

## Design of BWAT method development in diabetic foot ulcers patients in hospital: Action research

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### Abstract

Diabetic foot ulcers (DFU) are one of the complications of diabetes that has a serious impact and requires high treatment costs. However, they can be prevented early through a series of assessments. The most recommended initial assessment method to determine the risk of complications is the BWAT Method. However, nurses' BWAT method is still considered too long and complicated. In addition, the hospital also has a different handling program from the BWAT method, so it is necessary to develop the BWAT method and adjust this method to the SOP, which is expected to be more easily applied by nurses. This study aims to design the development of the Bates-Jensen Wound Assessment Tools (BWAT) method for DFU patients with the development of Hospital SOPs. The research method is qualitative action research, while data collection uses focus group discussion (FGD) on 10 participants determined through purposive sampling techniques, with minimum nurse criteria and a minimum length of work of 5 years. Data analysis using the Collaizi model expert judgment was given to three speakers to design SOPs for the BWAT method of wound assessment. The study results obtained four themes related to wound assessment in DFU patients and a draft SOP for wound assessment by developing the BWAT method for DFU patients who received treatment at the hospital. The SOP development trial found that with the same flow but with shorter language, the SOP is easier to understand and easier for nurses to implement; however, improvements are still needed from this SOP, namely in the form of additional evaluation items in the SOP that are expected to be used to improve communication between health care providers to facilitate the process of providing sustainable nursing services.

**Keywords:** BWAT; diabetic foot ulcers; diabetes mellitus; wound assesment

### 1. Introduction

Diabetes mellitus is a public health problem that has a major impact on sufferers and, of course, the health financing system (Khan et al., 2020). In 2021, there will be an estimated 536.6 million diabetics worldwide, and by 2045, it is estimated that the prevalence will increase by 12.2% to 783.2 million (Sun et al., 2022). In Indonesia, an estimated 19.4 million people are living with diabetes, which is expected to increase to 23.3 million by 2030 and 28.5 million by 2045 (IDF, 2021). One of the most common complications of DM that has a serious impact and requires high medical costs is diabetic foot ulcer (DFU) (Lin et al., 2020). The prevalence of DFU worldwide reaches 6.3% (Zhang et al., 2017). This prevalence is lower than DFU in Indonesia, which reaches 12% (Yusuf et al., 2016). The recurrence rate of DFU is also quite high. Some results of previous prospective cohort studies showed that DFU patients who relapsed within one year, three years, and five years after recovery reached 22%–44% and 60%–65%, respectively (Armstrong et al., 2017; Hicks et al., 2020; Petersen et al., 2020). DFU is associated with decreased quality of life (Alosaimi et al., 2019; Perrin et al., 2022), increased morbidity and mortality (Jupiter et al., 2016; Schaper et al., 2016), and increased service burden and health financing burden (Lo et al., 2021; Raghav et al., 2018).

Regarding DFU morbidity, Pemayun and Naibaho (2017) found that the number of lower-extremity amputation cases in Indonesia reached 36.3%, with 24% being major amputations and 7% being multiple amputations. This number is higher when compared to the number of amputations in several countries, such as Ethiopia (30.43%) (Bekele & Chelkeba, 2020), Australia (34.1%) (Rodrigues et al.,

2016), and Germany (31.9%) (Malyar et al., 2016). The risk of death in DFU sufferers increased 2.5-fold compared to those who did not suffer from DFU (Walsh et al., 2016), with mortality reaching 5% within the first year after DFU diagnosis and 40–42% mortality within five years (Jupiter et al., 2016; Walsh et al., 2016).

