Effect of Diabetic Foot Care Training Program for Family Caregivers on Diabetic's Outcome

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ABSTRACT

Background: Diabetic foot (DF) is the most serious complication of diabetes mellitus associated with major morbidity, mortality, and reduced quality of life. The most common cause of hospital related admissions and is responsible for 70% of all lower limb amputations. It presently affects 15-25% of all diabetic patients during their lifetime. Aim: To assess the effect of diabetic foot care training program on family caregiver's knowledge and practice and diabetic's outcome. Design: A quasi-experimental with pre-
test/post-test design will be utilized. Sample: A non-probability sample of 134 family caregivers. Setting: This study was conducted at the diabetic outpatient clinic, at the National Institute of Diabetes and Endocrinology. Tools for Data Collection: Three tools were used: a- Family Caregiver's Structured Interviewing Questionnaire, b- Family Caregiver's Observational Practices Checklist, c- SINBAD Classification Observational Checklist. Results: The mean age of the family caregivers who participated in the study was $29.7 \pm 6.1$ years, $78.4\%$ of them had poor knowledge and $90.2\%$ of them had unsatisfactory practice regarding diabetic foot care before implementation of the training program and there was a statistically significant positive correlation in pretest and immediate posttest regarding knowledge and practices of the studied caregivers ($p=0.0001$ & $p=0.0001$) respectively. Conclusion: There is an increase in the knowledge and practices mean scores in immediate and follow up posttests compared to pretest mean scores and there is a decrease in the SINBAD mean scores of follow up posttest compared to pretest. Recommendations: The diabetic foot care training programs should be developed on a community level to enhance family caregiver's skills ability to care for their patients with emphasis on the most important risk factors and appropriate management. Furthermore researches on wide scale to confirm study results.

Diabetes mellitus (DM) is a major public health problem that is approaching epidemic proportions globally and is one of the largest global health emergencies of the 21st century. It affects about one every eleven individuals all over the world (Adem, et al., 2020). It presently affects over 463 million people worldwide and this number is expected to reach 700 million by the year 2045, the prevalence is higher in urban areas than rural areas and in high-income countries than low-income countries (The International Diabetes Federation (IDF), 2020).

DM is associated with increased rates of several microvascular complications such as nephropathy, retinopathy, and neuropathy, and...
macrovascular complications such as atherosclerosis and stroke, peripheral vascular disease and foot ulcers. About 60% of diabetics will develop neuropathy, eventually leading to a foot ulcer. Proper diagnosis and management of diabetes are crucial to reduce its health and economic burden on patients as well as the broader communities (Lin, et al., 2020).

Diabetic foot ulcer (DFU) is a major complication of diabetes that is not being managed. It has significant health and socioeconomic problems holding adverse effects on the quality of life and imposing a heavy economic burden on the patient's families and the health sector. One of the common outcomes of diabetic foot complications is lower limb amputation and subsequent physical and emotional problems. Diabetic patients are 10–15 times more likely to require lower limb amputation than non-diabetic (Monteiro, et al., 2020).

Diabetic foot problems are the most common cause of hospital related admissions for diabetics rather than any other long-term complications of diabetes and are responsible for nearly 50% of all-diabetes-related hospital admission. The lifetime risk of a patient with diabetes developing a DFU is 25%, up to 85% of all lower-limb amputations in diabetes are preceded by foot ulcers and every 20 s someone in the world has an amputation of (part of) the leg because of diabetes It is also estimated
that 24.4% of the total health care expenditure among the diabetic population is related to foot complications (Zubair, 2020).

Family caregiver's education is a cornerstone for preventing foot problems (as callosities), improving their knowledge and enhancing their compliance with appropriate foot care. Family caregiver's health education is likely to be effective in reducing the burden of diabetic foot ulcer and promote healing of foot ulcers (Messenger, 2019).

**Aim of the study**

The present study aims to assess the effect of diabetic foot care training program on family caregiver's knowledge and practice and diabetic's outcome.

