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Nursing Interventions for Prevention of Foot Ulcers in Patients with Diabetes: an Integrative Review

REVIEW

Antonio Dean Barbosa Marques[1], Anne Kayline Soares Texeira[1], Thereza Maria Magalhães Moreira[2], Rhanna Emanuela Fontenele Lima de Carvalho[2], Ana Virgínia de Melo Fialho[2], Edna Maria Camelo Chaves[2]

1 Nurse. Phd student in the Graduate Program in Clinical Care in Nursing and Health of the State University of Ceará, UECE. Fortaleza, CE, Brazil.
2 Nurse. Professor in the Graduate Program in Clinical Care in Nursing and Health of the State University of Ceará, UECE. Fortaleza, CE, Brazil.

Contact information:

Antonio Dean Barbosa Marques.

Address: Av. Dr. Silas Munguba, 1700, Campus do Itaperi, Fortaleza, CE, Brazil.

antonio-dean@hotmail.com

Abstract

Objective: This study aims to perform a literature review of nursing interventions for ulcer prevention in patients with diabetic foot.

Method: This is an integrative review which included studies from BDENF, LILACS, IBECS, CINAHL and PubMed databases, as well as the virtual library SCIELO without time restriction.

Results: The authors identified fifteen articles that met the study criteria. Nursing interventions for ulcer prevention in diabetic foot were performed both individually and on a collective basis, or as combination. The huge majority of interventions were done in institutional programs for health promotion.

Conclusion: The current evidence demonstrates the importance of health education as a tool in diabetic foot and lower extremities amputation prevention. This type of education increases patient's awareness of their own disease and help them to develop skills for self-care and better lifestyle.

Keywords
Nursing; Diabetic Foot; Prevention e Control; Review.

Introduction

Diabetes mellitus (DM) has been considered one of this century's most serious diseases. It requires several interventions for its prevention, treatment and rehabilitation [1]. According to the International Federation of Diabetes, the number of people with DM may reach 642 million people by 2040 [2]. These alarming indexes are justified by the chronic complications caused by this disease, including micro-

vascular (retinopathy and diabetic nephropathy), macrovascular (coronary artery disease, stroke and peripheral vascular disease) and neurological complications [3].

Diabetic neuropathy is characterized by demyelination of axon segments due to chronic hyperglycemia. It causes functional and structural impairment of peripheral nerves, leading to lack of peripheral sensitivity, deformities and ulceration [4-5]. In addition, the pathological process of infection, ulceration or destruction of the deep foot tissues associated to neurological abnormalities and various degrees of peripheral vascular disease in the lower extremities of DM patients is known as diabetic foot [6]. Due to foot ulcerations, DM patients are usually susceptible to lower extremities amputation. According to several data, its prevalence and incidence have increased worldwide. It is also considered an irreversible, costly and incapacitating complication with severe physical, mental and social consequences [7].

Additionally, poor therapeutic education is one of the main risk factors for these complications. The American Diabetes Association (ADA) mentions the relevance of educational approach in preventing those complications and reinforce the importance of daily and proper care of the lower limbs in preventing ulcers occurrence [8]. The regular feet evaluation of patients with DM should be performed by family physicians or nurses at the recommended frequency [9]. In this setting, nurses have an essential role in the implementation of interventions aimed to prevent foot ulcers in DM patients.

Therefore, this research aims to investigate the current evidence on nurses' interventions in the prevention of foot ulcers in DM patients.

Methods

Researchers decided to carry out an integrative review of literature based on the following stages: elaboration of the guiding question; search in literature; data production; critical analysis of the included articles; comparison of the evidence and review presentation [10].

The elaboration of the guiding question was based on the PICO anagram, being P = for population; I = intervention (or exposure); C = comparison; and O = outcome. In order to formulate the question, it is recommended to define at least the P and the I parameters [11-12]. Thus, the following question was elaborated: what evidence is available about interventions developed by the nurses to prevent foot ulcers in people with DM? In this sense, P = person with diabetic foot, aged > 18 years; I = type of intervention used.

