Evidence-Based Protocol: Effect on Foot Care Self-Efficacy among Diabetic Patients during COVID 19 Pandemic

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Abstract

Background: Diabetes Mellitus (DM) is considered one of Egypt's most common and costly chronic conditions. Foot ulceration is a major complication of diabetes that is associated with high morbidity and mortality. The COVID-19 outbreak had a serious and disruptive effect on delivering hospital care for those with Diabetic Foot Ulcers (DFUs). The COVID-19 pandemic has created havoc in diabetes management; during this COVID-19 pandemic, interventions to enhance self-efficacy; for better diabetes management, reducing diabetes complications, especially diabetic foot, or prolonging their onset are the need of the hour. The usage of telemedicine in the prevention of disease and injuries and for the continuing education of diabetic patients enables nurses to increase contact time with patients and individuals to take the onus of their disease through increased self-efficacy. **Study Aim:** This study aimed to evaluate the effect of evidence-based foot care protocol on foot care self-efficacy among diabetic patients during the Covid-19 pandemic. **Methods:** A quasi-experimental research (pre/post-test) design was used; The research was carried out at the Ain Shams University Hospitals' diabetes outpatient clinic in Cairo, Egypt. A purposive sample of 140 adult patients was recruited for the study. Patient's assessment and clinical data sheet, Diabetic patient's knowledge questionnaire, and Foot care self-efficacy questionnaire were used for data collection. **Results:** A statistically significant difference was found between pre/post-implementation of evidence-based foot care protocol regarding patients' knowledge and self-efficacy. **Conclusion:** evidence-based foot care protocol was helpful in the improvement of diabetic patients' knowledge and their foot care self-efficacy during the Covid-19 pandemic through online teaching (Zoom) and WhatsApp applications. **Recommendations:** Continuous training and educational programs must be designed for diabetic patients through online teaching to get updated knowledge and practice to enhance foot care self-efficacy, especially during the COVID-19 pandemic.

Keywords: Evidence-Based, foot care, self-efficacy, Covid-19 pandemic

Introduction

Diabetes mellitus (DM) is a metabolic disorder, a common and potentially disabling chronic disease. The condition is presently afflicting 194 million people worldwide. It is estimated to rapidly increase to 333 million people in 2025 due to longer life expectancy, sedentary lifestyle, and changing dietary patterns. Globally, nearly 415 million people have DM; most patients belong to middle-income and low-income countries. WHO estimates that 60% of the diabetic population will be from developing countries of Asia by 2025. This rise in the prevalence of DM is likely to bring a concomitant increase in its complications among diabetic patients. One important complication of DM is the foot problems; these complications constitute an increasing public health problem and are a leading cause of admission, amputation, and mortality in diabetic patients **(Singh et al., 2020; Galal et al., 2021).** Diabetic foot syndrome, a long-term consequence of Diabetes Mellitus, is the most common cause of non-traumatic amputations. Around 8% of the world population suffers from diabetes, and 15% of diabetic patients present a diabetic foot ulcer which leads to amputation in 2.5% of the cases **(Hernandez-Cardoso et al., 2022)**.

Uncontrolled diabetes causes neuropathy and peripheral arterial disease through various

complex metabolic pathways. The development of foot ulcers is triggered by neuropathic sensory loss superadded with peripheral vascular disease. A systematic review reported a prevalence of 0.003–2.8% for diabetes-related peripheral neuropathy and 0.01–0.4% for diabetes-related peripheral arterial disease. Foot ulcers, gangrene, osteolysis, fractures, dislocation, and deformities are caused by sensory neuropathy, vasculopathy, mechanical variabilities like the load on the joints/foot, metabolic abnormalities, and repeated microtrauma **(Singh et al., 2020).**

Diabetic foot risk factors include diabetes duration, aging, and the presence of hypertension. However, neuropathy, which causes sensory loss, and peripheral vascular disease, which causes ischemia, are also substantial risk factors for foot ulcers and amputation. Previous research has indicated that diabetes individuals had disparities between their knowledge and practice, with good knowledge contrasting poor practice and a lack of education on a diabetic foot; thus, knowledge was gathered through family or social media **(Shamim et al., 2021).**

Foot ulceration is the most common and costly late complication of diabetes, with morbidity and mortality being worse than for many cancers. Data suggest that up to one in three people with diabetes will develop a DFU sometime during their lifetime. Non-healing DFUs are a leading cause of hospitalization, amputation, disability, and death among the diabetic population **(Boulton, 2021).** According to statistics, 25% of diabetic individuals get a foot ulcer during their lifetime, and the cost of treatment for a DFUS is more than twice that of treating any other chronic ulcer. Amputation of the diabetic foot negatively influences patients' lives more than other problems. Referral delays for significant foot disorders are particularly concerning. As a result of neuropathy, 20% of patients with diabetes had a high risk of foot ulcers. In industrialized countries, diabetic foot ulcers (DFUs) account for 12–15 percent of the overall estimated cost of diabetes, rising to 40% in impoverished ones. DFUs are one of the most prevalent diabetes complications, with a prevalence of 4 to 10% among those affected. In the United States, the total incidence of DFU is 5.8–6.0% in people with diabetes, while it is 2.1–2.2 percent in smaller groups in Europe. Foot ulcer treatment can be costly, and roughly 49–85 percent of all DFUS can be avoided by raising awareness and implementing adequate precautions **(Pourkazemi et al., 2020).**

The diabetic foot as a complication of DM accounts for around 6% of all the associated complications in individuals suffering from type 1 DM. The diabetic foot complications in patients include foot ulcers, wound infections, and gangrene. Around 0.03–1.5% of the patients suffering from DM tend to develop gangrene, resulting in limb (foot) amputation. This complication seriously deteriorates the quality of life among the patients. Hence, it becomes almost imperative for the patient to be educated and made aware of the complications of the diabetic foot and knowledge to take care of the foot **(Singh et al., 2020; Shamim et al., 2021)**.

