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### Validity and reliability test for assessing the bleeding factor in breast cancer wounds

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#### Abstract

**Background:** Breast cancer is the cancer with the highest incidence in women in the world. In Indonesia, breast cancer also ranks first in terms of number and cause of death. Bleeding is a common complication of advanced breast cancer. Identification of bleeding factors in breast cancer wounds is very important. Research instruments are needed to analyze various factors related to bleeding and their indicators

**Purpose:** To determine the validity and reliability of the construct of factors related to bleeding in breast cancer wounds and their indicators.

**Method:** A cross-sectional approach, specifically focusing on observational study. The study took place from January to May 2024, in Dr. Soedraso Hospital Pontianak. The independent variable was factors affecting breast cancer wound bleeding the dependent variables is assessment of breast cancer wound bleeding. Using purposive sampling and the Slovin formula, 60 respondents were selected. The validity and reliability tests in this study were conducted using the outer model evaluation in SEM-PLS with SmartPLS 4.0. Validity was assessed through convergent validity using the AVE value and discriminant validity with the Fornell-Larcker criterion. Reliability was evaluated based on outer loading values and composite reliability (Rho-C) to measure internal consistency.

**Results:** the outer loading value, composite reliability (Rho-C), and average variance extracted (AVE) have met the validity and reliability test standards. The outer loading value of the indicators ranged from 0.628 to 1.000, with the highest value in the indicators of cancer stage, leukocytes, nutritional status (MNA), and bleeding at 1.000. Composite reliability for the variables of wound classification, dressing use and wound care, chemotherapy, therapy, and haematology ranged from 0.776 to 0.903, while the variables of cancer stage, infection, nutritional status, and bleeding each amounted to 1.000. AVE values ranged from 0.599 to 0.822, with the highest value of 1.000 for the variables of cancer stage, infection, nutritional status, and bleeding.

**Conclusion:** This research conducted validity and reliability tests using the measurement model (outer model) evaluation in SEM-PLS. The assessment included outer loading, composite reliability (Rho-C), AVE, and the Fornell-Larcker criteria. The results confirmed that the research instrument was valid and reliable, making it suitable for analyzing bleeding factors in breast cancer wounds.

**Keywords:** Assessment; Breast Cancer; Reliability; Validity; Wounds Bleeding.

## INTRODUCTION

The incidence of cancer in women globally places breast cancer in the first place, followed by colorectal cancer, lung cancer, uterine cervical cancer, and thyroid cancer. Based on data from the International Agency for Research on Cancer in 2020, breast cancer is the highest incidence of cancer in women in the world with an incidence of 2.261.419 or 24.5% of total cancer incidence, and ranks fourth among the causes of cancer-related deaths in the world, namely 684.996 (6.9%). Indonesia, 396.914 new cases of cancer were found, with the largest number of new cases of breast cancer being 65.858. Breast cancer is also the first cause of death in women in Indonesia with a death rate of 22.430 people (Sari, Haryanto, & Hastuti, 2024).

Based on Medical Records data from dr. Soedarso Hospital Pontianak, the number of breast cancer cases in 2020 was 234 cases, in 2021 there were 281 cases, and there was an increase of almost 90% in 2022, namely 424 cases. In 2022, breast cancer will be the first of the top 10 cancer-related diseases with a total of 4946 visits (calculated from the ER, inpatient, and outpatient care).

Breast cancer is a malignant tumor that develops in breast tissue and can spread to other body organs. It is often detected at a late stage and has a poor prognosis. In practice, the author often finds breast cancer patients with wet wounds, exudate, masses or nodules, necrotic tissue, slough, and bleeding. Bleeding is a condition where blood comes out from damaged blood vessels. Bleeding is a common complication that often occurs in advanced cancer patients (Toesca, Peradze, Manconi, Galimberti, Intra, Colleoni, & Veronesi, 2017). Bleeding in breast cancer wounds can be caused by several factors, including tumor invasion into blood vessels, fragile and necrotic tissue, infection, and the effects of cancer treatments such as chemotherapy or radiation therapy. Tumor-related bleeding is often exacerbated by poor wound healing and the presence of exudates, which can further contribute to infection and tissue breakdown (Kurniawan, 2013).