Indonesia faces a daunting task in managing the prevalence of DFU. In order to achieve optimal cure of complications, a nursing care management strategy is needed through an appropriate and effective approach. This approach requires proper monitoring of wound progress through wound assessment tools (Jais & Pratama, 2023). This assessment tool was used to evaluate the effectiveness of treatments (Jørgensen et al., 2016). Nursing care that is very urgent in carrying out DFU prevention is the availability of accurate tools and methods of wound assessment that nurses can use when conducting initial assessments and monitoring the wound healing process. Improper assessment can cause wound healing to be delayed, cause discomfort in the form of pain, increase the risk of infection, and decrease the quality of life for patients (Yani, 2017). Methods of wound assessment are also expected to detect even the slightest changes in wound size, providing appropriate information to guide and inform treatment strategies. In addition, the assessment method should also be able to assess the size, depth, presentation, and location of the wound, which will help underlie the selection and development of therapies and monitor various patient responses to intervention (Sukmana et al., 2020). In addition to using assessment methods, wound evaluation tools are recommended to improve communication between healthcare providers (Bates-Jensen et al., 2019). Lack of communication is an obstacle to optimal wound care management in hospitals (Walker et al., 2019).

One of the wound assessment measuring tools often used is the Bates-Jensen Wound Assessment Tool (BWAT). BWAT is a wound evaluation tool consisting of 13 unique characteristic parameters of wounds. Specific parameter definitions are described for each parameter. Nine parameters were scored on a scale of 1–5 (a score of 1 indicates the healthiest, while a score of 5 indicates the least healthy attribute), and the other four parameters were rated on a scale of 0–5, in scores on the characteristics that have healed (0 = none). The scores of 13 characteristics are added for a total score of 9–65. A score of 9 and a score of 65 indicate minimal tissue damage and severe tissue degeneration, respectively (Bates-Jensen et al., 2019). BWAT is used to evaluate wound progression comprehensively. Evaluation of wounds using BWAT can be objectively measured, so it is estimated that the information obtained from the patient being evaluated will help determine the factors that influence it. BWAT can also guide patient care planning and positively impact treatment outcomes (Karahan et al., 2018).

However, using BWAT in some hospitals has not been widely practiced. In addition, there are different SOPs in each hospital related to wound assessment, so further studies are needed to find out the form of permanent procedures that have been carried out and how wound assessments have been carried out, and then design the SOPs by adjusting and developing the BWAT Model. It was done to make it easier for nurses to care for diabetic foot ulcer patients. This study aims to design the development of the Bates-Jensen Wound Assessment Tools (BWAT) method for DFU patients with the development of hospital SOPs. SOPs have been tested on nurses in hospitals. The trial of SOP development found that with the same flow but a shorter language, SOPs are easier to understand and easier for nurses to implement. However, improvements are still needed from this SOP, namely the use of additional wound evaluation tools to improve communication between healthcare providers to facilitate continuous nursing service delivery.

## 2. Research Methods

This research is qualitative with an action research approach at one of the private hospitals in Kudus, Central Java. Qualitative research design is research to understand the phenomenon of what is experienced by research subjects holistically in the form of language, scientific words (Blacius dedi,

2021). Purposive sampling techniques were used to select participants, with the criteria of having worked in a room treating diabetic foot ulcers for at least five years and having a nursing education. Data were collected in two stages: a focus group discussion (FGD) with 10 participants and expert consultation. The FGD was conducted for 60 minutes, divided into two sessions: the first session with 5 participants, namely P1–P5, and the second session with 5 participants, namely P6–P10, with 30 minutes each. The FGD process begins with the participants' informed consent, followed by the discussion process. This FGD aims to identify and obtain needs about the permanent procedure for reviewing patient data by nurses by providing four themes using the same key points of questions to participants according to the research topic. The discussion process is recorded using a camera. The recording of the discussion results in the transcript was then analyzed using the Collaizi model so that the themes of the research results could be identified.

The activity continued with expert consultation conducted with three experts, namely one surgical specialist, one medical and surgical nursing doctor, and one diabetes mellitus wound care practitioner nurse, to obtain input regarding the perfection of the SOP design for wound assessment according to nurses' needs. This research has received approval from the Health Research Ethics Commission (KEPK) of Universitas Muhammadiyah Kudus with number 38/Z-5/KEPK/UMKU/XII/2022.

### 3. Results and Discussion

#### 3.1. Results

##### 3.1.1. Results of Focus Group Discussion

The participants in this study were all women aged around 27–40 years, all educated Ners, with working tenure between 5–17 years, as seen in Table 1.