Diabetes mellitus (DM) complications are costly to the healthcare system. In 2015, total global health expenditures related to diabetes were estimated to be over 673 billion US$, with this figure predicted to rise to US$ 802 billion by 2040. 2 Diabetic foot ulcers (DFU) account for around 85% of diabetes-related amputations and more than half of non-traumatic lower extremity amputations (LEAs). A prior local study by this author found that DM was responsible for over half of all amputations, indicating a critical need for foot-care intervention. The financial consequences of diabetic LEA include direct treatment expenditures and indirect costs such as lost productivity and a decline in quality of life **(Manickum, Madiba & Ramklass,2021).**

Poor knowledge and poor foot care practices were identified as important risk factors for foot problems in diabetes. Hence, in order to minimize, if not prevent, foot complications, it is important that appropriate and timely foot self-care be emphasized for patients with diabetes. It has been observed that about 10–15% of people with diabetes will develop a foot ulcer at some point, and about 5–24% of the foot will progress and finally lead to limb amputation. Facilitators of foot self-care practices, such as patient education, appear reserved for individuals who have

already developed foot complications **(Singh et al.,2020).**

Healthcare organizations knew there was a need to integrate evidence-based practices into clinical practice for optimal outcomes. They were achieved with interventions directed at patients, such as teaching adult patients with diabetes about caring for their feet. This teaching changed their behavior, contributed to the prevention of diabetic foot ulcers and amputation, and decreased the economic burden **(Dorresteijn, Kriegsman, & Valk, 2010)**. A strengthening effort for sound foot care behavior is to focus on self-efficacy **(Huda et al., 2019)**.

Self-efficacy plays a crucial role in social cognitive theory. It is defined as the level of confidence that the person needs to perform a particular behavior or skill effectively within his or her ability **(LaMorte, 2019)**. Strengthening DM patients' self-efficacy can help them improve and adjust their foot care behaviors, preventing future problems (McEwen et al., 2016). Several studies have shown self-efficacy to enhance foot care behavior and reduce foot injuries by up to 85% **(Sharoni et al., 2018)**. As mentioned by **(Dehghan et al., 2017)**, self-efficacy is an important factor within successful self-care programs developed for diabetic patients.

The novel Coronavirus (2019-nCoV) crisis started in Wuhan, China, in December 2019 and has spread globally. The World Health Organisation's latest report showed over 6.5 million confirmed cases of COVID-19 in over 210 countries, accounting for more than 397,000 deaths (06 June 2020). The covid-19 pandemic and resulting lockdown in March 2020 led to the suspension of face-to-face diabetes education **(Zhu et al., 2020; World Health Organization, 2020; Alayyan et al., 2021).** The COVID-19 pandemic has made the already complex management of DFD even more challenging in these difficult times. Multi-disciplinary Diabetic foot care services have been put under pressure due to decreased hospital and clinic capacities, staff shortages, sickness, reduced allied health professional availability, and other patient-specific factors. The clinicians and careers looking after this patient group have had to adapt to the circumstances and use creative means to ensure their patients remain disease-free and avoid hospital admissions. Patient education and promoting self-care are vital in the current environment **(Jaly et al., 2020).**

Significance of the study

In 2019, the International Diabetes Federation (IDF) ranked Egypt as one of the top ten nations in the world with the greatest diabetes prevalence, with approximately 9 million persons aged 20 to 79 living with the disease. In Egypt, the number of diabetic patients has risen significantly from roughly 4.5 million in 2007 to 7.5 million in 2013 and is anticipated to rise to 13.1 million by 2035. **(Singh, et al., 2020; Galal, et al., 2021).**

Egypt occupies the ^{eighth} rank in the prevalence of diabetes worldwide, with an estimated 8.2 million diabetic patients. It is expected that the number will double by the year 2045. By then, Egypt will jump to the ^{sixth} rank in diabetes prevalence **(Saeedi et al., 2019)**. Foot problems and amputations remain very high, accounting for up to 20% of diabetes-related hospital admissions. **(Shankar et al., 2005)**. Diabetic foot and its consequences (ulcers and amputation) are preventable through good education **(Kassab et al., 2022)**.

Due to the current unpredictable changes following the global coronavirus disease (COVID-19) pandemic, significant changes have occurred in healthcare systems. Most of the clinical and evidence-based care services for patients with diabetic feet have been disrupted. Therefore, many patients with diabetic foot ulcers cannot receive the necessary care, despite its great significance. All healthcare providers, including physicians and nurses, have difficult tasks and responsibilities during the COVID-19 crisis. Although patients with diabetic feet are at risk of infection, hospitalization, amputation, and death, they must remain out of hospitals, and distance educational and therapeutic services must be provided for them.

We hypothesized that an evidence-based foot care protocol would improve foot care self-efficacy among diabetic patients during the Covid-19 pandemic, improve their

understanding of foot-care practices, and adopt these principles into their daily routine. The evidence-based foot care protocol described here included components of knowledge and practice of foot care. The level of foot-care knowledge and practices among diabetic patients were assessed in this study. It also sought to establish if an evidence-based foot care protocol would provide any change in knowledge and behavior regarding foot care. The objectives of the study were to (1) assess diabetic patients' knowledge regarding foot care, (2) implement evidence-based foot care protocol on foot care self-efficacy among diabetic patients during the Covid-19 pandemic, and (3) evaluate the effect of evidence-based foot care protocol on foot care self-efficacy among diabetic patients during Covid-19 pandemic.