**Research hypotheses**

To fulfil the aim of this study the following research hypotheses are formulated:

H1: The family caregivers who receive diabetic foot care training program will have higher knowledge scores in post-test than their pre-test scores.

H2: The family caregivers who receive diabetic foot care training program will have higher practice scores in post-test than their pre-test scores.
H3: Diabetic foot will be improved after program implementation.

Research Design:

A quasi - experimental one group pre-test – post-test design was utilized in this study.

Setting:

The study was conducted at the diabetic foot out-patient clinic, at National Institute of Diabetes and Endocrinology (NIDE). Cairo, Egypt.

Sample:

A non-probability sample (consecutive) of 134 family caregivers and their diabetic patients with diabetic foot ulcer (grade 1 or grade 2).

Tools of data collection:

First tool: Structured interviewing questionnaire:

It was developed by the researcher and is divided into 2 parts: 1st part: (1) Family caregivers’ demographic characteristics: consisted of 11 questions regarding demographic characteristics of family caregivers such as gender, age, relationship with the patient, marital status, education, occupation, family income, presence of chronic illnesses, previous
information about diabetic foot & source of information. (2) Diabetic patients’ demographic characteristics: consisted of 12 questions regarding demographic characteristics of diabetic patients such as gender, age, weight, height, blood glucose level, Hb A1C, presence of chronic illness and type of medication for treating diabetes.

2nd part: Family caregivers’ knowledge regarding diabetic foot care: It was developed by the researcher and consisted of 28 questions such as what is diabetic foot, causes, signs, symptoms, and complications of diabetic foot, how to prevent diabetic foot, importance of foot care, steps of foot care & foot examination, importance of cutting nail, importance of wearing socks, kind of socks, types of shoes, importance of exercises, types of exercises, components of diabetic diet, food which should be limited for diabetic patient, food to eat freely, food that help in wound healing, methods for treating diabetic foot, experience about wound care and steps for wound care.

Family caregivers’ knowledge scoring system:

The complete answer was giving two scores, (27 questions equal 54 scores), incomplete answer was giving one score and unknown answer was giving zero. A total score of knowledge was computed by summing correct responses of all questions. The total points were 56 points considered: the score $\geq 75\%$ referred to good knowledge, score $60 - < 75\%$ referred to
average knowledge and score < 60% referred to poor knowledge ((Waheida, et al, 2018).

**Second tool: Family caregivers’ observational Practices checklist regarding diabetic foot care:** It was developed by the researcher & consisted of 30 question to observe the following practices of the family caregivers such as foot examination such as change of foot colour, presence of ulcer and callus, skin dryness, callus, presence of infection between toes, nail abnormalities, foot deformity.

**Family caregivers’ observational Practices scoring system:**

On scoring this part, each item will be checked as done or not done. If the proper action is done one score was giving (31 items equal 31 scores) and if not done zero was giving. The total practice scores were summed and converted to percentage. The total points were 31 points considered. The score ≥ 75% referred to satisfactory practices and the score < 75% referred to unsatisfactory practices (Abdullah & Al Senany 2017).

**Third tool: SINBAD classification observational checklist:** It is adopted from International Working Group on the Diabetic Foot Guideline. It
referred six items about site, presence of ischemia, neuropathy, bacterial infection, area and depth.

**SINBAD scoring system:** consists of 6 parameters and scored between 0 and 6. Score < 3 referred to less severe ulcer with a mean healing time of 77 days and score ≥ 3 referred to severe ulcers with a mean healing time is range from 126–577 days (Venkatraman, et al, (2020).

**Validity and reliability of the utilized tools**

Content validity of the study tools 1 & 2 was done by a panel of three expert professors in the field of community health nursing. The researcher asked the experts’ link each tool objective with its respective item. Cronbach’s Alpha was done to determine the internal consistency of the developed tools (0.84-0.84) for knowledge and practice respectively.

