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Effect Of Focused Education On Foot Care Practice And Self Efficacy Amongst Type 2 Adult Diabetics Attending A Tertiary Healthcare Clinic, South East Nigeria.

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Abstract

Background: Diabetic foot disease is a worldwide economic burden due to its increase in morbidity and mortality.

Objective: It assessed the effect of focused education on foot care and self-efficacy among type-2 adult diabetics, aimed at recommending strategies for preventing complications and improving their quality of life.

Method: Type two diabetic patients (142) that met the inclusion criteria were randomized into experimental and control groups. Assessment of diabetic foot-care knowledge, behavior and efficacy was done using an interviewer-administered questionnaire. Focused education intervention was given individually to the experimental group, while general education was given to the control group. Data were grouped and analysed using Statistical Package for Social Sciences (SPSS) software version 22. Mixed analysis of variance and paired t-test were employed in the analysis of data.

Results: Participants who received focused education improved significantly when compared to the control group on foot-care knowledge ($P=0.003$, effect size=5.16); diabetic self-efficacy ($P<0.001$, effect size=0.52) and foot self-care behavior ($P<0.001$, effect size=4.65).

Conclusion: Focused education significantly improved diabetic foot-care knowledge and self-efficacy, hence, adopting this management will serve as health promotion to prevent debilitating complications and most improve quality of life.

Keywords: Foot care, Diabetes, Self-efficacy

Introduction

Diabetic foot disease is a worldwide economic burden due to its increase in morbidity and mortality. Diabetes-related foot problems increase rates of admission to acute and community health services. Forty to seventy percent of lower extremity amputations have been credited to diabetes.**[1]** For developing countries, factors related to poverty, literacy and environmental barriers, delays in seeking treatment, and less priority given to foot care by both patients and health providers have been adduced as major contributing factors that can increase the risk of foot complications.**[2]** As the prevention of diabetic foot is the primary focus of this study, the need to offer the right education to diabetic patients to reduce the menace of foot complications with resultant limb loss in most cases had necessitated this study. The majority of foot ulcers result from often negligible foot trauma with background sensory neuropathy. The critical triad seen in patients with diabetic foot ulcers is peripheral sensory neuropathy, deformity, and trauma.**[3]**

A Nigerian study which highlighted the gaps in the knowledge and practice of foot care in diabetes mellitus (DM) patients underscored the need for an educational program to reduce diabetic foot complications. It identified illiteracy and low socioeconomic status to be significantly associated with inadequate knowledge and practice of foot care. **[4, 5]** According to the patients' characteristics, the

theory of knowledge, attitude and practice applies to encourage patients to go for periodic inspection and education about diabetic complications to enhance the knowledge and promote the self-care behaviors.**[6]**

One of the critical factors in achieving active self-care is self-efficacy, a phenomenon from a social cognitive theory that concentrates on one's confidence to perform a given behavior. Many diabetic patients are usually willing to learn more about their illness and take steps to control it, thus creating room for education to improve self-efficacy.**[7]** There is strong evidence that self-efficacy is directly linked to improved self-management practices.**[8]** There has been a paucity of literature on the effect of focused education on foot care and self-efficacy. However, several international studies have documented associations between self-efficacy and diabetes self-care. People with diabetes making their own decisions for improving blood sugar levels and performing related self-chosen actions and maintaining it in the long term is the critical element of diabetes self-care management.**[9]**

Materials And Methods

Study Design

This was a randomized double-blind controlled study whose data was collected from September 2018 to January 2019 and involved adult diabetic patients who met the inclusion criteria.

Sample Size Determination

The sample size was calculated using the formula. **[10]**

$$n = \frac{(Z_\alpha+Z_\beta)^2 \times [P_1(1-P_1) + P_2(1-P_2)]^2}{[P_1 - P_2]^2}$$

Where;

n = Minimum sample size in each group, Zα = 1.96, standard normal deviate corresponding to 95% confidence level, Zβ = 0.84, Standard normal deviate at desired power of 80%, P_1=the proportion with good knowledge of foot care and self-efficacy after the intervention (focused education), taken as 78%, P_2 = Control group response, taken as 63.13%.