Aim of the study:

This study aimed to evaluate the effect of evidence-based foot care protocol on foot care self-efficacy among diabetic patients during the Covid-19 pandemic through the following:

1. Assessing diabetic patients' needs regarding foot care
2. Planning and implementing evidence-based foot care protocol for patients with diabetes during the Covid-19 pandemic focusing on their foot care self-efficacy.
3. Evaluating the effect of evidence-based foot care protocol on foot care self-efficacy among diabetic patients during the Covid-19 pandemic

Research Hypothesis:

1. Patients with diabetic foot knowledge scores will be increased after evidence-based protocol implementation compared to the preintervention level.
2. Patients with diabetic foot will have increased self-efficacy scores after evidence-based protocol implementation compared to the preintervention level.

Research Design:

A quasi-experimental research (pre/post-test) design was adopted to conduct this study. Quasi-experimental study designs are often described as nonrandomized, pre-post intervention studies **(National Library of Medicine, 2022)**.

Research variables:

◘ Independent variable

- Evidence-based foot care protocol

◘ Dependent variables

- Diabetic foot knowledge
- Self-efficacy

Setting:

The study was conducted at the diabetic outpatient clinic at Ain Shams University Hospitals, Cairo, Egypt, on one group pre/post-intervention who attended the outpatient clinic for follow-up. All selected subjects were exposed to evidence-based foot care protocol focusing on foot care self-efficacy.

Sample:

A purposive sample of 140 patients was recruited **for the study according to the following inclusion** criteria: Acceptance to participate in the study, adult and had a clinical diagnosis of type 2 diabetes, and ability to read and write to understand the goals of the study, had a smartphone and Internet access in their houses and able to reach the web site by themselves or by one of their families. Patients experiencing cognitive impairment and alcohol or drug abuse were excluded from the study.

The rule of sum and sample equation based on information from relevant studies and the last year's hospital admission statistics were used to determine the study's sample size. The supple size was calculated according to the following statistical formula;

$$\mathbf{n}= \frac{t^2 \times p(1-p)}{m^2}$$

n= the required sample size
t= the confidence level at 95% (Standard value of 1.96)
p= the estimated prevalence of HTN
m=the margin of error at 5% (Standard value of 0.05)

Tools for data collection:

Four different tools were used to collect data pertinent to this study. They included the following:

1- Patient's assessment record: it contains four sections.

Part 1 intended to collect data about the sociodemographic characteristics of the patients under study to provide descriptive data regarding the patient's age, gender, educational level, work status, and marital status.

Part 2 was designed by the researchers to gather data related to medical and family history, such as type of DM, family history, duration of illness, method of treatment, regularity of blood sugar level with diabetic treatment, have any other chronic diseases, foot problems, previous hospitalization for diabetic foot, and diabetic complications.

Part 3: It was concerned with assessing body mass index (BMI) and present history of diabetic foot (neuropathy, peripheral vascular disease, and foot infection).

Part 4: It comprised diabetic patients' habits such as smoking, a regular measure of their blood sugar level, and keen knowledge of diabetes and diabetic foot care.

Scoring system:

Weight in kilograms was divided by squared height in meters to calculate BMI [BMI = weight (kg)/height $(m)^{2}$]. A BMI of less than 18.5 was considered underweight, 18.50 - 24.99 was regarded as normal, 25 – 29.9 was considered overweight, and 30 was deemed obese **(**World Obesity Federation**, 2021).**

2- Diabetic patient's knowledge questionnaire:

The researcher developed this tool in the Arabic language in order to assess the patient's level of knowledge pre/post-intervention concerning the definition, risk factor, signs & symptoms, types, complications, and treatment of diabetes, as well as questions on definition, causes, risk factor, prevention, daily foot care and medical and surgical treatment of diabetic foot based on the related literature **(Smeltzer et al., 2017; Nachimuthu, Ahmed Khan, & Viswanathan, 2021)**. It consists of 33 three-choice items (True, False, Neutral). The reliability test was done using the Cronbach's Alpha test, which equals 0.890.

Scoring System:

The total score of the questionnaire was 33 grades. Each correct answer had one grade, while the incorrect one had zero.

The total score was categorized into:

Less than 50% was graded as unsatisfactory knowledge.

More than or equal to 50% < 70 was graded as satisfactory knowledge.

More than or equal to 70% was graded as good knowledge

3- Foot care self-efficacy questionnaire:

The researchers developed the Arabic questionnaire after reviewing the related literature (**Hinkle, & Cheever, 2018; Singh et al., 2020)**. It was designed to measure foot care self-efficacy for patients under study before and after the intervention. It was included a series of 31 distributed through nine sections, questions in the form of Yes/No statements covering the Patient's commitment to proper nutrition, controlling blood sugar levels, taking the medication regularly to avoid diabetic foot, quitting smoking, doing aerobic exercise regularly, daily foot care, selection of suitable footwear, neurovascular assessment and follow up. The reliability test was done using the Cronbach's Alpha test, which equals 0.970.

Scoring System:

The total score was 31marks. Each correct answer had one grade, while the incorrect one had zero.

The scoring system was divided into two levels:

- < 60% graded as inadequate self-efficacy.
- ≥ 60% graded as adequate self-efficacy.

Evidence-Based foot care protocol:

It was designed by the researchers to improve the patient's knowledge and practice regarding diabetic foot care. The researchers developed the content of intervention guidelines based on the related literature **(Berman et al.,2018; Hinkle & Cheever,**

2018; Schaper et al., 2020). Based on the experts' opinion, some modifications were done, and the final form was developed. It is written in the Arabic language and divided into two main parts.

The first part: included the theoretical background of diabetes and diabetic foot (as a definition of diabetes, Types of diabetes, Signs & Symptoms of diabetes, normal blood sugar level, Healthy foot habits for diabetic patients, drug treatment for diabetes, insulin therapy, acute complications of diabetes, Chronic complications of diabetes, specific complications regard to the foot care, the causes of foot problems and signs and symptoms of foot problems, signs & symptoms of diabetic infection and importance of follow up).

The second part: included self-care management regarding diabetic care (as how to prevent foot problems, neurovascular assessment of the diabetic foot, items of neurovascular assessment, daily foot care to diabetic foot such as inspect feet, skin care, proper nail cutting, selection of footwear of shoes and socks).