The management of bleeding in breast cancer wounds requires a comprehensive approach, including proper wound care, selection of appropriate dressings, infection control, and supportive therapies. Haemostatic agents, such as alginate dressings or tranexamic acid, are often used to control bleeding,

while pain management and nutritional support play a crucial role in improving the patient's overall condition. Assessing the risk factors for bleeding in breast cancer wounds is essential for optimizing treatment strategies (Suparna, & Sari, 2022). Factors such as wound classification, cancer stage, chemotherapy, infection status, haematological parameters (albumin, haemoglobin, haematocrit, and platelets), and nutritional status must be considered to develop an effective intervention plan. Through systematic evaluation and proper management, the quality of life of breast cancer patients with bleeding wounds can be improved, minimizing complications and enhancing overall patient care (Loeffler, 2017).

Breast cancer can have an impact on the patient's poor quality of life, namely on physical health and social relationships. Apart from that, a complication that often arises in breast cancer is bleeding. If bleeding is not treated properly and correctly it will have an impact on further complications such as anemia (Agustiyaningsih, Rohyadi, & Tursini, 2021). Furthermore, with integrating medical, nutritional, and psychological interventions, healthcare providers can improve symptom management, enhance wound healing, and ultimately improve the overall well-being and quality of life of breast cancer patients dealing with wound-related bleeding (Nwaogu, Bommarito, Olsen, & Margenthaler, 2015).

Based on several previous studies, various factors were found that influence the occurrence of bleeding in breast cancer. Bleeding is significantly higher in malignant fungating wounds. Patients with bleeding skin lesions can use a non-adherent dressing. Bleeding in wounds can be treated with topical agents such as absorbable collagen, use of calcium alginate and epinephrine, and use of pressure dressings (Bell, & Mirring, 2019). Bleeding in cancer patients is still a problem that often occurs, especially in advanced stages of cancer. Giving high doses of chemotherapy such as cyclophosphamide can cause bleeding at an advanced stage (McLaughlin, Staley, Vicini, Thiruchelvam, Hutchison, Mendez, & Feldman, 2017).

In terms of wound care factors, there is research that states that wound care has an effect on clinical appearance and reduces exudate production and bleeding. The factors of radiation therapy and chemotherapy with bleeding conditions are worsened by immunotherapy, non-steroidal anti-inflammatory

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drugs (NSAIDs), pain relievers, and anticoagulants (Dharma, & Fitarsih, 2023). Several factors associated with bleeding in breast cancer wounds include chemotherapy, radiation, comorbidities, malignant fungating wound, BMI $\geq$ 40, use of dressings, thrombocytopenia, cancer with advanced stages, use of several therapies (anticoagulants, anti-inflammatory pain relievers, NSAIDs) and infections (Otsby, Armer, Dale, Van Loo, Wilbanks, & Stewart, 2014). Bleeding in breast cancer has an impact on quality of life, psychology, cause feelings of anxiety in patients, experience limitations in activities, and even feelings of threat of death, anemia, increased days of care, and economic burden (Hair, Risher, Sarstedt, & Ringle, 2019).

## RESEARCH METHOD

A cross-sectional approach, specifically focusing on observational study. The study took place from January to May 2024, in Dr. Soedraso Hospital Pontianak. The independent variable was factors affecting breast cancer wound bleeding the dependent variables is assessment of breast cancer wound bleeding. Using purposive sampling and the Slovin formula, 60 respondents were selected, who met specific inclusion and exclusion criteria.

The inclusion criteria required patients with a diagnosis of breast cancer at any stage, patients with breast cancer injury with signs of bleeding, age  $\geq$ 18 years, patients undergoing cancer wound treatment at the hospital. While exclusion criteria involved patients with a history of blood coagulation disorders, patients on long-term anticoagulants, breast cancer wounds that have undergone complete necrosis without signs of bleeding.

The research instrument used was a bleeding factor assessment sheet in breast cancer wounds. The assessment of bleeding factors in breast cancer wounds was completed in the form of a checklist sheet, in the sections assessing wound classification, wound care and dressing use, chemotherapy, infection, and haematology factors, in the factors of therapy received by the patient (anticoagulants, NSAID pain relievers, anti-cancer immunosuppressants) and cancer stage. Nutritional status was assessed using the MNA-SF (Mini Nutritional Assessment-Short Form) assessment format. Bleeding of the cancer wound was assessed for low, moderate, or high grade bleeding.

