

Development of Tele-Nursing Guidelines to Improve the Quality of Services in Diabetic Wound Care: A Case Study of Mae Chan Hospital, Mae Chan District, Chiang Rai Province, Thailand

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Development of Tele-Nursing Guidelines to Improve the Quality of Services in Diabetic Wound Care: A Case Study of Mae Chan Hospital, Mae Chan District, Chiang Rai Province, Thailand

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Abstract

Background: The majority of patients with diabetic wounds live in the community; however, there are not enough nurses to meet the increasing demand for care and other issues in the community, such as lack of health equipment, resources, and access to health services, communication channel for healthcare advice, and continuity of care rehabilitation. Therefore, strategies for caring for diabetic wounds are necessary, such as creating a network of channels for giving advice from specialists to nurses, caregivers, and patients in the community, monitoring and following up with patients, and providing quality of service through online channels.

Objective: To develop tele-nursing guidelines for caring for patients with diabetic wounds and foot ulcers and to study the effects of tele-nursing towards wound healing.

Methods: The participatory action research, which divided into three cycles: 1) Study the current situations, problems and needs of patients with diabetic wounds and the feasibility of using tele-nursing guidelines; 2) Study tele-nursing guidelines towards diabetic wound healing; 3) Study the effects of tele-nursing on diabetic wound healing by evaluating the wounds, foot or leg amputation, and satisfaction with the use of tele-nursing. The informants were 20 patients with diabetic ulcers, multidisciplinary team including a surgeon, a pharmacist, a nutritionist, and 9 professional nurses at a subdistrict health promoting hospital in the Mae Chan Hospital network total of 12 people, and 1 computer technical officer.

Results: The results showed that the mean of diabetic wound severity scores after receiving tele-nursing care in the 2nd, 4th, 6th, and 8th weeks had decreased with a statistical significance level of .001. No patients were found to have foot or leg amputation. The patients in the group that received tele-nursing care showed that their wounds healed in an average of 8.6 weeks (mean 8.6, S.D.= 4.3). Out of 5, the satisfaction score for tele-nursing care was 4.7 (S.D.= 0.2).

Conclusions: This study results indicated that tele-nursing might be effective to improve self-care behaviors, reduces the use of resource use in treating diabetic wounds, reduce hospital admissions and expenses of the patients and maintain service quality on the remote area of Mae Chan District, Chiang Rai Province, Thailand.

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Original Manuscript

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Abstract

The purpose of this participatory action research was to develop tele-nursing guidelines for caring for patients with diabetic wounds and foot ulcers and to study the effects of tele-nursing towards wound healing, which divided into three cycles: 1) Study the current situations, problems and needs of patients with diabetic wounds and the feasibility of using tele-nursing guidelines; 2) Study tele-nursing guidelines towards diabetic wound healing; 3) Study the effects of tele-nursing on diabetic wound healing by evaluating the wounds, foot or leg amputation, and satisfaction with the use of tele-nursing. The informants were 20 patients with diabetic ulcers, multidisciplinary team including a surgeon, a pharmacist, a nutritionist, and 9 professional nurses at a subdistrict health promoting hospital in the Mae Chan Hospital network total of 12 people, and 1 computer technical officer. Data collection was performed between April 2023 and March 2024. The results showed that the mean of diabetic wound severity scores after receiving tele-nursing care in the 2nd, 4th, 6th, and 8th weeks had decreased with a statistical significance level of .001. No patients were found to have foot or leg amputation. The patients in the group that received tele-nursing care showed that their wounds healed in an average of 8.6 weeks (mean 8.6, S.D.= 4.3). Out of 5, the satisfaction score for tele-nursing care was 4.7 (S.D.= 0.2).

Keywords: tele-nursing; diabetic ulcers; wound care; nursing guideline; quality of service

Introduction

Diabetes is one of the serious chronic diseases that is strongly associated with health complications, including macrovascular disease, microvascular disease, peripheral vascular complications, and neuropathy, leading to serious health problems such as coronary heart disease, stroke, kidney disease, and retinal abnormalities. In addition, patients with diabetes are at risk of having foot ulcers, which are the most common complications causing disability, amputation, or premature death. This is one of the most critical public health problems. Diabetic foot ulcers are among the most common complications in persons with diabetes who have problems with uncontrolled blood sugar [1]. The incidence showed that patients with diabetes develop foot ulcers at 19-34% and have recurrence symptoms within 3–5 years at 65%; moreover, foot or leg amputation is found to be shared among patients with diabetes compared to the general population 50-70%, and have a chance of premature death within 5 years [2]. Foot ulcers among persons with diabetes take a longer time to recover than normal people, with an average of 11-14 weeks. This could affect the lifestyles of the patients because it causes physical, mental, and social limitations. According to the study of health expenses for caring for patients with foot ulcers in a tertiary university hospital in Singapore between 2013-2017, the average cost of wound care alone was US\$3,368 per patient per year; the cost of minor amputation below the ankle was \$10,468 per patient per year; and the cost of major amputation above or below the knee was \$30,131 per patient per year [3].