Ethical Considerations and Administrative approvals

The official authorization was obtained from the authoritative person in the hospital. The researchers introduced themselves to the patients who contented the inclusion criteria and informed them about the purpose of the current study to obtain their approval to share in this study. Patients were informed that they voluntarily participated in this study and could withdraw without giving reasons at any time. Verbal consent was taken from each participant to share in the study. Their confidentiality and anonymity were assured through coding the data obtained from them.

Pilot Study:

The pilot study was done on 10% of the sample to assess the tools' clarity and quantify the time required to complete the questions. Modifications and omissions of various details were made based on the results, and the final forms were created. Participants in the pilot study were not counted in the main study sample.

Content validity and reliability:

Evidence-based foot care protocol was subjected to a content validity test to determine whether the tools were adequate to achieve the aim of the study. The tools were submitted to a panel of five experts in medical-surgical nursing, community health nursing, faculty of nursing, and two professional consultant experts in endocrine medicine from the faculty of medicine, Ain Shams University. Test reliability of the proposed tools was ascertained with Cronbach's α, which showed a strong significant positive correlation between test A and re-test B).

Fieldwork:

The study was conducted through four phases: They are assessment, planning, implementation, and evaluation phase.

1. **Assessment phase:**

After reviewing the literature and preparing the study tools by the researchers, an official permit was obtained from the Faculty of Nursing ethical and research committee, Ain Shams University, and from the diabetic Outpatient Clinic at Ain Shams University Hospital, which is affiliated with Ain Shams University and verbal consent of the patients who were participating.

The data was collected; within six months, starting from June of 2021 to the end of December 2021. All patients who were present in the diabetic Outpatient Clinic during the period of data collection and met the criteria of subjects' selection were included in the study after obtaining their informed consent after explaining the aim of the study and its process.

- The Evidence-Based foot care protocol by the researchers. Goals, learning activities, teaching methods, and media (photo/video sharing services and network sites) were prepared.
- The total subject consisted of 140 adult diabetic patients was included in the study.
- Furthermore, data collection is started with each patient being interviewed individually.

- On admission, the researchers built a therapeutic communication with the patient to get co-operation after explaining the purpose of the study.

2. Planning phase:

Evidence-Based foot care protocols were designed based on analysis of the actual patients' needs in pre-assessment using the pre-constructed tools. The content was written in simple Arabic and consistent with the related literature. Moreover, met patients' needs and their level of understanding.

A group was established through the mobile WhatsApp application and its name (healthy foot). All the sample of the study was added to this group. This group's objective was to give proper health education to diabetic patients about a diabetic foot and to ease the communication with patients.

3. Implementation phase:

Evidence-Based foot care protocol includes the following knowledge concerning diabetic patients (definition of diabetes, types of diabetes, signs & symptoms of diabetes, normal blood sugar level, healthy foot habits for diabetic patients, drug treatment for diabetes, insulin therapy, acute complications of diabetes, chronic complications of diabetes, specific complications regard to the foot care, the causes of foot problems and signs and symptoms of foot problems, signs & symptoms of diabetic infection and importance of follow up) and self-care management regarding diabetic care.

The total numbers of diabetic patients were 140, divided into 14 main groups. Then implementation of the Evidence-Based foot care protocol was carried out through online teaching through Zoom for each group separately. Each group took two theoretical and two practical sessions. Each session took approximately 1.5 to 2 hours, and sometimes patients sent their questions privately because they did not like to share health problems with others. All patients were given equal chances to understand the Evidence-Based foot care protocol content to ensure exposure of all patients to the same learning experience. Each patient received the same Evidence-Based foot care protocol and used the same teaching methods and media.

4. Evaluation phase:

This phase aimed to evaluate the effect of evidence-based foot care protocol on foot care self-efficacy through assessment of the knowledge, foot care self-efficacy, pre-and post-3 months of the Evidence-Based foot care protocol implementation using the same tools.

Statistical Analysis

The statistical analysis was carried out using (SPSS) version 23 windows and was presented in tables and graphs. Data were analyzed using appropriate statistical methods. i.e., percentage, arithmetic mean (X), standard deviation (SD), For inferential analysis; the Chi-Square test and Pearson correlation coefficient (r) were used to explore the relationship and association between examined variables. Regarding P-value, it was considered that: non-significant (NS) if $P > 0.05$, Significant (S) if $P < 0.05$.

Results

Table (1) clarifies that the age of studied patients ranged from 25 - 65 years**;** more than half **(**57.1%) their age in between 50 – 65 years. For gender, more than two-thirds (67.1%) are females. Less than half of the patients (41.4%) have a bachelor's level of education or equivalent, followed by those at secondary school level (28.6%), while those with basic level education are 14.3%. This result shows that 71.4% of the patients are married regarding marital status. Meanwhile, 60.7% of them are not working.

Table (2) displays that most of the patients (82.9%) have a positive family history of DM, and the majority of them (94.3%) have type II DM. When assessing the duration of illness, the results show that (30.7%) range between 6 – 10 years, and (28.6%) have the disease for more than 15 years. Regarding treatment methods, this table shows that (72.9%) take oral medication. Over half of patients (55.7%) have irregular blood sugar levels. About (46.4%) of patients have hypertension, as shown in table 2. It also shows that (37.1%) of patients under study have foot problems, and (12.9 %) of them were admitted to the hospital because of these problems.

Table (3) describes patients' present history of the diabetic foot; it shows that gradual numbness in the foot is the most common symptom of neuropathy (48.6%), while the numbness in the leg is the most

frequent peripheral vascular disease symptom (41.4%). For Foot infection, about (27.1%) of patients have foot hotness.

Table (4) reveals that more than two-thirds of patients (69.3%) are not smoking, but (53.6 %) of them expose to passive smoking. Regarding regular blood glucose levels (52.1%), measure blood glucose regularly. More than half of patients (52.9%) are keen to update their DM and foot care information.

