of this study is to test the reliability of the Android-based Braden scale in predicting Pressure Injury risk in stroke patients. In this study, an Intraclass Correlation Coefficient analysis was conducted between the researcher as the observer and the expert. The results of the Intraclass Correlation Coefficient (ICC) analysis between the observer and expert for the paper-based Braden scale were 0.94 (95% CI; 0.895 – 0.976), and for the Android-based Braden scale, it was 0.94 (95% CI 0.895 – 0.976). From this analysis, it can be concluded that there is no difference in perception between the observer and expert regarding the paper-based Braden scale and the Android-based Braden scale.

In this study, a Test-Retest approach was used with Spearman correlation testing. The research results showed a p-value of <0.001, indicating a significant correlation between the Braden Scale Android scores on Day 2 of care and the Braden Scale Android scores on Day 3 of care. The Spearman correlation coefficient value of 0.901 indicates a positive correlation with strong correlation strength. The conclusion of this study is that the Android-based Braden scale is reliable in predicting pressure injury risk in stroke patients.

Researchers found that the Android-based Braden scale developed is user-friendly for nurses. On the initial page, nurses simply click 'login', and the Android-based Braden scale can immediately be used to assess pressure injury risk. This Android-based Braden scale can be used offline, providing accessibility anywhere and anytime, thus offering convenience to users.

One of the biggest advantages of using Android-based applications on smartphones is easy and fast access. One health-related application developed by Husain et al., 2010, regarding a Medical Calculator, is very helpful as it includes various medical algorithms commonly used by nurses. The medical algorithms in the application include BMI calculations, the nurse's wheel, OB wheel, Braden scale, glomerular filtration rate, creatinine clearance, pediatric dose calculations, and more. The MedCalc medical calculator app is popular and available for free on Palm Window Mobile, iPhone, and is also available on Google OS for Android. [20] Another finding similar to this study is the development of an Android-based scale to detect pressure injury risk, as shown in a study conducted by Grey et al., aimed at validating the Pressure Ulcer Risk Scale (PURS) in detecting pressure injury risk in acute hospitals. The research results indicated that the Pressure Ulcer Risk Scale (PURS) has a sensitivity of 72.9% and a specificity of 71.3%. The conclusion of the study stated that PURS

demonstrates strong capability in detecting pressure injury risk in medical, surgical, and general orthopedic acute care settings, comparable to other measures. Streamlining the assessment burden without losing completeness can be achieved by integrating the risk scale into the existing assessment system. [21]

Unlike the study conducted by Hayn et al., who developed an application called the eHealth System, where the system aims for pressure injury risk assessment based on the advantages of accelerometers and pressure sensors for monitoring pressure injury risk factors. The sensor data is then sent to a tablet where it is analyzed and presented graphically. The results of the study showed a weak correlation between the eHealth system and the paper-based Braden scale in predicting pressure injury risk (correlation factor = 0.31). [22]

Another study that developed an Android-based application is the research conducted by Kim (2016), who developed an Android-based application aimed at detecting pressure injury risk. The study was conducted as a pilot study. The results of the study stated that the developed Android-based application was able to detect pressure injury risk. This application also provides lightweight decision support functions to display the collected assessment data that aligns with the Braden scale parameters. [23].

Another finding from a study conducted by Pedro (2011) developed a Mobile Health platform for pressure ulcer monitoring. From the trial interaction of the application and registration data, positive results were obtained in speeding up access to essential information, making work easier and better, ensuring the safety of crucial information, and making data records more credible. The recommended application can assist nursing work. The usefulness of the Mobile Health platform for pressure ulcer monitoring can expedite decision-making and reduce the issues encountered when using paper-based methods. [24]

Mobile applications are increasingly being used to support work in the nursing world. One of the mobile applications that can be utilized is the application developed by Rodrigues et al., 2013, which developed mULCER to support initiatives for interventions against patients at potential risk of pressure injury. [25]

The Android-based Braden scale application still needs improvement to be integrated into the digital assessments used in hospitals. Although the research results indicate that the Android-based Braden scale is reliable in predicting pressure injury risk, researchers hope that further research can be conducted with a larger sample size. Additionally, in further development, researchers hope that the Android-based Braden scale application can be uploaded to the Play Store or Google Store so that it can be used by the public, ultimately reducing the prevalence of pressure injuries in at-risk patients, especially stroke patients. The Android-based Braden scale can be developed to be compatible with platforms other than Android, such as iOS, Windows Phone, or BlackBerry OS.

Another potential issue that may arise in developing this Android application is that there is no guarantee the application will run smoothly on every device. While the application you create may run smoothly on a Samsung device, it may not function properly when installed on a different device like Xperia or a different type of Android device.

CONCLUSION AND RECOMMENDATIONS

The Android-based Braden scale is reliable in predicting pressure injury risk in stroke patients. From the Intraclass Correlation Coefficient (ICC) analysis, it can be concluded that there is no difference in perception between the observer and expert regarding the paper-based Braden scale and the Android-based Braden scale. Further research is hoped to evaluate and refine the Android-based Braden scale so that it can be integrated into the digital assessment format used in hospitals.

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