**Data collection procedure**

An official written approval was obtained from the research ethics committee and the related committees at Faculty of Nursing- Cairo
University as well as research ethics committee at General Organization for Teaching Hospitals. These approvals were followed by obtaining formal permission from the director of National Institute of Diabetes and Endocrinology to approve the fieldwork and collecting data. The researcher explained the aim and steps of the study to the family caregivers. They were informed that all answers will be confidentially kept and they have the right to withdraw from the study at any time without giving any reason, the family caregivers will be informed that the data will be used for the purpose of this study only. Written consents were obtained from the family caregivers who accepted to participate in the study.

The study was carried on four phases: assessment, planning, implementation and evaluation phase. Assessment phase: it included assessment of family caregivers and their diabetic's demographic characteristics and family caregivers’ knowledge by using family caregivers’ structured interviewing questionnaire and the family caregiver's practices regarding diabetic foot care by using observational Practices checklist. The patient with diabetic foot ulcer was assessed by using SINBAD classification observational checklist. Planning phase based on assessment results and comprehensive review of relevant literature, the researcher designed the training program about diabetic foot care to improve family caregiver's knowledge and practices.
Implementation phase: The designed training program was carried out on six teaching sessions through pre-designed materials and the duration of each session was 30 minutes. The selected participants were divided into 20 groups; each group consisted of 6-7 family caregivers. An orientation to the session objective took place in the beginning of each session; the booklet included comprehensive knowledge about diabetic foot such as definition, causes, signs & symptoms of diabetic foot, complications, and methods of prevention, and different modalities for management and wound care. Summary was given after each session. The booklet was distributed to the family caregivers at the end of the program.

During evaluation phase the researcher evaluated the effect of diabetic foot training program on family caregiver's knowledge and practices was done in this phase. The same tools were giving immediately after the program implementation and three months after the program to the same family caregivers to evaluate the knowledge and changes in their practices after the program.

**Ethical and legal considerations**

An official permission was obtained from the research ethics committee and the related committees at Faculty of Nursing- Cairo University as well as research ethics committee at General Organization for Teaching Hospitals were obtained to carry out the current study. Also an
official permission was obtained from the director of National Institute of Diabetes and Endocrinology. The researcher emphasized that participation in the study is completely voluntarily. Anonymity and confidentiality were assured.

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) program, version 27 was used for data analysis. Numerical data were expressed as means and standard deviations. Quantitative data were expressed as frequencies and percentages. Comparison between pre-test, post-test, and 3 months follow up test were done using t-test and ANOVA

Results

Table (1) Percentage distribution of the family caregivers’ demographic characteristics (N=134).

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Family Caregivers’ sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>63</td>
<td>47.01</td>
</tr>
<tr>
<td>Female</td>
<td>71</td>
<td>52.99</td>
</tr>
<tr>
<td><strong>Family Caregivers’ age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 25 years</td>
<td>25</td>
<td>18.66</td>
</tr>
<tr>
<td>25 - &lt; 30 years</td>
<td>53</td>
<td>39.55</td>
</tr>
<tr>
<td>30 - ≤ 35 years</td>
<td>26</td>
<td>19.40</td>
</tr>
<tr>
<td>35- ≤ 40 years</td>
<td>18</td>
<td>13.43</td>
</tr>
<tr>
<td>+40 years</td>
<td>12</td>
<td>8.96</td>
</tr>
<tr>
<td><strong>Family caregivers’ education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read &amp; write</td>
<td>45</td>
<td>33.6%</td>
</tr>
<tr>
<td>Primary education</td>
<td>60</td>
<td>44.7%</td>
</tr>
<tr>
<td>Secondary education</td>
<td>21</td>
<td>15.7%</td>
</tr>
<tr>
<td>University education</td>
<td>6</td>
<td>4.5%</td>
</tr>
</tbody>
</table>
Table (1) reveals that 52.99% of the family caregivers were females. Regarding the family caregivers age, 39.55% of them aged from 25 to 30 years old while 32.83% of them aged from 30 to 40 years old with a mean age of $29.7 \pm 6.1$ years. Also, this table shows that, 44.7% of them had primary education. 33.58% of the family caregivers had their own business, while 24.63% of them were housewives. Moreover, 32.08% of the family caregivers came to the clinic with their fathers, and 56.72% of the caregivers were married.