Table (5) illustrates that there is a statistically significant difference in all items of knowledge of DM pre/post-implementation of evidence-based foot care protocol (X^2 =91.23, p<0.000). Also, the total score of patients' knowledge about diabetic foot pre/post-implementation of evidence-based foot care protocol was statistically significant (X^2 =109.81, p<0.000). The also shows a statistically significant difference between pre/post-implementation of evidence-based foot care protocol and patients' total knowledge (X^2 =98.96, p<0.000).

Table (6) displays statistically highly significant differences (p<0.001) in all items of patients' self-efficacy of foot care between pre/post-evidence-based foot care protocol. 38.6%, 46.4%, 52.1%, 16.4%, 32.1%, 25.7%, 64.3%, 42.9% and 9.3% of studied patients had adequate self-efficacy regarding proper nutrition, control blood sugar level, taking the medication regularly, quit smoking, doing aerobic exercise, daily foot care, selection of suitable footwear, neurovascular assessment of foot and regular medical follow-up respectively pre-intervention, compared to 70%, 87.9%, 95%, 53.6%, 75.7%, 77.9%, 100%, 65.0% and 67.1% of them had a adequate self-efficacy respectively post-intervention.

Table (7) describes a significant positive correlation (r = 0.343 & P=0.001) between patients' total knowledge and their total self-efficacy regarding pre-intervention of evidence-based foot care protocol. Also, there is a highly significant positive correlation (r = 0.985 & P<0.000) between patients' total knowledge and their total self-efficacy regarding post-intervention of evidence-based foot care protocol.

Table (1): Frequency and percentage distribution of diabetic patients' sociodemographic characteristics (n=140)

Item	No	%
Age (years):		
25 - < 30	8	5.7
30 - < 40	8	5.7
40 - < 50	44	31.4
50 - 65	80	57.1
Range: 25 - 65		
Gender:		
Male	46	32.9
Female	94	67.1
Educational level:		
Read & write	22	15.7
Basic education	20	14.3
Secondary school	40	28.6
Bachelor	58	41.4
Marital status:		
Single	8	5.7
Married	100	71.4
Divorced	28	20.0
Widow	4	2.9
Occupation:		
Working	55	39.3
Not working (housewife or retired)	85	60.7

Table (2): Frequency and percentage distribution of the diabetic patients' family and medical history (n=140)

Item	No	%
Family history of DM:		
Yes	116	82.9
No	24	17.1
Type of DM		
Type I	8	5.7
Type II	132	94.3
Duration of illness (in years)		
≤ 5	39	27.9
6 – 10	43	30.7
11 – 15	18	12.9
> 15	40	28.6
***Method of treatment**		
Diet regimen and exercise	22	15.7
Oral medication	102	72.9
Insulin	53	37.9
Regularity of blood sugar level with diabetic treatment:		
Yes	62	44.3
No	78	55.7
***Having other chronic diseases:**		
Hypertension	65	46.4
Heart disease	37	26.4
Bone disorder	29	20.7
Blood disorder	27	19.3
CNS disorder	6	4.3
Skin disorder	4	2.9
Others	24	17.1
Not have other chronic diseases	22	15.7
Have any foot problems:		
Yes	52	37.1
No	88	62.9
Previous hospital admission due to diabetic foot problems		
Yes	18	12.9
No	122	87.1

* Items are not mutually exclusive

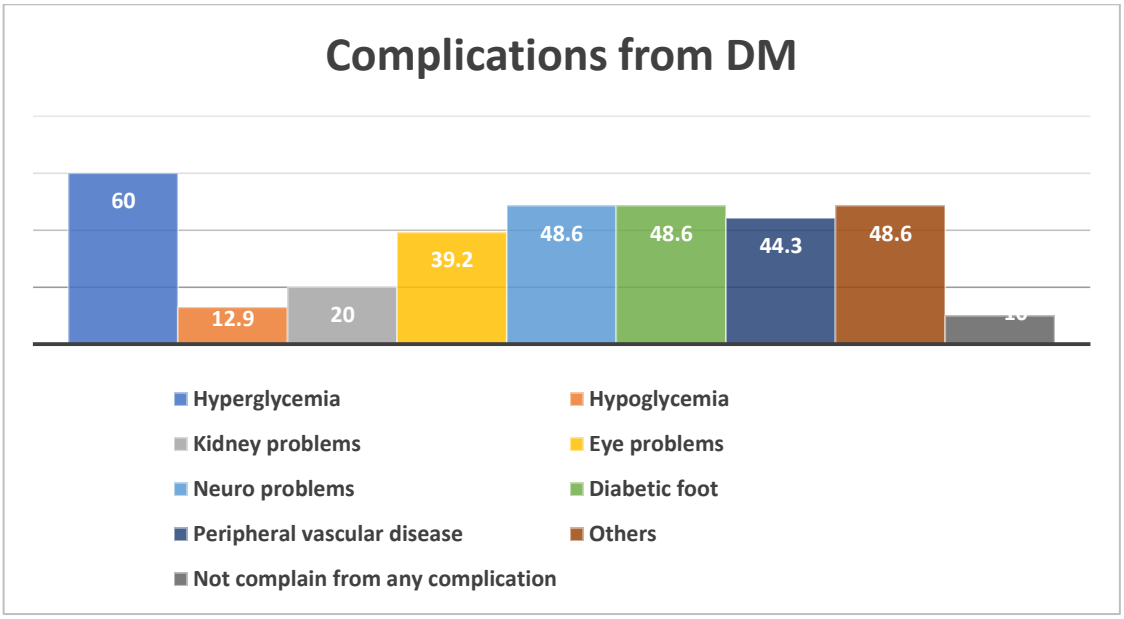

Fig. (1): Percentage distribution of diabetes mellitus complications among patients under study.