The validity and reliability tests in this study were carried out using the measurement model evaluation (outer model) in Structural Equation Modeling-Partial Least Square (SEM-PLS) with the SmartPLS 4.0 application. The validity test includes convergent validity which is assessed through the Average Variance Extracted (AVE) value. The validity of the discriminant is evaluated using the Fornell-Larcker criterion. Reliability test is carried out by paying attention to the outer loading value on each indicator. Rho-c value (Composite Reliability) to measure the internal consistency of the concept.

The researcher has fulfilled the ethical permit requirements from ITEKES Muhammadiyah West Kalimantan with the number: 25/II.I.AU/KET.ETIK/II/2024 and ethical approval from the Research Ethics Committee of Dr. Soedarso Pontianak Hospital with the number: 10/RSUD/KEPKI/II/2024 and has received permission to conduct research at Dr. Soedarso Hospital with the number: 000.9/02408/RSUD.

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**RESEARCH RESULTS****Table 1. Namely Variables and Indicators studies**

| Variable             |                             | Indicator |                                   |
|----------------------|-----------------------------|-----------|-----------------------------------|
| Independent Variable |                             |           |                                   |
| X1                   | Wound Classification        | X1.1      | Type of injury                    |
|                      |                             | X1.2      | Long Wound                        |
|                      |                             | X1.3      | Degree of injury                  |
| X2                   | Dressing and Wound Care     | X2.1      | Dressing used                     |
|                      |                             | X2.2      | Wound care SOP                    |
| X3                   | Cancer Stage                | X3.1      | Cancer stage                      |
| X4                   | Chemotherapy                | X4.1      | Frequency of chemotherapy         |
|                      |                             | X4.2      | Long diagnosis                    |
| X5                   | Therapy                     | X5.1      | Types of therapy                  |
|                      |                             | X5.2      | Duration of consumption           |
| X6                   | Haematology                 | X6.1      | Albumin                           |
|                      |                             | X6.2      | Haemoglobin                       |
|                      |                             | X6.3      | Haematocrit                       |
|                      |                             | X6.4      | Trombosit                         |
| X7                   | Infection                   | X7.1      | Leukocytes                        |
| X8                   | Nutritional Status          | X8.1      | Mini nutritional Assessment (MNA) |
| Dependent Variable   |                             |           |                                   |
| Y                    | Bleeding from cancer wounds | Y1        | Bleeding                          |

The table above shows the independent and dependent variables in the study of factors affecting bleeding in breast cancer wounds. The independent variables include wound classification, wound care, cancer stage, chemotherapy, therapy, hematology, infection, and nutritional status, each with specific indicators. The dependent variable was cancer wound bleeding. This study evaluated the influence of various clinical factors, therapies, and patient status on bleeding risk.

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**Table 2. Characteristic of Respondent (N=60)**

| <b>Variable</b>                   | <b>Results</b>        |
|-----------------------------------|-----------------------|
| <b>Age (n/%)</b>                  |                       |
| <b>Age (Mean±SD)(Range)(Year)</b> | (49.15±10.910)(21-77) |
| 21-39                             | 10/16.7               |
| 40-58                             | 44/73.3               |
| 59-77                             | 6/10.0                |
| <b>Religion (n/%)</b>             |                       |
| Budha                             | 1/1.7                 |
| Islam                             | 47/78.3               |
| Katholik                          | 8/13.3                |
| Kristen                           | 4/6.7                 |
| <b>Ethnicity (n/%)</b>            |                       |
| Batak                             | 1/1.7                 |
| Bugis                             | 2/3.3                 |
| Dayak                             | 9/15.0                |
| Jawa                              | 6/10.0                |
| Madura                            | 6/10.0                |
| Melayu                            | 33/55.0               |
| Tionghoa                          | 3/5.0                 |
| <b>Marital Status (n/%)</b>       |                       |
| Single                            | 1/1.7                 |
| Married                           | 49/81.7               |
| Widowed                           | 10/16.6               |
| <b>Place (n/%)</b>                |                       |
| Pontianak                         | 17/28.3               |
| Beyond Pontianak                  | 43/71.7               |
| <b>Employment (n/%)</b>           |                       |
| Civil servant/teacher             | 3/5.0                 |
| Self employed                     | 7/11.7                |
| Business                          | 1/1.6                 |
| Unemployed                        | 49/81.7               |
| <b>Education (n/%)</b>            |                       |
| Elementary School                 | 20/33.3               |
| Junior High School                | 13/21.7               |
| Senior High School                | 20/33.3               |
| Bachelor                          | 3/5.0                 |
| Out of School                     | 4/6.7                 |

Table 1. Shows characteristics of respondent with a mean age and standard deviation (49.15±10.910) ranging from 21-77 years, the majority were 47 (78.3%) Muslims and 33 (55%) were of Malay ethnicity. Almost all respondents were married 49 (81.7%) and lived outside Pontianak City with 43 (71.7%). Most of the respondents did unemployed as many as 49 (81.7%) and completed their education at elementary school and high school level by 20 (33.3%).