Inserting the required information in the formula: n = 57 subjects

Adjusting for 20% attrition (that is 80% response) the sample size was calculated by dividing the original calculated sample size by the anticipated response rate as n/0.8 = 57/0.8, and approximately, a total sample size of 71 diabetics/ participants each for the study group and control group were selected, giving a total of 142 participants.

Sampling Method

An equal number of computer-generated codes BA and DC were used to group the diabetic patients who met the inclusion criteria: code BA was assigned to the intervention group and code DC for the control group. Simple random sampling was applied to select the first patient every day by simple balloting. Randomization of the study participants was done using the diabetic patient attendance register into two groups daily by the researcher. Participants were randomly assigned observing simple randomization procedures for either the experimental or the control group.

Inclusion And Exclusion Criteria

Inclusion in this study were adults aged between 18-60 years who had been diagnosed with Type 2 diabetes for at least one year, who voluntarily agreed to participate in the study, access to a mobile phone by the participant (this was necessary because of the weekly reminders sent to the participants in the experimental group). Exclusion from this study were type 2 adult diabetics with severe retinopathy, hearing loss, or psychiatric illness, gestational diabetes (since their diagnosis is usually less than one year).

Study Instruments

These included an interviewer-administered, semi-structured questionnaire (modified revised version of the Summary of Diabetes Self-Care Activities (SDSCA) measure,**[11]** Diabetic Foot Care Self-Efficacy Scale (DFCSES) for sense of self-efficacy**[12]** and Foot Self-care Behavior Scale (FSCBS) for foot care behavior.**[8]**) The questionnaire was divided into 6 sub-sections: S0ciodemography, Diabetic Foot Care Self-Efficacy Scale (DFCSES), Foot Self-care Behavior Scale (FSCBS), Diabetes Foot Assessment/Risk Screening Guide, blood parameter and physical examination.

Four research assistants were trained to assist with the recruitment and data collection. The researcher and the other assistants were involved in data collection, point of care testing and focused education to the intervention group, and general education of the control participants at baseline (T0 week). At 12 weeks (T12) from intervention, the research assistants were taught the process of simple balloting, randomization, allocation concealment, and blinding. Adherence to the structured options of the questionnaire helped to eliminate the possibility of inter-observer variation to a large extent.

Research Protocol

The study was in two phases, at the initial encounter and after twelve weeks. Informed written consent was obtained from the participants who were enrolled in the study.

Phase 1 activities were done at first contact (pre-intervention and intervention activities). Selected participants were made to sign the consent form for accepting to participate in the study. Each participant's socio-demographic characteristics were taken. The subjects were seen at different offices and the questionnaires for each subject were filled using face-to-face interviews. A total of two visits; Day 1 and twelve weeks after the intervention, were planned for both groups. At each visit, the questionnaire was filled, fasting blood glucose level was tested and foot assessments/testing were made. After the pre-test evaluations, booklets containing the demonstration

method and foot care health education were taught to the subjects on the experimental group and eventually given to them. A placebo booklet on general health education in Diabetes was taught and given to the control group. Appointments for the next visit were given to both groups. The researcher sent text messages weekly and made phone calls in the first and second months to re-emphasize the focused education on foot care practice for the experimental group only.

At the twelfth week (T12) evaluation, patients' foot care behaviors, self-efficacies, and fasting blood glucose levels, together with foot care practices were reassessed. All recruited subjects were motivated to keep to their appointments via free diabetic drugs and transport stipend. Foot care education was provided to each patient in the experimental group. An educational booklet designed to raise the self-efficacy of patients regarding foot care was given to each of the subjects in the experimental group. The focused education was provided on a one-to-one basis for each batch of the experimental group members per day; with each education session taking approximately 30 minutes. The Focused education was performed by using mixed learning methods consisting of lecture, question-answer, demonstration, and practice. The education booklet included information on healthy feet, diabetic foot complications, how diabetes affects your feet, and frequently occurring foot problems among others. General education of the control group was continued in the outpatient environment. The researcher did not attempt to intervene in the control group but an information booklet on general care in diabetes was given to them to serve as a placebo.

Phase 2 activity was purely post intervention. The control and the experimental groups were given appointments at the same time for the third month (T12). The same questionnaire was administered during the initial encounter.

Blinding

None of the participants had the power to choose the group they belonged to. Outcome assessors and the data analyst were kept blinded to the allocation. This blinding and evenness were maintained through proper counseling of the participants that no group was superior to others, sing the same picture cover for all manuscripts.