Foot ulcers [4,5] can be classified into the following types of wounds: 1) Infected ulcers: the wound is infected and becomes inflamed. The area around the wound is red and spreading from the original site. Symptoms of infected wounds are redness, swollen, pain, and pus; 2) Neuropathic ulcers: this is the most common complication of uncontrolled diabetes. The wound is usually round in shape, with a deep hole in the middle part and thickened skin on the edges. It is found at the base of the big toe and pinky toe. Neuropathic ulcers develop from smaller wounds with symptoms of redness, swelling, numbness, or inflammation around the affected area; and 3) Ischemic ulcers: the wounds develop when the arteries do not deliver enough blood flow to a specific area that causes local ischemia in the skin and the underlying tissues. Initially, these ulcers manifest as blue discoloration, necrosis, or gangrene. They are painful wounds often found on the tips of the toes, especially a big and pinky toe. The characteristics of the wounds are pale, yellow, and cold with weak or absent pulse. They are often starting at the fingertips and pose an increased risk of amputation if left untreated. Diabetic ulcers are complex and chronic wounds that cannot follow the normal wound-healing process. When

the wound is infected, dead tissue (sloughing or shedding) and purulent exudate from inflammation of the wound. There is no new tissue formation, and it does not heal within 4 weeks. Diabetic wounds heal slowly, and sometimes it does not heal. If the wounds are left without proper care, it will cause the infection and spread deep down to the bone layer (Osteomyelitis), causing organ removal (amputation). If severe infection enters the bloodstream (septicemia), it can cause death. The essential goals in caring for patients with diabetic ulcers are to prevent disability from the wound spreading to the point where it is necessary to amputate the involved organ, to prevent new wounds forming after treatment, and to increase the quality of life of the patients.

Diabetic wound care is integral to medical practice to heal wounds better and faster. To promote wound healing faster, namely: 1) Clean the wound to prevent infection and promote the wound healing process; 2) Keep the wound elevated to reduce fluid accumulation and promote blood circulation; 3) Provide adequate knowledge regarding nutrition to promote wound healing process; 4) Have enough rest because resting will reduce the metabolic process inside unnecessary cells and tissues can carry enough oxygen and nutrients to the wounds; and 5) Promote personal hygiene [6]. Diabetic wound care should be supervised by a nurse with clinical expertise who can collect, evaluate, analyze, and identify the needs and problems of patients. Expert nurses should be able to manage options for care and use medical supplies and equipment correctly and appropriately, obtain communication skills to coordinate with the treatment team and encourage family members to participate in care, able to identify health services and resources, and protect patients' rights and privacy and to preserve patient safety and prevent harm during the care [7-9]

The study showed that the majority of patients with diabetic wounds live in the community; however, there are not enough nurses to meet the increasing demand for care and other issues in the community, such as lack of health equipment, resources, and access to health services, communication channel for healthcare advice, and continuity of care rehabilitation. Therefore, strategies for caring for diabetic wounds are necessary, such as creating a network of channels for giving advice from specialists to nurses, caregivers, and patients in the community, monitoring and following up with patients, and providing quality of service through online channels. Various healthcare advice channels could increase access to services, reduce waiting time, and facilitate patients in a new way of life (New Normal). Moreover, the use of digital technology systems to provide health services for continuous care and referral to primary care units with the best practice guidelines, The Nursing and Midwifery Council has announced tele-nursing strategies to provide

healthcare advice and to find solutions related to health within the knowledge framework of the nursing and midwifery profession [10].

Tele-nursing uses information and communication technologies to develop all fields of nursing care, education, and research at a distance [11]. Thailand Nursing and Midwifery provides advice and solutions related to health within the knowledge framework by using this digital technology system to provide services and support all forms of nursing care, including continuous care, quality of care, equal access to health, and allowing people to manage their health through online services [10]. Tele-nursing care increases channel access to health services, covers health care in remote areas, especially in areas with travel restrictions, maintains professional standards and quality, and patients do not need to commute to the hospital, which helps reduce the cost of hospital admission and other related expenses; and monitors and follow up patient's condition done through online channel.