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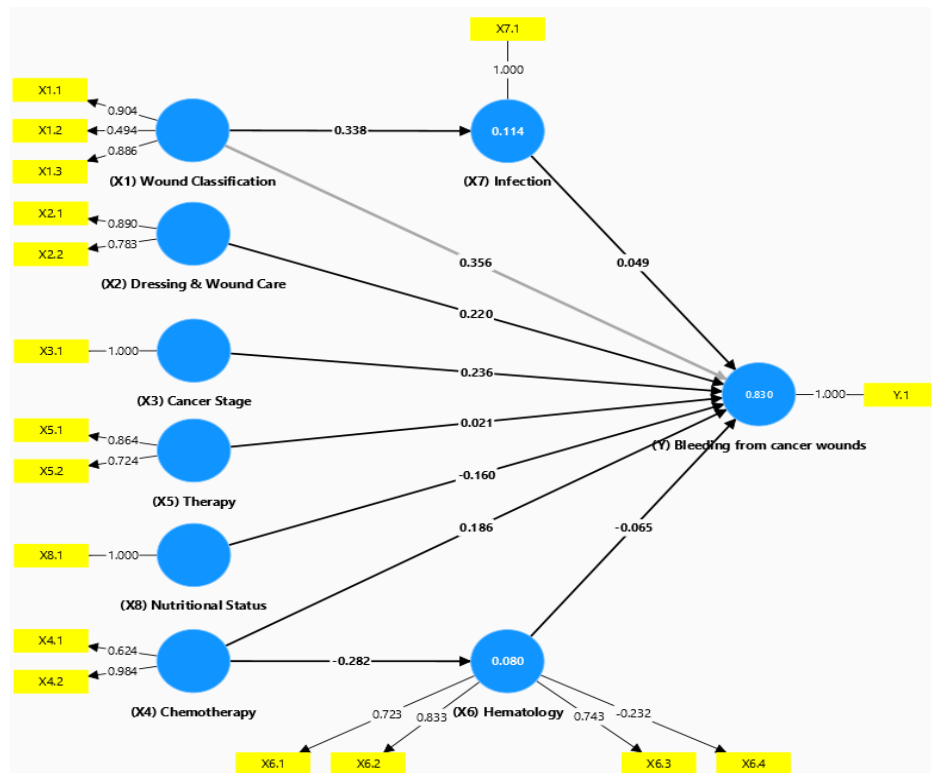


Figure 1. Evaluation Model Measurement Model

Table 2. Reliability Indicator Values (Outer Loading), Internal Reliability Consistency (Composite Reliability (Rho-C) and Convergent Validity (Average Variance Extracted -AVE)

| Variable                | Indicator                      | Outer Loading | Composite Reliability (Rho-C) | Average Variance Extracted (AVE) |
|-------------------------|--------------------------------|---------------|-------------------------------|----------------------------------|
| Wound Classification    | X1.1 Type of injury            | 0.904         | 0.819                         | 0.615                            |
|                         | X1.2 Long wound                | 0.494*        |                               |                                  |
|                         | X1.3 Degree of injury          | 0.886         |                               |                                  |
| Dressing and wound care | X2.1 Dressing used             | 0.890         | 0.825                         | 0.702                            |
|                         | X2.2 Wound care SOP            | 0.783         |                               |                                  |
| Cancer Stage            | X3.1 Cancer Stage              | 1.000         | 1                             | 1                                |
| Chemotherapy            | X4.1 Frequency of chemotherapy | 0.624*        | 0.801                         | 0.679                            |
|                         | X4.2 Long Diagnosis            | 0.984         |                               |                                  |
| Therapy                 | X5.1 Types of therapy          | 0.864         | 0.776                         | 0.636                            |
|                         | X5.2 Duration of consumption   | 0.724         |                               |                                  |
| Haematology             | X6.1 Albumin                   | 0.723         | 0.662*                        | 0.455**                          |
|                         | X6.2 Haemoglobin               | 0.833         |                               |                                  |
|                         | X6.3 Haematocrit               | 0.743         |                               |                                  |
|                         | X6.4 Trombosit                 | -0.232*       |                               |                                  |
| Infection               | X7.1 Leukocytes                | 1.000         | 1                             | 1                                |
| Nutritional Status      | X8.1 MNA                       | 1.000         | 1                             | 1                                |
| Bleeding                | Y.1 Bleeding                   | 1.000         | 1                             | 1                                |