For complications from DM, the figure shows that the most common complication is hyperglycemia (60%), followed by neuro problems and diabetic foot (48.6%), then peripheral vascular disease (44.3%). In comparison, only (10 %) have not any complications.

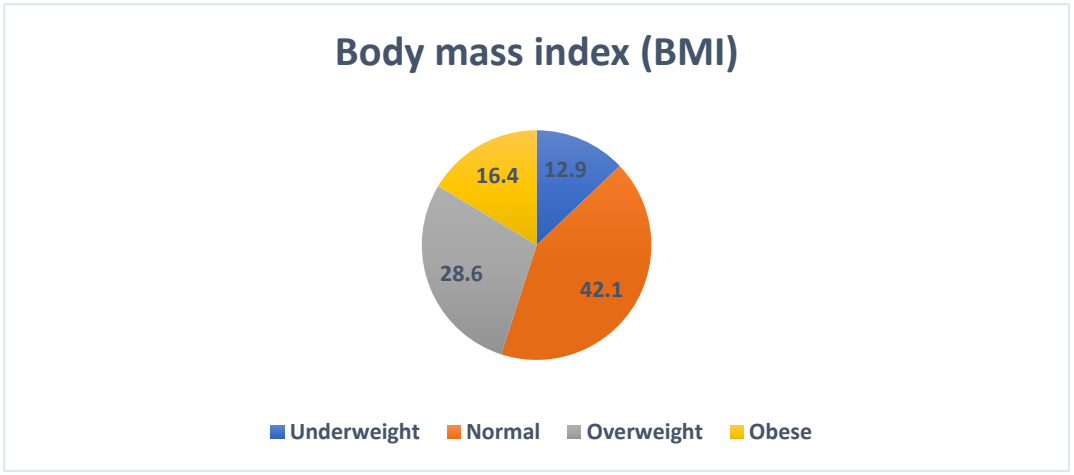

Fig. (2): Percentage distribution of body mass index among patients under study.

The above figure illustrates that (42.1%) have normal BMI (18.5 – 24.99) while (28.6%) are considered overweight (25 – 29.9).

Table (3): Frequency and percentage distribution of the diabetic patients' present history of diabetic foot (n=140).

Item	*No*	*%*
Symptoms of neuropathy:		
Burning pain while walking	40	28.6
Gradual numbness in the foot	68	48.6
Cold foot	44	31.4
High sensitivity to touch	18	12.9
Weakness in foot muscles	33	23.6
Irregular foot movements	28	20
Not present	37	26.4
Peripheral vascular disease:		
Painful cramps in the hip area	32	22.9
Muscle cramps after movement	28	20
Numbness in leg	58	41.4
Change the color of the leg	20	14.3
Shiny leg skin	28	20
Sores in toes and foot that do not heal	10	7.1
Not present	50	35.7
Foot infection:		
Redness of foot	26	18.6
Foot hotness	38	27.1
Discharge of pus	12	8.6
Bad odor from the wound	12	8.6
Loss of the ability to walk for a long time	22	15.7
Foot swelling	30	21.4
Deformation of foot toes and toenails	20	14.3
Not present	80	57.1

* Items are not mutually exclusive

Table (4): Frequency and percentage distribution of diabetic patients' habits (n=140)

Item	*No*	*%*
Smoking		
Yes	43	30.7
No	97	69.3
Expose to passive smoking (n=118)		
Yes	52	53.6
No	45	46.4
The regular measure of blood glucose level		
Yes	73	52.1
No	67	47.9
Keen to know all information about DM and foot care:		
Yes	74	52.9
No	66	47.1

Table (5): Comparison of patients' knowledge regarding pre/post-evidence-based foot care protocol (n = 140)

Item	Pre-intervention			Post-intervention			X^2	P value
	Unsatisfactory (%)	Satisfactory (%)	Good Knowledge (%)	Unsatisfactory (%)	Satisfactory (%)	Good knowledge		
Patients' knowledge about DM	79 (56.4)	55 (39.3)	6 (4.3)	9 (6.4)	88 (62.9)	43 (30.7)	91.23	< 0.00*
Patients' knowledge about Diabetic foot	98 (70)	37 (26.4)	5 (3.6)	13 (9.3)	97 (69.3)	30 (21.4)	109.81	< 0.00*
Total knowledge score	89 (85.6)	45 (32.1)	6 (4.3)	11 (7.9)	93 (66.4)	36 (25.7)	98.96	< 0.00*

***Statistically significant difference**

Table (6): Comparison of adequacy patients' self-efficacy pre/post evidence-based foot care protocol (n = 140)

Item	Pre-intervention (%)	Post-intervention (%)	X^2	P value
Proper nutrition	54 (38.6)	98 (70)	27.9	< 0.00*
Control blood sugar level	65 (46.4)	123 (87.9)	54.5	< 0.00*
Taking the medication regularly	73 (52.1)	133 (95)	66.1	< 0.00*
Quit smoking and prevent exposing to passive smoking	23 (16.4)	75 (53.6)	42.4	< 0.00*
Doing aerobic exercise	45 (32.1)	106 (75.7)	53.5	< 0.00*
Daily foot care	36 (25.7)	109 (77.9)	76.2	< 0.00*
Selection of suitable footwear	90 (64.3)	140 (100)	60.9	< 0.00*
Neurovascular assessment of foot	60 (42.9)	91 (65)	13.8	< 0.00*
Regular medical follow-up	13 (9.3)	94 (67.1)	99.2	< 0.00*
Total reported adequate self-efficacy of foot care	51 (36.4)	108 (77.1)	47.3	< 0.00*

Table (7): Correlation between total self-efficacy and knowledge of foot care pre/post-evidence-based foot care protocol (n=140)

Patients' Total self-efficacy	Patients' Total Knowledge	
	Pre-intervention	Post-intervention
	r (p-value)	r (p value)
Pre intervention	0.343 (0.001)**	-
Post-intervention	-	0.985 (0.000) **

*Correlation is significant at the 0.05 level

**Correlation is highly significant at the 0.001 level

Discussion

More importantly, with technological advances, the model of care delivery could be shifted from considering a patient as a passive recipient of care to an active engagement in the health ecosystem. The COVID-19 pandemic, in particular, accelerated the adoption of such a new care delivery model to facilitate remote care delivery to patients and empower them in self-care. It is estimated that DFU patients are seen in outpatient facilities 14 times per year and hospitalized approximately 1.5 times per year. As a nurse searching for alternatives to deliver timely care to patients with the presence or risk of DFU, it is tempting to imagine that a post-COVID future may lead to some positive changes in healthcare for people with chronic illness, particularly in promoting preventive and personalized care for people with DFU.