<table>
<thead>
<tr>
<th>Family caregivers’ occupation</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not working</td>
<td>21</td>
<td>15.67</td>
</tr>
<tr>
<td>Governmental work</td>
<td>33</td>
<td>24.63</td>
</tr>
<tr>
<td>Own business</td>
<td>45</td>
<td>33.58</td>
</tr>
<tr>
<td>Housewives</td>
<td>33</td>
<td>24.63</td>
</tr>
<tr>
<td>Retired</td>
<td>2</td>
<td>1.49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relationship to the patient</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Father</td>
<td>43</td>
<td>32.08</td>
</tr>
<tr>
<td>Mother</td>
<td>32</td>
<td>23.88</td>
</tr>
<tr>
<td>Brother</td>
<td>17</td>
<td>12.69</td>
</tr>
<tr>
<td>Sister</td>
<td>17</td>
<td>12.69</td>
</tr>
<tr>
<td>Others</td>
<td>25</td>
<td>18.66</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>47</td>
<td>35.07</td>
</tr>
<tr>
<td>Married</td>
<td>76</td>
<td>56.72</td>
</tr>
<tr>
<td>Divorced</td>
<td>6</td>
<td>4.48</td>
</tr>
<tr>
<td>Widowed</td>
<td>5</td>
<td>3.73</td>
</tr>
</tbody>
</table>
Figure (1) Percentage distribution of family caregivers’ total knowledge levels in pre, post and follow-up tests (N=134).

Figure (1) indicates that, 99.3% and 63.3% of the family caregivers had good level of knowledge in immediate and follow-up posttests respectively, compared to 78.4%, 0% and 0% of them had poor level of knowledge in pretest, immediate posttest and follow-up posttest respectively. This figure supported the first research hypothesis.

Figure (2) Percentage distribution of family caregivers’ total practice levels pretest, immediate and follow-up posttests (N=134).
Figure (2) indicates that, 98.5% and 85.1% of the family caregivers had a satisfactory level of practice in immediate and follow-up posttests respectively, compared to 90.2%, 1.5% and 14.9% of them had unsatisfactory practice in pretest, immediate and follow-up posttests respectively. This figure supported the second research hypothesis.

Figure (3) Percentage distribution of diabetic patient's total scores of SINBAD in the pretest and follow-up posttest (N=134)

Figure (3) indicates that, 47.8% of the diabetic patients had less severe ulcers and 52.2% of them had severe ulcers in the pretest. However, in the follow-up posttest the percentage of having severe ulcers decreased to 47.8%. This figure supported the third research hypothesis.

Table (2): Correlation between total knowledge and total practice scores in pretest, immediate posttest and follow-up posttest (N=134).
Table (2) clarifies that, there was a highly statistically significant positive correlation between family caregiver's total knowledge and total practice scores in pretest and immediate posttest (p=0.0001 & p=0.0001) respectively.

**Discussion**

Foot disease (DFD) is a major complication of diabetes, which includes foot ulceration. Multiple pathophysiological factors including peripheral artery disease and peripheral neuropathy lead to foot ulceration and around half of these ulcers become complicated by infection, often leading to hospitalization, amputation, and increased mortality. In consequence, DFD is a major challenge for the healthcare system, leading to enormous economic consequences for diabetic patients, their families, and government (Ahmed, et al., 2020).