Mae Chan Hospital is located in Chiang Rai Province. It is a middle-level hospital that can host up to 120 beds and support referral from community hospitals in the joint service network of 4 districts: Mae Chan District, Mae Fah Luang District, Doi Luang District, and Chiang Saen District. Mae Chan Hospital is responsible for caring for patients referred from community hospitals when the capacity of those hospitals in 4 districts reaches the limit. The hospital helps increase access to treatment for service users in the area, reduces referrals to regional hospitals (Advance-level Hospital), and supports primary service units in each district. Wound and Ostomy Care Clinic, Mae Chan Hospital, Chiang Rai Province, provides services for patients with chronic wounds, bedsores, general wounds, penetrating wounds, drains, and ostomy care. Some nurses specialize in diabetic wounds, one specialist in ostomy care, and one in general care for patients. There were numbers of people who received services from 2020-2022 in the total of 2,142, 1,571, and 1,675, representing 3,725 times, 4,931 times, and 6,239 times, respectively. There were 114, 70, and 67 patients with diabetic ulcers, accounting for 405, 281, and 291 times, respectively. The average cost of commuting to hospital for the patients to receive wound care is 10 dollars per time. The average number of days to receive wound care services is 14-45 days per person. In general, travel distance for patients to visit the wound care and ostomy clinic is 1-40 kilometers. Due to travel distance and expenses involved in wound care at hospital, some of the patients are unable to receive treatment regularly and continuously; because of this, many patients experience wound spreading and recurrence of wound infection, and some cases experience foot or leg amputation.

According to the literature reviews, tele-nursing is important in assisting patients to access standard care for chronic wounds. Tele-nursing care helps reduce complications, and the number of patients admitted to the hospital encourages participation among patients, caregivers, and nurses in self-care practices and increases patient satisfaction because it reduces time travel, traveling costs, and other related expenses if going to hospital. Therefore, the research team was interested in studying the development of tele-nursing guidelines for caring for patients with diabetic wounds and foot ulcers and to study the effects of tele-nursing towards wound healing among the patients with the aim to provide quality of service to prevent the spreading and recurrence of wound infection, and to prevent foot and leg amputation among patients. This study aims to develop tele-nursing guidelines for caring for patients with diabetic wounds and foot ulcers, and investigate the effects of using tele-nursing toward wound healing among patients.

Methods

This was participatory action research [12], which divided the study into 3 cycles:

Cycle 1: Study the current situations, problems, and needs of patients with diabetic wounds and the feasibility of using tele-nursing guidelines under the context of Mae Chan Hospital, Chiang Rai Province, and community networks in the study area. The researcher used lessons learned from the study to conclude the issues and needs of developing and drafting tele-nursing guidelines for diabetic wound care. Informants and participants in the design of diabetic wound care guidelines and tele-nursing system were purposively selected consisting of: 1) Patients with diabetic wounds and/or their caregivers who received care in the Wound and Ostomy Care Clinic totaling 10 persons; 2) The multidisciplinary team including a surgeon, a pharmacist, a nutritionist, and 9 professional nurses at subdistrict health-promoting hospital in the Mae Chan Hospital networks total of 12 people; and 3) A computer technical officer.

Cycle 2: Study tele-nursing guidelines towards diabetic wound healing. Participants were recruited in the study consisting of: 1) Patients with diabetic wounds. Sample size calculation was done using G-power version 3.1.9.4, test power set at .70, confidence value at .05, and influence value (effect size) at .30. The number of 13 samples was obtained from the calculation. An additional 50 percent was added to the sample size, so the total of the sample participating in this cycle was 20 persons; and 2) Professional nurses from sub-district health promoting hospitals under the Mae Chan Hospital networks totaling 20 persons.

Cycle 3: Study the effects of tele-nursing on diabetic wound healing by evaluating the wounds, foot or leg amputation, and satisfaction with using tele-nursing guidelines. A quasi-experimental one-group pretest-posttest design was employed in this stage of the study.