This study aims to evaluate the effect of evidence-based foot care protocol on foot care self-efficacy among diabetic patients during the Covid-19 pandemic.

Findings of this study revealed that more than half of the patients under study were 50 – 65 years. This finding might be suggested that increased age is associated with diabetes. This finding followed **Khalil et al. (2018)**, who mentioned that diabetes was most common in people older than 50 in their research titled "Prevalence of type 2 diabetes mellitus in a sample of the adult population of Alexandria, Egypt ".

In the current study, it was detected that more than two-thirds of patients were females. This result might be because most of the patients who agreed to participate in the study were females. This result agrees with **Abdelghani et al. (2022)**' who found that less than two-thirds of all patients who had DM were females in their study " Evaluation of perceived fears of COVID-19 virus infection and its relationship to health-related quality of life among patients with diabetes mellitus in Egypt during a pandemic: a developing country single-center study ". **Likewise, Amer et al. (2018), in the study titled "Influence of self-efficacy management on adherence to self-care activities and treatment outcome among diabetes mellitus type 2**," reported that a total of 392 diabetic patients were included in their study. Male patients were 212 (54.1%).

The results revealed that more than two-fifths of patients under study were highly educated. This finding could be related to evidence-based foot care protocol online, which is easy to use for educated patients. This finding corresponds with **Rusdiana and Amelia (2018)**. They stated that a study about diabetes self-management education found that more than one-tenth of all studied patients had academy/university degrees.

Our research found that three-quarters of patients under study were married. This finding might be because the age range of the studied patients ranged from 25 – 65 years. This finding agrees with **Pourkazemi et al. (2020),** who reported that most of the studied patients were married in a study about diabetic foot care. This finding might be because most studied patients were more than 30 years old.

In the present study, less than two-thirds of patients are not working (housewives or retired). This result might be related to more than two-thirds of patients under study being

females, and more than half were 50 – 65 years old. This finding is similar to **Manickum, Madiba & Ramklass (2021)**, who revealed that most diabetic patients in their study were unemployed.

Our study shows that most patients had a positive family history of diabetes. This finding might be due to the positive family history being considered a risk factor for diabetes. This finding corresponds with **Ramadan & Ali (2019),** who mentioned that more than two-fifths of patients in their study about motivational interviewing and its efficacy on glycaemic control had a positive family history of diabetes.

The present study reveals that most of the patients under study have type II DM. When assessing the duration of illness, the results show that less than one-third range between 6 – 10 years and more than one-quarter have had the disease for more than 15 years. This finding is not corresponding with **Adem et al. (2020**), who revealed in her study that two-thirds of patients had a diabetes history of fewer than five years and had type II DM.

Results of the present study indicate that less than three-quarters of patients under study were on oral medication, and more than one-third of them were on insulin therapy; more than two-fifths of them had hypertension as comorbidity. This finding might be related to the fact that most of the patients under study had type II DM. This result agrees with **Birhanu, Salih & Abate (2020)**, who reported that less than half of patients in their study were on oral medication and had hypertension. While our results disagree with **Messina et al. (2018)**, the study title was "Assessing self-efficacy in type 2 diabetes management: validation of the Italian version of the Diabetes Management Self-Efficacy Scale (IT-DMSES)," which stated that (43%) of the diabetic patients in their research were on oral hypoglycemic agent and comorbidities of the diabetic patient were dyslipidemia, hypertension, thyroid disease, and ischemic heart disease.

Concerning regularity of blood sugar level with diabetic treatment, more than half of patients under study had unregular blood sugar levels with treatment. This finding corresponds with **Mariam et al. (2017**), who found that about half of the patients had uncontrolled diabetes in terms of hemoglobin A1c (HbA1c).

Our study shows that more than one-third of participants have foot problems, and more than one-tenth of them were admitted to the hospital because of these problems. In congruence with this, a study in Japan among diabetic patients found that calluses and cracks were the most prevalent signs of non-ulcerative diabetic foot **(Takehara et al., 2019).**

Concerning complications from DM, our study revealed that the most common complication is hyperglycemia (less than two-thirds), followed by neuro problems and diabetic foot (less than half), then peripheral vascular disease (more than two-fifths), while only one-tenth of participants have not any complications. At the same time, **Mariam et al. (2017)** reported in their research that more than one-tenth of study participants had sensation loss to vibration. Peripheral vascular disease was detected in less than one-tenth of participants, and one-tenth had peripheral neuropathy. Similarly, more than a tenth of the study population had callus.

Also, our research revealed that more than two-fifths of patients have normal BMI (18.5 – 24.99), while more than one-quarter are considered overweight (25 – 29.9). This result could be because diabetic patients have realized the importance of minimizing their weight to avoid complications on their blood glucose levels. This result was in agreement with **Manickum, Madiba, & Ramklass (2021)**, who found that more than half of participants were overweight, and more than one-tenth were classified as obese. In comparison, our result is incongruent with **Amer et al. (2018),** who showed that the obese and overweight were (63.8%) of total diabetic patients in their study.