The following databases were used to select the articles: *Base de dados em Enfermagem* - BDENF, *Literatura Latino-Americana e do Caribe em Ciências de Saúde* - LILACS, *Indice Bibliográfico Español de Ciencias de la Salud* - IBECS (via Virtual Health Library - VHL), Cumulative Index to Nursing and Allied Health Literature - CINHAL, National Library of Medicine and National Institutes of Health - PUBMED (via *Portal CAPES*) and in the electronic library Scientific Electronic Library Online - Scielo-Br. The choice of the databases was motivated by the fact that they have national and international high-impact publications, by the breadth of the search spectrum and by the diversity of indexed journals.

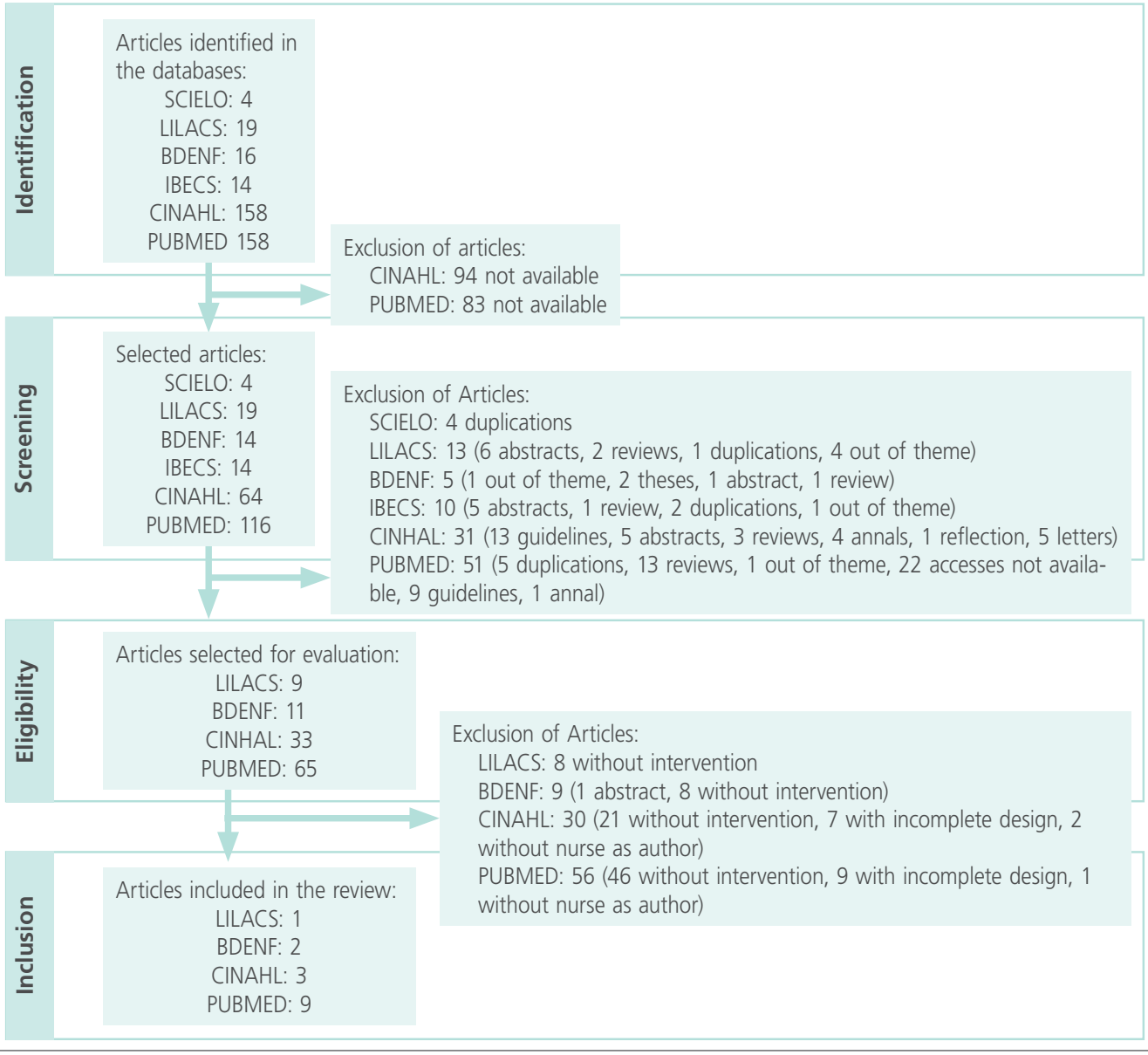
The inclusion criteria were: manuscripts available in full, without temporal cut, in the Portuguese, English or Spanish languages that addressed interventions for the prevention of foot ulcers in people with DM. Abstracts, annals, editorials, letters to the editor, revisions, reflections, duplicities, articles with incomplete details, dissertations, theses and articles without a nurse as author were excluded.