Table 1. Characteristics of participants

Participant	Gender	Age (year)	Education	Working Tenure (year)
P1	Female	40	Ners	17
P2	Female	40	Ners	17
P3	Female	32	Ners	9
P4	Female	30	Ners	7
P5	Female	35	Ners	14
P6	Female	28	Ners	5
P7	Female	34	Ners	13
P8	Female	27	Ners	5
P9	Female	34	Ners	14
P10	Female	34	Ners	13

Source: Primary data, 2023

Based on the results of FGD data analysis, four themes were identified, namely:

#### **Theme 1: Wound Assessment in Diabetic Foot Ulcer Patients is Not Specific**

##### **Subtheme 1: The Study Focused More on DM than on Diabetic Foot Ulcers**

Participants revealed that they have been conducting wound assessments, especially diabetic foot ulcers, not specifically but still in general, including TTV examination, GDS, history of suffering from DM, HbA1c examination, and DM drug consumption.

“What I do when I study patients with diabetic foot ulcers is determine TTV, GDS, wound location, and degree of injury.” (P1)

“When I reviewed patients with DM ulcers, I studied a history of DM, GDS checks, and HbA1c examinations” (P3).

### **Subtheme 2: Incomplete Assessment**

Participants used different methods of assessing wounds, so the assessment became incomplete. One participant examined the cause of the injury. Seven participants examined the location of the wound and the degree of the wound. Six participants examined the shape of the wound, two participants reviewed how the wound was treated at home, and two reviewed the length of suffering from DM wounds.

“The first thing I did was to monitor GDS, wound shape, DM wound degree, and treatment actions to adjust the degree of the wound and the location of the DM wound.” (P2)

“I ask the patient when the injury occurred, then do a GDS check, review the history of suffering from DM, ask how the wound is treated at home, determine the current condition of the wound, and change the bandage.” (P9)

## **Theme 2: Nurses do Not Have Yet a Special Wound Assessment Format for Diabetic Foot Ulcers**

### **Subtheme 1: There are No Guidelines for Assessing Diabetic Foot Ulcers**

All participants said they did not have specific assessment guidelines for DFU injuries but used a general assessment format.

“There are no guidelines. The assessment is still the same in general, for the assessment of the wound has not been specified” (P7)

### **Subtheme 2: Assessment Based on The Experience of Each Nurse**

The assessment carried out by nurses so far is based on each nurse’s experience.

“So far, we are free; for my experience, I am used to it because I have been a surgical assistant, so the knowledge is only from habit; for the SOP, there is no one, and I do not know fully; I just learn from the teachings of the specialist, and over time I get used to it” (P1).

## **Theme 3: Nurses Need Standard Operating Procedures (SPOs) that are Complete and Easy to Implement**

### **Subtheme 1: The Need for Standard Operating Procedures (SPO)**

Participants said they needed a special SPO assessment for diabetic foot ulcers. They argue that if guidelines meet the standards, the assessment will be easier, more efficient, and more effective; there will be uniformity in the assessment, and hospital services will improve.

“In my opinion, it is not as needed, so it needs to be made for SPO (special format) for DM patients because so far it has not been provided.” (P2)

### **Subtheme 2: Selection of Sops For The Checklist Model**

Participants revealed that the SOPs they needed should be a checklist to facilitate work and not take long.

“Like a checklist so that it does not take long, just tick according to what is in the patient.” (P3)

## **Theme 4: Nurses Choose the Bates-Jensen Wound Assessment Tools (BWAT) Method Wound Assessment Model as an SOP in Hospitals**

### **Subtheme 1: BWAT Meets 13 Wound Characteristics**

Participants thought BWAT was easier to predict wounds, including healthy tissue scores 1-13, wound regeneration scores 14-59, and wound degeneration scores 60-65.

“In my opinion, using a format that contains 13 characteristics is better because it is more specific and can facilitate study and appropriate handling.” (P10)

### **Subtheme 2: BWAT is More Complete**

All participants said that BWAT was more complete and detailed for wound assessment.