Information: \* = unreliable

\*\*= invalid

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Table 4. Shows three indicators had outer loading values below 0.7: X1.2 (length of the wound) at 0.494, X4.1 (frequency of chemotherapy) at 0.624, and X6.4 (platelets) at -0.232. The haematology variable also had a composite reliability (Rho-C) of 0.662 (below 0.7) and an AVE of 0.455 (below 0.5). To improve model reliability and validity, indicators X1.2 and X6.4 were removed.

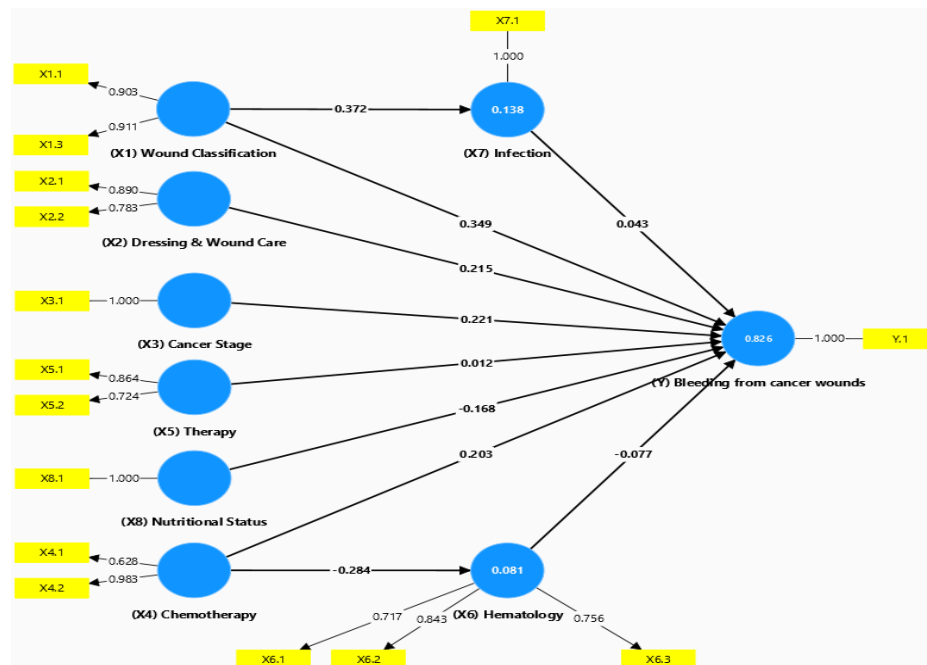


Figure 2. 2nd Stage Measurement Model Evaluation Model

Table 3. Reliability Indicator Values (Outer Loading), Internal Reliability Consistency (Composite Reliability (Rho-C) and Convergent Validity (Average Variance Extracted -AVE) 2nd Stage

| Variable                | Indicator                      | Outer Loading | Composite Reliability (Rho-C) | Average Variance Extracted (AVE) |
|-------------------------|--------------------------------|---------------|-------------------------------|----------------------------------|
| Wound Classification    | X1.1 Type of injury            | 0.903         | 0.903                         | 0.822                            |
|                         | X1.3 Degree of injury          | 0.911         |                               |                                  |
| Dressing and wound care | X2.1 Dressing used             | 0.890         | 0.825                         | 0.702                            |
|                         | X2.2 Wound care SOP            | 0.783         |                               |                                  |
| Cancer Stage            | X3.1 Cancer stage              | 1             | 1                             | 1                                |
| Chemotherapy            | X4.1 Frequency of chemotherapy | 0.628         | 0.803                         | 0.681                            |
|                         | X4.2 Long Diagnosis            | 0.983         |                               |                                  |
| Therapy                 | X5.1 Types of therapy          | 0.864         | 0.776                         | 0.636                            |
|                         | X5.2 Duration of consumption   | 0.724         |                               |                                  |
| Haematology             | X6.1 Albumin                   | 0.717         | 0.817                         | 0.599                            |
|                         | X6.2 Haemoglobin               | 0.843         |                               |                                  |
|                         | X6.3 Haematocrit               | 0.756         |                               |                                  |
| Infection               | X7.1 Leukocytes                | 1             | 1                             | 1                                |
| Nutritional Status      | X8.1 MNA                       | 1             | 1                             | 1                                |
| Bleeding                | Y.1 Bleeding                   | 1             | 1                             | 1                                |