The data were collected in July 2016 by using the controlled descriptors in the following search equation: nursing AND diabetic foot AND prevention and control, According to DeCS (Descriptors in Health Science) e Mesh (Medical Subject Headings).

The PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) checklist [13] was used for the selection of studies. Initially, 410 publications were identified. Subsequently, three Relevance Tests (RT) were applied. The preliminary selection of the references was performed through the RT I, considering the inclusion and exclusion criteria, and 233 publications were included in the first moment. Subsequently, the RT II was applied, which consisted in reading the title and the abstract of the article. Following to the selected articles, the RT III was carried out, which consisted on reading the entire articles and identifying their pertinence **(Figure 1)**. The selected studies were categorized based on an adapted instrument [14] using a code for identification of the studies, objectives, interventions and outcomes.

For classifying the level of evidence (LE), the authors adopted the scheme proposed by Melnyk and Fineout-Overholt [15]: level 1 - evidence from a

Figure 1: Flowchart for the publications selection for the integrative review, based on the PRISMA model - Fortaleza-Ceará-Brazil, 2016.



systematic review or meta-analysis of relevant randomized controlled trials or from clinical guidelines based on systematic reviews of randomized controlled trials; level 2 - evidence obtained from at least one well-designed randomized controlled trial; level 3 - evidence obtained from well-designed clinical trials without randomization; level 4 - evidence from well-designed cohort and case-control studies; level 5 - evidence originating from a systematic review of descriptive and qualitative studies; level 6 - evidence from a single descriptive or qualitative study; level 7 - evidence from the opinion of authorities and/or expert committees report.

Results

Among the selected articles, only three were published in Brazilian databases, the other (n = 12) were published in international journals. Regarding the databases, one article was published in LILACS, two in BDENF, three in CINAHL and nine in PUBMED. It is worth noting that among the 15 articles that compose this study, eight were published in nursing journals, six in multidisciplinary journals and only one in a medical journal. Among those from nursing journals, two were from specialized publications (nephrology and vascular), while among multidisciplinary journals, four had scopes focused on DM care.

Regarding LE of the studies, the great majority of them were LE 3 (n = 5), followed by LE 4 (n = 4), LE 2 and LE 6, as presented in table 1. Regarding study designs, there was a predominance of cross-sectional and descriptive studies. When analyzing the target audience of the intervention, 14 studies had people with DM as target group, and only one study was directed to health practitioners (physicians, medical assistants and nurses) **(Table 1, 2)**.

Table 1. Characterization of studies based on level of evidence, type of study and target audience, Fortaleza-Ceará-Brazil. 2016.

	N	References
Level of evidence (LE)		
LE 2	3	17, 25, 29
LE 3	5	16, 19, 21, 23, 24
LE 4	4	18,20, 22, 27
LE 6	3	26, 28, 30
Type of study		
Cross-sectional	4	18, 20, 22, 27
Quasi-experimental	3	19, 21, 23, 24
Randomized	3	17, 25, 29
Descriptive	4	26, 28, 30
Target of intervention		
People with DM	14	16, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30
Health practitioners	1	18

Source: Data obtained from the selected databases, 2016.

Table 2. Distribution and characterization of studies included in the Integrative Review based on code, intervention and outcome, Fortaleza-Ceará-Brazil, 2016.