“I think the BWAT format is better because it is more complete and is also more precise in determining the next handling.” (P8)

### **3.1.2. Results of Expert Judgement**

After FGD, the second stage of this research is expert consultation or expert judgment with three resource persons, namely one academic field person who is a doctor of medical nursing and surgery, one person in the medical field who is a general surgeon, and one nurse wound care practitioner. Based on the input given by the three experts, the number of wound characteristics assessed is still the same as the previous BWAT method, including 13 characteristics consisting of size, depth, edge, undermining, necrotic tissue type, neoplastic tissue amount, exudate type, exudate amount, skin color surrounding the wound, peripheral tissue edema, peripheral tissue induration, granulation tissue, and epithelialization. The experts considered that these 13 characteristics met all the elements of wound assessment expected from both the medical and nursing sides. However, there were additions to the instructions for using SOPs and scoring tables to assist nurses in conducting assessments and for uniformity in determining wound validation.

Some experts also argue that some sentences of instructions are still too long and confusing, so it is recommended to make the instructions more applicable so that they are easier to understand by the nurse who carries them out. In addition, experts also recommend that in the instructions for use, there be tools and methods used to assess wound characteristics, especially when assessing size, depth, edge, and undermining. Another expert input is related to wound scoring. In addition to containing instructions for use, steps, or procedures in assessing wounds in each characteristic, it is also necessary to add some explanation of the condition of the wound to each score assessed. The addition of explanations in each assessment score is expected to make it easier for nurses to determine scores and add up the total scores obtained so that it is easier to determine the status of patient injuries. The recommendations of the three experts were used as input in the draft SOP for the initial assessment of the resulting wounds. The development of this method has been tested on nurses in hospitals. The SOP development trial found that with the same flow but with a shorter language, the SOP is easier to understand and easier for nurses to implement; however, improvements are still needed from this SOP, namely in the form of additional evaluation items in the SOP that can be used to improve communication between health care providers to facilitate the process of providing sustainable nursing services.

### **3.2. Discussion**

The results of this study show that the assessment of wounds in DFU patients is not optimal because the assessment is still general and not specific to DFU. In addition, the assessment data is incomplete because participants use different assessment methods. Multidisciplinary, systematic, and structured data collection about patients can reveal a person's complex clinical condition to guide decision-making and improve the quality of services provided (Vanneste et al., 2015). DFU treatment requires a multidisciplinary care team; therefore, proper assessment of the wound is very important as information for the care team in finding the causative factors of the wound. Assessing the wound's size, depth,

presentation, and location will help underlie the selection and development of therapies and monitor various patient responses to intervention (Sukmana et al., 2020).

DFU assessment is a very important factor in predicting the length of healing and providing information about the condition of the wound so that it becomes the basis for determining appropriate interventions to prevent the development of DFU. Preventing DFU progression can significantly decrease the frequency of lower limb amputations by 49%–87%. Early identification and proper management of complications associated with DFU can also reduce ulceration rates by 44%–85% (Abdissa et al., 2020). DFU is associated with a significant clinical and economic burden on health services. Previous research showed that annually, each patient in Singapore pays an average of \$3368 for an ulcer, \$10468 for a minor amputation, and \$30131 for a major amputation (Lo et al., 2021). In Indonesia, the cost of amputation with a duration of treatment of approximately 15 days reaches 45.5 million rupiahs. Neuropathy, vasculopathy, and infection wounds are the most common, with infectious wounds requiring a longer duration of treatment (17 8.13 days) and more expensive costs reaching 54 million rupiahs (Zufry, 2018). Based on this, it can be said that conducting a proper and complete DFU assessment can indirectly reduce the high cost of health services for DFU patients.

The results found that the hospital did not yet have a special wound assessment format for DFU. This causes nurses to conduct assessments using their methods according to the experience they gain. Several important factors play a role in the patient assessment process, including the ability of nurses and the availability of appropriate instruments. The nurse's ability is one of the most important factors in implementing assessments for patients with DFU. According to Ousey & Cook (2012), a nurse who can perform accurate foot wound assessments is very important to plan, implement, and evaluate the treatment needed for each patient. It was further explained that holistic patient and wound assessment is useful for accurately diagnosing the cause of injury and identifying factors that may delay wound healing. The ability to perform wound assessment is an important parameter that provides basic information about how wound healing progresses, facilitates effective decision-making, and can help predict patient outcomes (Ousey & Cook, 2012). A factor that is also very important to the success of the initial assessment is the availability of an accurate assessment instrument. The wound assessment instrument involves the assessment of initial and ongoing wounds. It has several objectives, including providing basic information to review wound progression, enabling goal setting and selection of correct dressings, and providing appropriate wound management. If wound assessment is not done properly, wound care will not be appropriate, resulting in delayed wound healing and/or serious complications (Greatrex, White, & Moxey, 2013). Therefore, DFU assessment is very important for good wound management.