Research Instruments

1. Tools used for data collection:

- 1.1 General characteristics information including gender, age, education level, occupation, history of smoking, history of diabetes and duration, and types of diabetic wounds.
- 1.2 Bates-Jensen Wound Assessment Tool (BWAT), the BWAT consists of 13 wound characteristics: size, visible depth, wound edges, undermining and tunneling processes, necrotic tissue type and amount, exudate type and amount, surrounding skin discoloration, peripheral tissue edema, peripheral tissue induration, granulation tissue and epithelialization [13]. The scores range from 13-65, and content validity and concurrent validity are both equal to 0.91. The assessment tool was used in a tryout among 10 patients with similar characteristics to find reliability using Cronbach's alpha coefficient formula; and the reliability value was 0.88. The cut-off scores of BWAT are: BWAT Minimal Scores of 13-20, BWAT Mild Severity Scores 21-30, BWAT Moderate Severity Scores 31-40, and BWAT Critical Severity Scores 41-65.
- 1.3 The questionnaire on satisfaction towards Tele-nursing guidelines consists of 7 items, and collecting feedback was 5 Likert scales measuring satisfaction with response options ranking from Very Satisfied = 5, Satisfied = 4, Natural = 0, Dissatisfied = 3, and Very Dissatisfied = 1.

2. The tools used to conduct the research study include:

- 2.1 Guidelines for diabetic wound care. The researcher developed the guidelines based on the existing literature review by specifying keywords to search for papers and related documents, including diabetic wounds, chronic wounds, guidelines for wound care, and wound care. Literature review search period was set from 2014-2023. Information was also obtained from cycle 1: Study the current situations, problems, and needs of patients with diabetic wounds and the feasibility of using tele-nursing guidelines. The researcher presented a draft of tele-nursing guidelines to 3 experts in the fields of surgery, preventive medicine, and wound and ostomy care. These experts reviewed the guidelines to ensure they were consistent with the research objectives. Content validity was performed by measuring the Index of Item Objective Congruence (IOC), which was equal to .80.
- 2.2 Line application “Wound Care Mae Chan”

2.3 Telemedicine Service System (Telemedicine; ITELE) of Mae Chan Hospital

Ethical Considerations

The Human Research Ethics Committee approved this research study, Chiang Rai Provincial Public Health Office No. 37/2023, Certification date of 1 April 2023. The researcher collected data and strictly followed research ethics principles. The researcher clarified the objectives of this study, the research process, the duration of the study, and the expected benefits. The researcher allowed informants and participants to ask for further information before participating in the research; they could withdraw from the research at any time without affecting the current treatment or benefits received from the hospital. The researcher was concerned about the participants' rights and privacy, so information was recorded in codes instead of using real names. Information provided by participants was kept confidential and could not be traced back to identify the person. Information was presented as an overall of the research study.

Results

1. According to the study objectives which aim to develop tele-nursing guidelines for caring patients with diabetic wounds and foot ulcers and to study the effects of tele-nursing towards wound healing by using participatory action research. These are the following results:

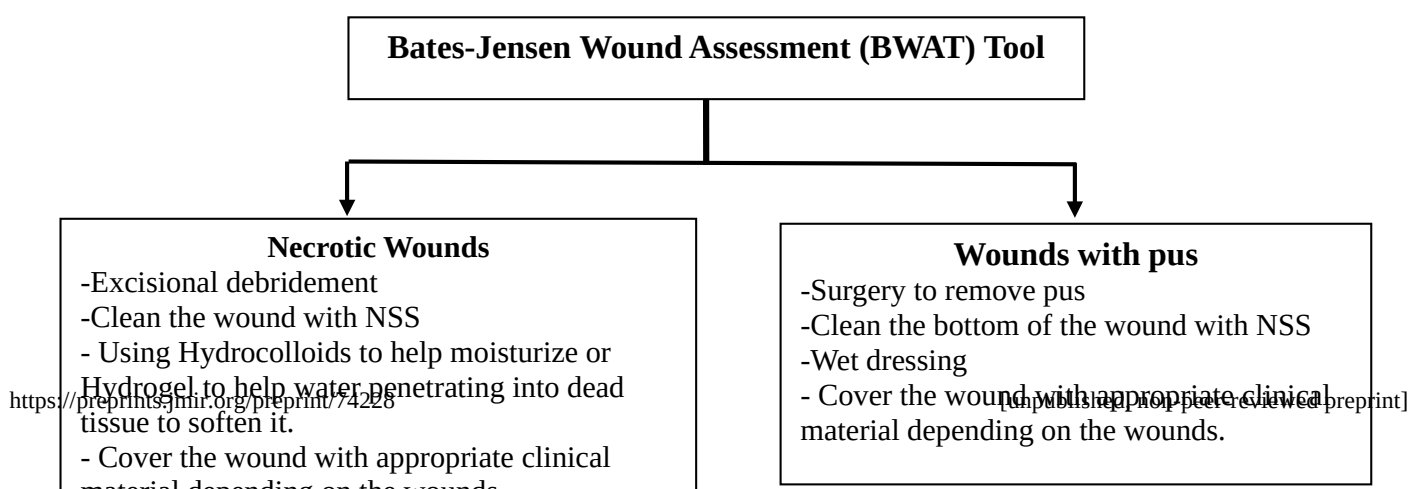
Cycle 1: To study the current situations, problems and needs of patients with diabetic wounds and the feasibility of using tele-nursing guidelines, the informants were 10 patients with diabetic wounds and foot ulcers, aged between 30-74 years, average age 62.6 years (SD =12.4), duration of diabetes 1-10 years, average duration of diabetes 4.9 years (SD = 3.5), and wound assessment score 51.3 (SD=3.3); additional informants were a surgeon, a pharmacist, a nutritionist, 9 professional nurses at the sub-district Health Promoting Hospital, and a computer technical officer. The following needs and problems were found to be developed:

1) Some patients could not receive wound care regularly and continuously because of the distance to the hospital, traveling difficulties, expenses for transportation, food, medical care, and related costs. Findings showed that some patients live far from the hospital. It costs them a lot of money per hospital visit. For some cases, patients have no one to take them to the hospital because family members have to work, and if they have to accompany the patients to the hospital, they have to miss their work and lose income. Moreover, they must spend extra money on transportation and food while waiting for patients to receive wound care. The cost of traveling to the hospital to receive wound care services is approximately 100-1,000 baht per time, which is too much for them to spend,

especially for patients and their family members who live in a remote community area.

2) Lack of knowledge about diabetic wound care is one of the problems. Patients lack adequate knowledge of wound care, nutrition, and control of blood sugar levels. These are factors for wound healing. In some cases, patients did not follow up on the appointment, which could also affect their physical health. Because of this, many patients experienced wound spreading and recurrence of wound infection, and in some cases, may experience foot or leg amputation.

3) For severely infected wounds, this requires skills and expertise in advanced wound care, which exceeds the potential of community nurses working in sub-district health-promoting hospitals; and 4) Patients did not have access and resources to advance wound care such as hydrocolloid, hydro fiber, alginate, hydrogel, foam, and film dressings; and 5) Nowadays, majority of patients and their family caregivers have smartphones that can be used to communicate via the LINE application. Introducing tele-nursing care for diabetic wound care among patients could help reduce barriers to receiving healthcare services. Based on the study of situations, needs, and problems among patients with diabetic wounds, tele-nursing guidelines for diabetic wound care are summarized as shown in Figure 1.