More than two-thirds of patients in the present study are not smoking, but more than half are exposed to passive smoking. This result agrees with **Wu et al. (2021**), which reported that most of the respondents were smoking or passively smoking.

The present study illustrates a statistically significant difference between pre/post-

intervention regarding patients' knowledge about DM, diabetic foot, and total knowledge where the majority of studied patients had unsatisfactory total knowledge pre-intervention compared to less than one-tenth of them had unsatisfactory total knowledge post-intervention. These differences in knowledge found in the present study might be related to the effect of evidence-based foot care protocol and easiness of finding complete information on the time the patients need through WhatsApp applications. The findings agree with **Abrar et al. (2020)**. They conclude that the educational video in traditional languages enhanced the patients' knowledge about diabetic foot care and thus could enable them to detect the risks for DFU and prevent DFU. This finding supports the first research hypothesis.

The current study findings illustrate a statistically significant difference among the study group pre/post-intervention regarding proper nutrition, control of blood sugar level, and aerobic exercise after implementing evidence-based foot care protocol. These differences among the patients under study might be related to evidence-based foot care protocol, which motivates the patient, especially those who are keen to acquire knowledge and skills that hopefully might improve their health. This finding was parallel with **El Gerges (2020)**, who reported that the experimental group showed significant improvement at the level of self-efficacy in managing their disease concerning general nutrition, specific nutrition, control of glycemia, and physical activity after therapeutic education.

Results of the present study indicated a statistically significant difference among the study group throughout program implementation regarding daily foot care. This difference might be related to evidence-based foot care protocol, which motivates patients through online teaching (Zoom) and WhatsApp applications to maintain foot care to avoid complications, especially the diabetic foot. This finding followed **Hailu, Moen, & Hjortdahl (2019).** who found significant improvements in the intervention participants' adherence to foot care recommendations after diabetes self-management education.

Concerning quitting smoking and preventing exposure to passive smoking, this study finding showed a statistically significant difference among the study group pre/post-evidence-based foot care protocol.

This improvement reflected the importance of evidence-based foot care protocol for diabetic patients; this could be because the patients became aware of the importance of quitting smoking and preventing exposure to passive smoking, so they have the desire to overcome its problems and complications. This result followed **Ramadan & Ali (2019),** who mentioned that motivational interviewing for patients with diabetes might assist them in quitting smoking.

Concerning sticking to regular follow-up for patients under study, this study finding showed a statistically significant difference among the study group pre/post-evidence-based foot care protocol. This difference might be related to applying the evidence-based foot care protocol, which motivates patients to maintain follow-up. **Ramadas et al. (2018**) supported this finding, mentioning that follow-up for patients with diabetes improved at the end of the program.

Regarding medication regimens, there was a statistically significant difference among the study group pre/post-evidence-based foot care protocol. This finding indicates that evidence-based foot care protocol motivated patients to follow medication regimens.

This finding was congruent with **Ramadan & Ali (2019),** who stated that the participants were more likely to carry out self-management about taking medication after motivational interviewing implementation.

The present study describes a statistically significant difference in the neurovascular assessment of the foot between pre/post protocol. This difference in examination found among the patients under study might be related to following evidence-based foot care protocol to prevent complications by controlling blood sugar levels. This finding was parallel with **Zilliox, Chandrasekaran & Russell (2022),** who stated that to date, Improved glucose management and a lifestyle improvement program that includes a tailored

diet and exercise regimen are the only therapies that may be beneficial in avoiding or reversing diabetic neuropathy.

There is a significant correlation between patients' total knowledge and their total self-efficacy regarding pre-intervention of evidence-based foot care protocol. Also, there is a highly significant correlation between patients' total knowledge and their total self-efficacy regarding post-intervention evidence-based foot care protocol. This finding clarified that when patients' level of knowledge improved, their foot care self-efficacy also improved. The research hypothesis justified this improvement in patients' total knowledge and foot care self-efficacy. It attributed it to the fact that the evidence-based foot care protocol was planned after assessing patients' identified knowledge gaps and needs. This finding was supported by **Sari, Astuti & Merdekawati (2021)**, who stated there is a significant relationship between knowledge and self-efficacy in their study titled "Knowledge and Self-Efficacy Towards Eating Behaviors by People Living with Diabetes Mellitus".

To summarize, the results of this study support the research hypothesis that evidence-based foot care protocol will positively affect foot care self-efficacy for patients with diabetes during the Covid-19 pandemic. This finding agrees with **Fitriadi, Josef, & Danawati (2021)**, who reported that foot care education through WhatsApp Group impacts knowledge and foot care practice for diabetic patients. There is an increase in knowledge and foot care practice after providing education through the WhatsApp Group.

Conclusion:

Based on the findings of this study, it can be concluded that evidence-based foot care protocol had a statistically significant positive effect on patients' knowledge and their foot care self-efficacy of diabetic foot patients during the Covid-19 pandemic through online teaching (Zoom) and WhatsApp applications.

Recommendation:

The following recommendations are formulated based on the results of the study:

- Further research is necessary on a larger sample size that involves participants and nurses from other regions in Egypt to establish the generalizability of the findings in this study.
- Continuous training and educational programs must be designed for diabetic patients, especially during the Covid-19 pandemic, to get updated knowledge and practice to enhance foot care self-efficacy during the COVID-19 pandemic by using all educational media and utilizing the distance learning technologies.
- The researchers recommended that health care agencies unitize new technology as mobile what's-app, potentiating the concepts of telemedicine to ensure accurate health care to patients and minimize workload, especially during the Covid-19 pandemic.
- Physicians and paramedical staff need to spread awareness and education about diabetic feet.

Consent for Publication:

Informed consent was obtained from all participants.

Availability of data and materials:

The data sets analyzed during the current study are available from the corresponding author, EH, upon request.

Funding

None.

Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

Acknowledgments

Researchers would like to thank all participants who participated in the study. Finally, Researchers would like to thank the teaching hospital which permitted us to conduct this study.

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