Nurses need a complete and easy-to-apply DFU assessment SOP. Nurses hope that with guidelines that are according to standards, the assessment will be easier, there will be uniformity in assessment, and it will be efficient and effective. According to Barbé et al. (2016), SOPs aim to ensure data consistency, accuracy, and quality through step-by-step written instructions on executing procedures correctly. SPO improves health service quality and patient safety (Ausserhofer et al., 2016; Shestopalova & Gololobova, 2018). According to Bates-Jensen et al. (2019), previously, healthcare providers only relied on observation to assess wounds and were inconsistent in using various assessment tools among different providers. Hence, standardized, evidence-based tools allow uniform assessment of wound characteristics, which is useful in tracking and measuring wound healing progress. Clinical practice guidelines recommend using wound assessment tools in healthcare settings to improve communication between healthcare providers and ensure optimal patient care (Bates-Jensen et al., 2019).

The nurses in this study chose the Bates-Jensen Wound Assessment Tools (BWAT) wound assessment model as an SOP at 'Aisyiyah Kudus Hospital because this tool was considered complete

enough to assess DFU. BWAT presents more detailed results for DFU assessment as it has more measured characteristics (Rasyid et al., 2019). The results of this study succeeded in developing the BWAT method by incorporating this method into the SOP to facilitate nurses in conducting initial DFU assessments. BWAT is a reliable, standardized, validated visual wound assessment tool for all chronic wounds. The tool contains 13 items that indicate the uniqueness of wound characteristics. Nine parameters are rated on a scale of 1–5 (a score of 1 indicates the healthiest, while a score of 5 indicates the most unhealthy attribute), and the other four parameters are scored on a scale of 0–5 based on the characteristics that have healed (0=none). The scores of the 13 characters are added up, with a total score of 9–65. A score of 9 and a score of 65 indicate minimal tissue damage and severe tissue degeneration, respectively (Bates-Jensen et al., 2019). The design of the development of this method is to be included in the initial assessment SOP of the wound by modifying narrative sentences into applicable sentence forms so that they are easy to understand and implement by nurses. In addition, according to expert input in the instructions for use, tools, and methods used to assess wound characteristics are included, especially when assessing size, depth, edge, and undermining. Other developments carried out by researchers are related to wound scoring and SOPs. In addition to containing instructions for use, steps, or procedures in assessing wounds in each characteristic, there are also several explanations of the condition of the wound in each score assessed. The addition of explanations to each assessment score is expected to make it easier for nurses to determine scores and add up the total scores obtained so that it is easier to determine the status of patient injuries.

#### 4. Conclusion

Based on the study's results, an assessment design has been developed from BWAT into SOPs commonly used by hospital nurses. Modifications were made by incorporating BWAT instruments into the assessment SOP and changing the instructions into a short and applicable language to facilitate nurses conducting initial assessments. In addition, according to expert input in the instructions for use, tools, and methods used to assess wound characteristics are included, especially when assessing size, depth, edge, and undermining. Other developments carried out by researchers are related to wound scoring and SOPs. In addition to containing instructions for use, steps, or procedures in assessing wounds in each characteristic, there are also several explanations of the condition of the wound in each score assessed. The addition of explanations to each assessment score is expected to make it easier for nurses to determine scores and add up the total scores obtained so that it is easier to determine the status of patient injuries. The SOP development trial found that with the same flow but with a shorter language, the SOP is easier to understand and easier for nurses to implement; however, improvements are still needed from this SOP, namely in the form of additional evaluation items in the SOP that can be used to improve communication between health care providers to facilitate the process of providing sustainable nursing services.

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