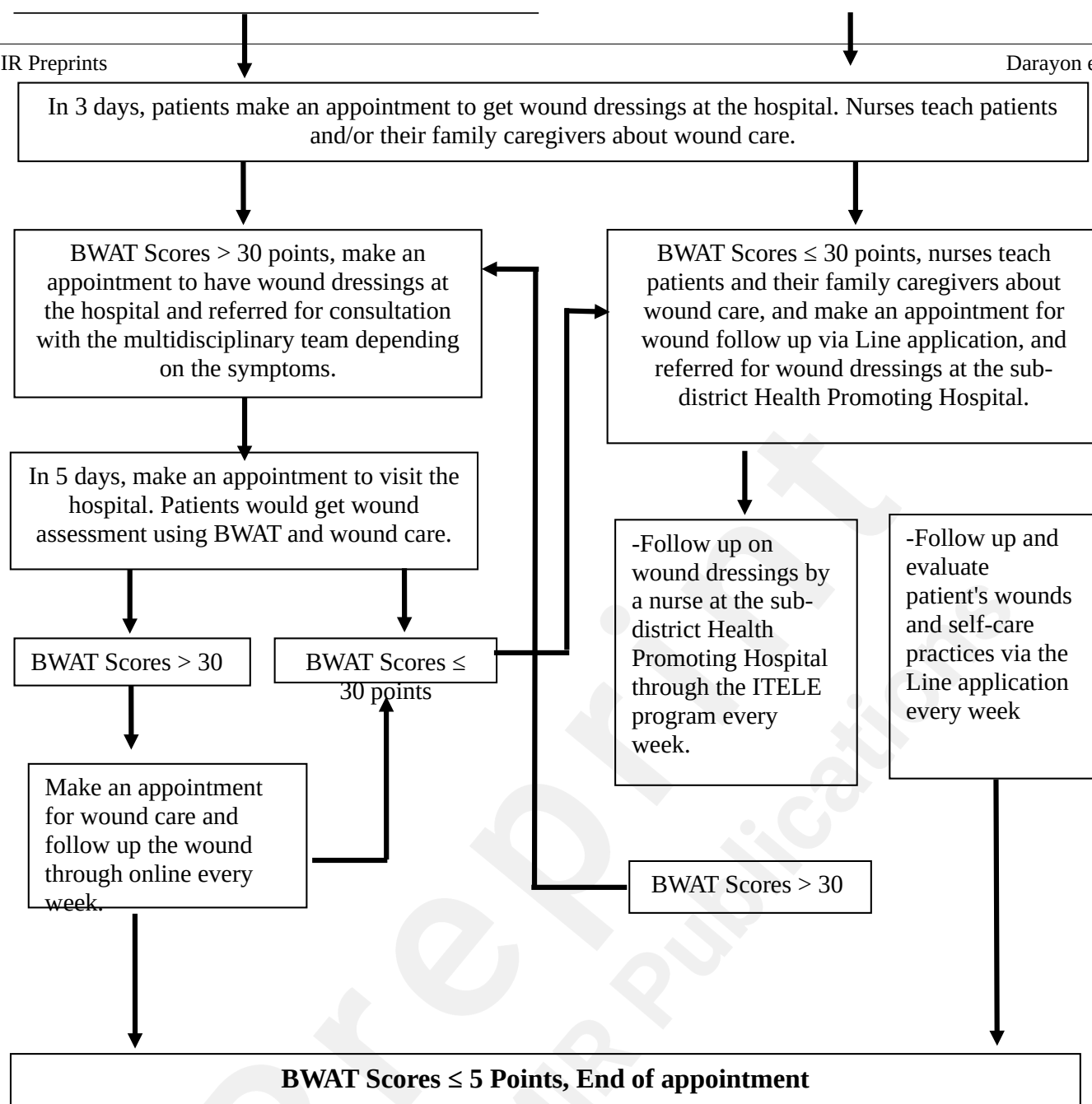


Figure 1: Tele-nursing guidelines for diabetic wound care

Cycle 2: Study tele-nursing guidelines towards diabetic wound healing. The results reveal the following:

- 1) The study samples were 20 patients with diabetic wounds and foot ulcers, and half of them were female (50%), aged 30-81 years, with average age 47.6 years (SD.=9.4), and an average

duration of diabetes of 7.6 years (SD.=6.4). Studies showed that the wounds were found most on the leg, foot, and toe (75%). The assessment wound severity score was 50.8 (SD=4.4), indicating that patients had wound critical severity (BWAT=41-65 points, representing critical severity), and the results are shown in Table 1.

Table 1. Attributes of the sample group

Items	n	percentage
Sex		
Male	10	50.0
Female	10	50.0
Age (Mean = 47.6 S.D.=9.4)		
30-49 years old	2	10.0
50-59 years old	3	15.0
60-69 years old	9	45.0
70 years and over	6	30.0
Duration of diabetes		
0-2 years	4	20.0
3-5 years	6	30.0
6-10 years	7	35.0
10 □□ years and over	3	15.0
Wound location		
Head, Neck	1	5.0
Arm, hand, fingers	4	20.0
Legs, feet, toes	15	75.0
Pain		
Pain occurs during wound dressing	7	35.0
Pain is present at all times.	8	40.0
Intermittent pain	5	25.0
Wound Status (Mean=50.8 S.D.=4.35)		
Critical severity (BWAT=41-65 points)	20	100.0
Wound characteristics		
Size (length x width)		
Less than 4 cm ²	3	15.0
4 cm ² - 16 cm ²	11	55.0
16.1 cm ² - 36 cm ²	2	10.0
36.1 cm ² - 80 cm ²	3	15.0
More than 80 cm ²	1	5.0
Depth		
Obscured by necrosis	5	25.0
Full-thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures	15	75.0
Wound edges		
Indistinct, diffuse, none clearly visible	19	95.0
Distinct, outline clearly visible, attached, even with wound base	1	5.0
Undermining		
Undermining < 2 cm in any area	14	70.0
Undermining 2-4 cm involving < 50% wound	6	30.0