The present study showed that more than half of the family caregivers were females, two-fifths of them aged from twenty-five to thirty
years old, and nearly one-third of the family caregivers came to the clinic with their fathers. Regarding marital status, more than half of them were married (Table 1). These findings were in the same line with the study conducted by Tuha, A., et al., (2021), who assessed the knowledge and practice regarding diabetic foot care on 344 family caregivers with their diabetic patients in Ethiopia and found more than half of them were females and more than two-thirds were married. On the other hand, the findings of the current study were in the contrast with the same study concerning the age, the researcher found that near one-quarter of the family caregivers aged from 41–50 years, and more than half came with their mothers. This discrepancy may be attributed to cultural differences.

Regarding education, more than two-fifths of the family caregivers had primary education (Table 1). One-quarter of them were housewives. This finding was in the same line with the study conducted by Pourkazemi, A., et al., (2020), on 375 family caregiver and their diabetics to assess knowledge and practice regarding diabetic foot care in Iran, and found more than three-quarters of them had elementary education. On the other hand, this finding contradicted with the above research who found that more than three-quarters of the family caregivers were housewives.
Regarding the total knowledge scores, the majority of the family caregivers and nearly two-thirds of them had good level of knowledge in immediate and follow-up posttests respectively, compared to more than three-quarters of the family caregivers had poor level of knowledge in the pretest (Figure 1). These results were in the agreement with a study done by Ali & Ghonem (2019), in Egypt who evaluated the effectiveness of the health education program regarding foot care among 64 diabetic patients and caregivers, and he found that all of caregivers and nearly two-thirds of them had good level of knowledge in immediate and follow-up posttests respectively, compared to the majority of the caregivers had poor level of knowledge in the pretest.

Regarding the total practice’s scores, the majority of the family caregivers had unsatisfactory practice in pretest while the majority of them had a satisfactory level of practice in both immediate and follow-up posttest (figure 2). These findings were in the same line with Saurabh, et al., (2018) in India, who evaluated the effectiveness of foot care education among 130 caregivers and patients with type 2 diabetes and he stated that more than half of the caregivers had unsatisfactory practice and more than one-third of them had a satisfactory level of practice in pretest and the average score for practice improved after implementation of the health education.
Concerning SINBD total scores, the present study results indicated that nearly half of the diabetic patients had less severe ulcers and more than half of them had severe ulcers in the pretest. However, in the follow-up posttest the percentage of having severe ulcers decreased to nearly half. This figure supported the third research hypothesis. These results contradicted Marzoq, et al., (2019), in Iraq who assessed the outcome of diabetic foot ulcers among 100 patients with diabetic foot ulcers and found that nearly two-thirds of the patients had healed ulcer, whereas the minority of them had persisted unhealed, one-quarter of the patients had a minor amputation.

The present study results indicated that a highly statistically significant positive correlation are found between the family caregivers’ total knowledge scores and total practice scores in pretest and immediate posttest (p=0.0001 & 0.0001) respectively. These findings were in agreement with the study done by Ahmed, et al., (2020) in Egypt, who found a highly statistically significant positive correlation between total caregivers’ knowledge and total practices ((p=0.000 & p=0.000) respectively.

Conclusion

Based on the findings of the present study, the diabetic foot care training program had significant positive effect on the family caregivers’
knowledge and practices toward diabetic foot care which evidenced by increase in their knowledge and practice mean scores in immediate and follow-up posttest compared to pretest mean scores. Also, the training program had significant positive effect on diabetic outcome which evidenced by the decrease in SINBAD mean scores follow-up posttest compared to pretest mean scores.

**Recommendations**

Considering the results of the current study, the following recommendations are suggested:

1- Including of the family caregivers as a main variable in diabetic foot training programs.

2- Regular educational programs should be designed for diabetic patients and family caregivers on a community level regarding risk factors of diabetic foot, appropriate care, and management of diabetes.

3- Research in the area of diabetic foot as well as diabetes prevention and care should be encouraged.

4- Furthermore, researches on wide scale to confirm study results.

**Source of Support:** Self

**Conflict of Interest:** None
References


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