Measurements

After an overnight fast of 8-12 hours, an Accu-chek meter and strips (Roche Diagnostics, Mt Wellington, New Zealand) was used to assess the fasting plasma glucose of every participant using the non-dominant index finger. Care was taken to ensure the insertion of the correct code key and that all strips had the same batch number.

Data Analysis

The data was coded and analyzed using the Statistical Package for Social Sciences (SPSS) software version 22. Clinical parameters were presented using frequency tables. Descriptive statistics of quantitative variables were presented in means, medians and standard deviations, while the qualitative or categorical variables were presented in percentages and proportions. T-test statistics were used to assess the difference between two quantitative variables while Chi-square was used for categorical variables. Marginal means of overall graphs were used to assess the effect of educational intervention on diabetic foot care self-efficacy, foot-care behavior and foot-care knowledge between the two groups. The significance level was set at $p<0.05$, while the confidence level was set at 98%.

Results

Comparison of the Diabetic Foot Care Self-efficacy between the Experimental and the Control Group at Baseline and Post Focused Educational Intervention

The pre-intervention in the experimental and the control groups were similar ($p=0.27$). However, after the intervention, the experimental group had statistically significantly excellent self-efficacy when compared to the control group ($p<0.001$). See **Table 1**

Table 1: Comparison of the diabetic foot care self-efficacy between the experimental and the control groups at baseline and post focused educational intervention

(DFCSE)	Experimental (n=71)	Control (n=71)	$\chi 2$	p- value
Baseline			2.61	0.27
Poor	3(4.2%)	6(8.5%)		
Fair	61(85.9%)	62(87.3%)		
Excellent	7(9.9%)	3(4.2%)		
Post-Intervention			124.56	<0.001
Poor	0(0.0%)	4(5.6%)		
Fair	2(2.8%)	64(90.1%)		
Excellent	69(97.2%)	3(4.2%)		

NB: Diabetic Foot Care Self-Efficacy (DFCSE) *=significant p-value, χ^2 = Chi square test

Comparison Of The Diabetic Foot Care Behavior Between The Experimental And The Control Groups At Baseline And Post Focused Educational Intervention

At pre-intervention, more than half of the participants in both groups had fair foot care behavior (p<001). However, after the intervention, the experimental group had significantly very good foot care behavior when compared to the control group (p<0.001). See **Table 2**

Table 2: Comparison of the diabetic foot care behaviour between the experimental and the control group at baseline and post focused educational intervention

Diabetic Foot Care Behaviour	Experimental (n=71)	Control (n=71)	Test Statistic	p-value
Baseline			^13.07	<0.001*
Fair	46(64.8%)	64(90.1%)		
Very Good	25(35.2%)	7(9.9%)		
Post Intervention			**	<0.001
Fair	0(0.0%)	61(85.9%)		
Very Good	71(100.0%)	10(14.1%)		

NB: None with poor foot care behavior in both groups; *=significant p-value, **= Fisher's Exact Test, ^ (Chi square value χ^2)

Comparison Of The Changes In The Outcome Variables At Pre- And Post-Focused Educational Intervention Among The Experimental Group

There were significant changes in the mean in all the parameters of the foot care variables (Diabetic Foot Care Self Efficacy, Diabetic Foot Self Care Behavior,) in the baseline and post-intervention values of the experimental group. It is illustrated in **Table 3**

Table 3: Comparison of the changes in the outcome variables at pre- and post-focused educational intervention among the experimental group

Variables	Mean (SD)	t-test	p-value
Post-Intervention DFCSE	56.86(18.09)	-	<0.001
Pre-Intervention DFCSE	40.70(10.27)	11.90	
Post-intervention DFSCB	55.01(12.76)	-	<0.001
Pre-intervention DFSCB	43.40(8.03)	10.41	

NB: DFCSE=Diabetic Foot Care Self-Efficacy, DFSCB=Diabetic Foot Self Care Behavior.

Comparison Of The Changes In The Outcome Variables At Pre- And Post-Focused Educational Intervention Among The Control Group

Table 4 showed significant changes in the mean of the parameters of the foot care variables (Diabetic Foot Care Self Efficacy, Diabetic Foot Self Care Behaviour,) in the baseline and post-intervention values of the control group, though the effect on foot self-care behavior for this group appears weaker.