Items	n	percentage
margins		
Necrotic Tissue Type		
Loosely adherent yellow slough	3	15.0
Adherent, soft, black eschar	17	85.0
Necrotic tissue amount		
> 50% and < 75% of wound covered	14	70.0
75% to 100% of wound covered	6	30.0
Exudate Type		
Serosanguineous: thin, watery, pale red/pink	1	5.0
Serous: thin, watery, clear	7	35.0
Purulent: thin or thick, opaque, tan/yellow, with or without odor	12	60.0
Exudate Amount	1	5.0
The amount of secretion is less than or equal to 25 percent.		
The amount of secretion is more than 25 – 75 percent.	7	35.0
The amount of secretion is more than 75%	12	60.0
Skin color surrounding the wound		
Bright red &/or blanches to touch	16	80.0
Black or hyperpigmented	4	20.0
Peripheral tissue edema		
Pitting edema extends < 4 cm around the wound	9	45.0
Crepitus and/or pitting edema extends >4 cm around the wound	11	55.0
Peripheral tissue induration		
None present	1	5.0
Induration, < 2 cm around the wound	2	10.0
Induration 2-4 cm extending < 50% around the wound	6	30.0
Induration 2-4 cm extending > 50% around the wound	11	55.0
Granulation Tissue		
Bright, beefy red; < 75% & > 25% of wound filled	3	15.0
Pink, &/or dull, dusky red &/or fills < 25% of wound	17	85.0
Epithelialization		
50% to < 50% wound covered	3	15.0
< 25% wound covered	17	85.0

2) The researcher prepared workshops and set up a meeting to explain the operation towards developing tele-nursing guidelines to the committee and those responsible for the continuous care, advanced wound care, and training program using the ITELE.

3) Compare the mean wound severity scores before and after receiving tele-nursing guidelines for diabetic wound care at week 2, week 4, week 6, and week 8 using One-way repeated-measures (ANOVA) statistical analysis; the results are shown in Table 2.

Table 2. Comparison of the wound severity scores before and after receiving tele-nursing guidelines towards diabetic wound care using repeated measures of one-way ANOVA statistics.

Analysis of variance	SS	df	MS	F
Between-group	15379.4	4	3844.8	401.7**
Within-group	3360.2	95	35.4	
Total	18739.6	99		

**p<.001, SS = Sum of Square, MS = Mean Square

According to Table 2, it was found that the mean score of wound severity was significantly difference at the .001 level.

4) Comparison of the wound severity scores before and after receiving tele-nursing nursing care guidelines for wound care at week 2, week 4, week 6, and week 8 using t-test statistical analysis as shown in Table 3.

Table 3. Comparison of the wound severity scores before and after receiving tele-nursing guidelines towards diabetic wound care at week 2, week 4, week 6, and week 8.

Mean scores of wound severity score	Mean	S.D.	t
- Before and after receiving tele-nursing care guidelines for diabetic wound care in the 2nd week	23.7	5.3	20.0***
- Before and after receiving tele-nursing care guidelines for diabetic wound care in the 4th week	29.6	3.9	34.3***
- Before and after receiving tele-nursing care guidelines for diabetic wound care in the 6th week	32.0	4.0	35.3***
- Before and after receiving tele-nursing care guidelines for diabetic wound care in the 8th week	34.0	4.7	36.1***
- After receiving tele-nursing care guidelines for diabetic wound care in the week 2 and week 4	5.9	3.9	6.8***
After receiving tele-nursing care guidelines for diabetic wound care in the week 2 and week 6	8.3	5.0	7.4***
After receiving tele-nursing care guidelines for diabetic wound care in the week 2 and week 8	10.3	6.5	7.1***
After receiving tele-nursing care guidelines for diabetic wound care in the week 4 and week 6	2.4	2.6	4.1**
After receiving tele-nursing care guidelines for diabetic wound care in the week 4 and week 8	4.4	3.9	5.1***

Mean scores of wound severity score	Mean	S.D.	t
After receiving tele-nursing care guidelines for diabetic wound care in the week 6 and week 8	2.0	2.3	3.8**

*** $p < .001$, ** $p < .01$

According to Table 3, the wound severity scores after receiving tele-nursing care in the 2nd, 4th, 6th, and 8th weeks had decreased statistically at a significance level of .001. The scores after receiving tele-nursing care in weeks 4, 6, and 8 had decreased statistically from week 2 at a significance level of .001. The scores after receiving tele-nursing care in weeks 6 and 8 had decreased statistically from week 4 at a significance level of .01, and the scores after receiving tele-nursing care in week 8 had decreased statistically from week 6 at a significance level of .01, respectively.