Information: \* = unreliable

\*\*= invalid

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Based on the table above, the outer loading value, composite reliability (Rho-C), and average variance extracted (AVE) have met the validity and reliability test standards. The outer loading value of the indicators ranged from 0.628 to 1.000, with the highest value in the indicators of cancer stage, leukocytes, nutritional status (MNA), and bleeding at 1.000. Composite reliability for the variables of wound classification, dressing use and wound care, chemotherapy, therapy, and haematology ranged from 0.776 to 0.903, while the variables of cancer stage, infection, nutritional status, and bleeding each amounted to 1.000. AVE values ranged from 0.599 to 0.822, with the highest value of 1.000 for the variables of cancer stage, infection, nutritional status, and bleeding. These results indicate that the measurement model has met the validity and reliability requirements.

**Table 4. Discriminant Validity Based on the Fornell-Larcker Criteria**

|    | X1           | X2           | X3           | X4           | X5           | X6           | X7           | X8           | Y            |
|----|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| X1 | <b>0.907</b> |              |              |              |              |              |              |              |              |
| X2 | 0.664        | <b>0.838</b> |              |              |              |              |              |              |              |
| X3 | 0.424        | 0.582        | <b>1.000</b> |              |              |              |              |              |              |
| X4 | 0.496        | 0.611        | 0.592        | <b>0.825</b> |              |              |              |              |              |
| X5 | -0.043       | 0.020        | 0.245        | 0.370        | <b>0.797</b> |              |              |              |              |
| X6 | -0.293       | -0.304       | -0.428       | -0.284       | -0.009       | <b>0.774</b> |              |              |              |
| X7 | 0.372        | 0.388        | 0.328        | -0.001       | -0.114       | -0.144       | <b>1.000</b> |              |              |
| X8 | -0.150       | -0.193       | -0.218       | -0.049       | -0.189       | 0.099        | -0.221       | <b>1.000</b> |              |
| Y  | 0.749        | 0.772        | 0.701        | 0.673        | 0.158        | -0.420       | 0.375        | -0.339       | <b>1.000</b> |

Based on the matrix in Table 4, the root AVE value for variable X1 on X1 is 0.907, which is greater than the correlation of construct X1 with other latent variables, namely X1-X2 of 0.664, X1-X3 of 0.424, X1-X4 of 0.496, X1-X5 of -0.043, X1-X6 of -0.293, X1-X7 of 0.372, X1-X8 of -0.150, and X1-Y of 0.749, and similar results are also seen in other variables.

## DISCUSSION

In this study, an observation sheet was used as an assessment instrument called Breast Cancer Wound Bleeding Factor Assessment (BCW-BFA) to measure factors related to bleeding in breast cancer wounds. The Breast Cancer Wound Bleeding Factor Assessment (BCW-BFA) observation sheet comprises respondent demographic data and bleeding factor variables. The assessment of variables along with indicators of factors related to bleeding consists of wound classification factors with indicators of type of wound and degree of wound, use of dressings and wound care with indicators of dressings used and wound care SOPs, cancer stage with a single indicator, namely cancer stage, chemotherapy. With indicators of frequency of chemotherapy and duration of diagnosis, administration of therapy with indicators of the type of therapy and duration of consumption, and haematological factors with indicators of albumin, haemoglobin, and haematocrit. The infection factor with a single indicator is leukocytes and the nutritional

status factor is with the Mini Nutritional Assessment (MNA) indicator. Validity and reliability tests must be carried out so that the Breast Cancer Wound Bleeding Factor Assessment (BCW-BFA) assessment sheet can be used as a measuring tool in research (Hair, Hult, Ringle, Sarstedt, Danks, Ray, & Ray, 2021).