Table 4: Comparison of the changes in the outcome variables at pre- and post-focused educational intervention among the control group

Variables	Mean (SD)	t-test	p-value
Post-Intervention DFCSE	40.04(7.21)	-6.41	<0.001
Pre-Intervention DFCSE	38.31(7.45)		
Post-intervention DFSCB	43.32(6.61)	-1.79	0.08
Pre-intervention DFSCB	41.39(6.58)		

NB: DFCSE=Diabetic Foot Care Self-Efficacy, DFSCB=Diabetic Foot Self Care Behaviour, DFKS=Diabetic Foot Knowledge Scale.

Comparison Of The Effect Of The Intervention On The Experimental And Control Groups On The Outcome Variables Across Intervals Of Follow-Up

Table 5 showed a significant difference between the two groups in all the outcome variables before and after the intervention. The mean difference between the experimental and the control groups for DFCSE was significant at baseline/pre-intervention (p= 0.005) and at

post-intervention (p<0.001). The mean difference between the experimental and the control groups for DFSCB was significant at baseline/pre intervention (p= 0.003) and at post-intervention (p<0.001)

Table 5: Comparison of the effect of the intervention on the experimental and control groups on the outcome variables across intervals of follow-up

Variable	Group	Mean Difference	t-test	p-value	Effect size
DFCSE T_0	Experimental Control	23.38	2.84	0.005	0.47
DFCSE T_1	Experimental Control	33.64	30.54	<0.001	0.52
DFSCB T_0	Experimental Control	4.01	3.07	0.003	0.52
DFSCB T_1	Experimental Control	23.38	27.73	<0.001	4.65

T_0=pre-intervention; T_1=post-intervention; DFCSE=Diabetic Foot Care Self Efficacy; DFSCB=Diabetic Foot Self-Care behavior.

The ANCOVA Results Of The Effect Of Educational Intervention On Diabetic Foot Care Self-Efficacy/ Foot Care Behavior Post-Intervention After Controlling For The Effect Of Confounders

To control for the effect of the baseline differences and other confounders such as age, level of education on the outcome variables, ANCOVA was used and the result showed that the focused education intervention significantly improved DFCSE (F=516.77, Sig.<0.001, Partial Eta Squared=0.94), DFSCB (F = 187.14, Sig.<0.001, Partial Eta Squared=0.85), post-intervention. See **Table 6**.

Table 6: The ANCOVA result of the effect of educational intervention on diabetic foot care self-efficacy/ foot care behavior post-intervention after controlling for the effect of confounders

Foot care self-efficacy post-intervention						
Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	42167.31	4	10541.83	516.77	<0.001	0.94
Intercept	3236.66	1	3236.66	158.67	<0.001	0.54
DFCSE Baseline	1999.54	1	1999.54	98.02	<0.001	0.42
Age	4.74	1	4.74	0.23	0.63	0.002
Education	70.21	1	70.21	3.44	0.66	0.03
Group	29308.35	1	29308.35	1436.73	<0.001	0.92
Error	2733.51	134	20.40			
Total	497082.00	139				
Corrected Total	44900.82	138				
Foot care behaviour post-intervention						
Corrected Model	19194.47	4	4798.62	187.14	<0.001	0.85
Intercept	6455.80	1	6455.80	251.77	<0.001	0.65
DFSCB Baseline	12.61	1	13.00	0.51	0.48	0.004
Age	3.79	1	3.79	0.15	0.70	0.001
Education	21.61	1	21.61	0.84	0.36	0.006
Group	16662.76	1	16662.76	649.84	<0.001	0.83
Error	3487.23	136	25.64			
Total	451189.00	141				
Corrected Total	22681.70	140				

Adjusted R Squared=0.84, Covariates: diabetic foot self-care behavior baseline score, diabetic foot care self-efficacy baseline score, age and level of education