Discussion

The findings of this study showed that samples had an average age of 62.2 years (SD.=12.4), an average duration of having diabetes of 4.9 years (SD.= 3.5), and the severity of wound was at a high level (BWAT= 51.3 S.D.= 3.3); therefore, this indicates that majority of samples are older people, and have high risk of critical wound severity. The following factors were found: 1) Factors affecting the wound healing process include infection, high blood sugar level, and nervous system disorders. This is consistent with the study by Burgess and colleagues [14], which found that the pathophysiology related to the diabetic wound healing process includes hyperglycemia, neuropathy, microvascular complications, infection, inflammation, and immune system deficiency in chronic wounds, and psychological impacts of diabetes mellitus; 2) Patient factor, in which they are unable to receive wound care continuously due to financial limitation, distance to hospital, and no caregivers taking them to the hospital, etc. From the in-depth interviews, it was found that the majority of patients live far distance from the hospital. Distance is one of the barriers to accessing health services. Some patients do not have anyone to care for because family members have to work. Due to this reason, some of the patients are unable to go to the hospital by themselves. If a caregiver comes to the hospital, it would cost more money for traveling expenses, which is more than the net income received each day. The average cost is 6-10 dollars per time, which is considered a high expense; and 3) Knowledge factors, patient do not have enough knowledge regarding blood sugar control and nutrition, which are important factors to promote wound healing. The problems and needs of patients led to the development of tele-nursing guidelines to provide patients with access to wound care services to prevent leg or foot amputation, increase the rate of wound healing, reduce

wound healing time, reduce inequality, and distribute opportunities to access to advance wound care and resources for wound healing.

A study of the development of using tele-nursing guidelines on diabetic wound healing found that the mean scores of wound-based severity score had decreased significantly after receiving tele-nursing guidelines for diabetic wounds in week 2, week 4, week 6, and week 8 at a significance level of .001. Moreover, no patients were found to have foot or leg amputation. This can be explained by the fact that the samples in this study received baseline assessment, including illness history, duration of the wound, history of received medicine, financial status, nutrition, and wound assessment using the Bates-Jensen Wound assessment guidelines. Patients also received wound assessment every week from the beginning throughout the study. Having wound assessment regularly is very important for effective wound care. Understanding factors affecting wound healing helps nurses make appropriate decisions in wound care [15]. This allows the wound healing process to proceed normally, and it works well together by preparing the wound to be in an appropriate state according to the principles of Wound bed preparation [16]. Wound management consists of 3 phases: 1) Debridement of the wound is when dead or unhealthy tissue is removed from a wound. It stimulates wound healing to the proliferative phase causing re-epithelialization of the wound to be smaller, which prevents or reduces the amount of infection by removing pathogenic parts such as foreign bodies; 2) Dealing with secretions to make the wound moist, making the wound healing more effective causing angiogenesis formation of granulation tissue and the process of re-epithelialization; and 3) Wound infection control by cleaning the wound to reduce number of germs and giving topical antibiotics [17,18]

Information for developing tele-nursing guidelines was obtained from studying the situations, problems, and needs of patients with diabetic wounds and foot ulcers, as well as from reviewing existing literature reviews. Based on the information, self-care behaviors are important for promoting wound healing among the patients such as, controlling blood sugar levels, taking care of the wound by cleaning and getting wound care regularly and continuously, and eating proper food with good nutrition. According to the study, the patients in a group that received tele-nursing care could heal wounds in an average of 8.6 weeks (mean 8.6 S.D.= 4.3). The patients in a group that received advanced wound care and normal wound care could heal their wounds in an average of 10.2 weeks. The patients in a group that received wound care every day (conventional wound dressings) and normal wound care could heal in an average of 11.72 weeks. The average cost of wound care for the group receiving tele-nursing guidelines was 11,772 Baht per person; receiving advance wound care

and normal care was 14,772 Baht per person; and receiving wound care and normal care everyday was 22,740 Baht person. In terms of the average score of satisfaction using tele-nursing guidelines, out of 5, it was 4.7 (SD= 0.2). This is consistent with many studies stating that self-care behaviors, blood control sugar level, and continuous use of use medication among patients with diabetes were better after tele-nursing care [19-22]; and this reduces the use of resource use in treating diabetic wounds, reduce hospital admissions and expenses of the patients and maintain service quality [23, 24].

Suggestions for using research results

In order to continuously produce good results for the implementation of tele-nursing guidelines to improve the quality of services in diabetic wound care, there must be preparation of those people involved in the development process, including community people, patients, health care providers, nurses, health staffs, and family caregivers in terms of knowledge in the field of diabetic wound care such as advance wound care, ITELE program, community nursing, self-care practices and knowledge regarding the use of remote technology in accordance to the steps of the nursing process, health assessment including defining problems, planning, practice, and evaluation.

There must be supervising, monitoring, and evaluation of the use of tele-nursing guidelines to improve nursing practices suitable to the community context and in accordance with knowledge about advanced wound care, diabetic wounds, chronic wounds, and remote technology.

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