Validity tests are carried out to ensure that the observation sheet can measure what is measured precisely and accurately. In this research, the validity test was carried out using Convergent Validity by looking at the average variance extracted (AVE) value, and Discriminant Validity using the Fornell-Larcker criteria. Reliability testing is carried out to ensure that the observation sheet can produce consistent data even though it is used in different situations and places. In this research, reliability testing was carried out by looking at reliability indicators, namely the outer loading value, and internal reliability consistency through composite reliability (Rho-C). Researchers use composite reliability Rho-c because in this study the data is on a

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different scale. Rho-a composite reliability is used for data with the same scale, and Rho-c composite reliability for data with different scales (Ringle, Wende, & Becker, 2015).

In this study, validity and reliability tests were carried out twice in the measurement process because in the initial measurement 3 indicators had an outer loading value of less than 0.7, namely X1.2 (length of the wound) with a value of 0.494, X4. 1 (frequency of chemotherapy) with a value of 0.624 and X6.4 (thrombocytes) with a value of -0.232. In the haematology variable, the composite reliability (Rho-C) value is still below 0.7 and the AVE value is still below 0.5. To improve the reliability and validity of the model, indicators X1.2 and indicators X6.4 is removed from the model so that it can increase the outer loading value of other indicators, increase the composite reliability and AVE values so that they meet the validity and reliability requirements. Even though the outer loading value on the X4.1 indicator is still below 0.7, it is still maintained in the model because the X4 variable (chemotherapy) has a composite reliability value above 0.7 and an AVE value above 0.5. According to Hair et. al. (2022), an outer loading value of 0.4 to 0.7 can still be considered, removing it from the model can be done if it will increase the composite reliability and AVE values above a predetermined threshold. Indicators with weaker outer loadings can be retained based on their contribution to content validity. Outer loading values between 0.5 – 0.6 can be considered sufficient to meet the requirements (Johnstone, & Rich, 2018).

After removing indicator X1.2 and indicator X6.4 from the model, then the test was carried out again on the remaining indicators with the model as in Figure 2 and the reliability and validity values as in Table 5. The results obtained after retesting showed that the outer loading value for all indicators had exceeded 0.7 except for indicator X4.1 (frequency of chemotherapy) with an outer loading value of 0.628. All variables have a composite reliability value above 0.7 and an AVE value above 0.5. There are two methods of testing the internal reliability of constructs, namely Cronbach's alpha and composite reliability. This research uses composite reliability because it calculates the actual reliability value of the variable. In indicators X3.1 (Cancer Stage), X7.1 (Leukocytes), X8.1 (MNA), and Y1 (Bleeding) the outer loading value is 1 (one), this is because this indicator is a single indicator.

Variables with a single indicator can cause identification and convergence problems in covariance-based SEM, but this is not a problem in variance-based SEM-PLS (Nicrodeme, Dureau, Cheron, Kriegel, Trendchand, Bauer, & Fromantin, 2021).

Discriminant Validity is established to ensure the uniqueness of the constructs in the research. This shows that the constructs (variables) in the research have their own identities and are not too correlated with other constructs in the research. In testing the Fornell-Larcker criteria, discriminant validity can be said to be good if the root of the AVE in the construct is higher than the correlation of the construct with other latent variables. From the matrix in Table (discriminant validity based on the Fornell-Larcker criteria), it can be seen that the AVE root X1-X1 is greater than X1-X2, X1-X3, X1-X4, X1-X5, X1-6, X1-X7. X1-X8 and X1-Y, as well as the others. Thus, all indicators and constructs in the model have met validity and reliability standards. Based on the results of the above analysis, it can be concluded that all constructs in the research model have met the criteria of discriminant validity, convergent validity, and reliability. In addition, the structural model has also met the evaluation criteria with significant  $R^2$  and path coefficient values. Thus, this research model can be considered suitable for use in hypothesis testing and further analysis (Ferlay, Ervik, Lam, Colombet, Mery, Pineros, & Bray, 2020).

Based on the measurement model evaluation carried out, the validity and reliability of variables and indicators related to bleeding were declared valid and reliable, and it can be said that all indicators can reflect the construct variables. The resulting assessment sheet is declared valid and reliable so that it can be relied on for accurate and reliable data collection because it meets the value standards and assessment rules (Tilley, Lipson, & Ramos, 2016).

## CONCLUSION

This research conducted validity and reliability tests using the measurement model (outer model) evaluation in SEM-PLS. The assessment included outer loading, composite reliability (Rho-C), AVE, and the Fornell-Larcker criteria. The results confirmed that the research instrument was valid and reliable, making it suitable for analyzing bleeding factors in breast cancer wounds.

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