Discussion

Foot Care Self-Efficacy

In **Table 1**, this study found that there was a significant improvement in foot care self-efficacy among participants who received focused education when compared with those who received general education ($p<0.001$). This was such that 97.2% of those who received focused education had excellent foot care self-efficacy when compared with 4.2% of those who had general education **(Table 2)**. Foot care self-efficacy even improved post intervention and across intervals of care **(Tables 4-6)**. Although the literature on the effect of focused education on foot care self-efficacy is sparse, one study by McCleary-Jones et al reported the beneficial effects of health literacy on foot care self-efficacy.**[13]** Similarly, Jiang et al reported significant improvement in foot care self-efficacy among participants who received focused education.**[14]** In another study, Bahador et al in their quasi-experimental study, reported significant improvement in the foot care self-efficacy after focused education.**[15]** The similarities in the findings of these studies with the current study may be due to the method used. For example, the setting of this study and that of Jiang and colleagues were similar. The primary similarity is that both institutions do not have focused education as part of the comprehensive management of type diabetes mellitus. Also, both studies used similar designs for evaluating the effect of focused education in the short term. These studies highlighted the importance of education tailored to specific needs in improving skills relevant to that area. The mechanism by which education improves self-efficacy may be multiple. One postulate from cognitive theorists is that education improves knowledge and confidence thereby shaping behaviour.**[16]**

Diabetic Foot Self-Care Behavior

There was a significant difference between the experimental and control groups in terms of foot care at 12 weeks after the focused education training **(Table 3)**. Most of the participants in the experimental group clearly showed a significant improvement in foot care behavior **(Table 4-6)**. The findings of this study are consistent with previous reports.**[17, 18]** Chin et al reported that diabetic foot care training increases the foot care behavior of patients and significantly reduces the disease complications.**[18]** Similarly, Baba et al., found that educational intervention improved foot health and confidence in undertaking preventive measures in foot care.**[19]** Though their work was community-based, it was similar to the present study in that it combined both written and interactive sessions in the education program. Furthermore, Adarmouch et al. found a general improvement in foot care practices after the intervention.**[20]** This improvement is similar to other studies.**[14, 21, 22]** Bell and colleagues, observed that educating patients about foot self-care may encourage routine foot care, especially when either formal or informal support is available to the individual.**[17]** The similarities in the findings of these studies with the present study may be due to methodological overlap, as both studies used similar study populations and focused education as against unstructured education routinely given by clinicians was used with use of personalized/individualized education intervention during the consultation. The findings generally support the robust evidence in the literature that education tailored to specific needs is useful in improving behavior. **[17-19]** The plausible explanation for the findings of this study may be that focused education improves knowledge about a specific subject, thereby modifying behavior. Also, the participants in the experimental group were more educated at the baseline when compared with the control group. The prior higher education may make the experimental group more likely to accept focused education on their illness and modify their behaviors accordingly. Furthermore, the weekly text messages and scheduled calls effect, which may increase supportive relationships among participants may have affected the outcome, since the education alone may not necessarily lead to behavioral changes. However, this study only focused on the effect of tailored education on diabetic foot care behavior in the short-term, whether similar effects are maintained after a long time needs to be investigated in Nigeria using a cohort followed up for a more extended period.

Conclusion

The result of this study has clearly shown that the implementation of an education program on self-care, particularly diabetic foot care, in our outpatient clinics will significantly improve the self-efficacy and feet care in diabetic patients. This educational intervention indicates the importance of training in patient's empowerment and their self-care.

Work attributed to: Department of Family Medicine, Alex Ekwueme Federal University Teaching Hospital, Abakaliki, Ebonyi State, Nigeria

Authors' contributions

CCA and CSA-O conceptualized and commissioned the study, performed the literature search, screened for the selected studies, extracted the data and wrote the initial draft of the manuscript. CSA-O, OAI, NAE, HUO, OA-O, IHA and CBA proposed the methodology, performed the analysis and interpretation of results. CCA, CSA-O, OA-O, IMI, NAE and IHA revised and supervised every aspects of the study. All the authors reviewed and approved the final manuscript.

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towards the successful conduct of this research. Special thanks to the respondents who gave their consent and participated very actively in this research.

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Availability of data and materials

The sets of data generated and analyzed in this study are available from the corresponding author on reasonable request through e-mail.

Ethical Consideration/consent to participate

Ethical approval was obtained from the hospital ethical review and research committee (FETHA/REC/VOL.1/2016/380). This research work complied with the Helsinki declaration 2013 on human research. Verbal and written consent was obtained from the participants and permission to carry out the study was obtained from the Head of the Department, Family Medicine, AEFUTHA. In the letter of consent, participants were assured of confidentiality.

Conflict of interest: There was no conflict of interest recorded in the study.

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