Code	Intervention	Outcome
16	Foot care program, which consisted of sessions of 30-60 minutes per patient for 2 years.	Reduction of *tinea pedis* severity score (P <0.001) and callus degree (P <0.001). High-risk patients had ulcers healed without developing gangrene.
17	Individual and group educational session, besides educational printed material.	The experimental group reached a mean of 15.8 before and 15.3 after pre-test. The control group has means of 15.22 and 14.33 after.
18	Disease management program. Education seminars for physicians and nurses.	Incidence of amputations decreased 47.4%. Reduction in hospital admissions due to diabetic foot decreased by 37.8%. The mean time of hospitalization was reduced from 4.75 to 3.72 days. All with p <0.05.
19	Questionnaire and educational activity based on the method of discussion and the prevention of foot injuries in diabetic patients.	Significant difference in foot care: nail trimming, proper footwear, use of cotton socks with no elastics and hydration of the feet.

Code	Intervention	Outcome
20	Multidisciplinary group education program	Patients still need to be encouraged to incorporate the daily examination of the feet, nail trimming in straight line, the use of moisturizers, files and cotton socks into everyday habits
21	Use of protocol, printed material and photographs about Buerger's exercises. Individualized education, home visits, and telephone counseling	Buerger's exercises combined with the health promotion program significantly improved the brachial pressure index and values of the Michigan neuropathy screening instrument
22	Intensive and individualized education in nursing about the disease and foot care. Risk questionnaire about diabetic foot ulceration	Decreased incidence of foot ulceration in high-risk patients. The incidence decreased from 7.00/100 people per year to 3.7/100 people per year after intensive nursing education
23	Questionnaire before and after implementation of the health education program. Teaching and training for three months.	The average knowledge of the patient, before and after implementation of the health education program: Problems in the feet was 1.18 and 1.57 (Student's t = 7.38 and p = 0.000). The warning signs of foot problems were 1.3 8 and 2.69 (Student's t = 4.90 and p = 0.000). Foot care was 1.03 and 2.37 (Student's t = 8.08 and p = 0.000)
24	Individual sessions (face-to-face) through interactive teaching, hands-on training, and telephone sessions to reinforce foot care	There was a reduction in the occurrence of skin, foot and toe problems (all p = <0.05)
25	Preventive program, regular evaluations.	Decreased frequency of neuropathy and use of adequate footwear by diabetic patients
26	Group intervention. Educational video (positive aspects through proper foot care)	Production of positive behavioral change over the outcome
27	Group intervention with education programs	Patients who participated in more than three education programs had significantly better performance on self-care
28	Educational intervention based on the Callista Roy's theory of cross-cultural adaptation. Questionnaire on measures to prevent amputation	Intervention programs should include spiritual-based messages relevant to amputation prevention
29	Group intervention with baseline measures of knowledge about foot care, self-efficacy	Better knowledge of foot care and self-efficacy, as well as reports of patients' self-care practices
30	Dynamics of presentation and group integration; dialogue-based exhibition; use of audiovisual resources; assessment of foot sensitivity and integrity	Increased demand from users for foot evaluation and for guidance on foot care

Source: Research data

Discussion

Nursing interventions for the prevention of diabetic foot were performed both individually [16, 21, 23, 25, 28-29] and in a collective basis [19, 20, 22, 24, 26, 30], or both [17-18, 27]. The vast majority of interventions were from institutional health promotion programs [16, 18, 20-21, 24, 26, 27, 29, 30]. These foot care promotion programs aim to empower patients for self-care, reducing the occurrence of diabetic foot ulcers, both at community and/or hospital level. It is emphasized that programs with nurses in the management process have better results [16, 21]. Educational programs are necessary to a proper self-care performance, especially in patients at higher risk [28]. The practice of self-care and/or taking care of the feet of people with DM requires the establishment of a close and collaborative relationship between patients and practitioners. Health education emerges as a strategy that facilitates this process of interaction, allowing awareness to motivate and promote changes in people's attitudes [18-20].

Early intervention is the best way to reduce the incidence of foot injuries in diabetic patients and consequently decrease lower extremity amputations [21]. One study emphasizes that health education cannot be part of a treatment, since the treatment must occur through the demands that arise during education sessions, considering the determinants and conditioning factors [23].

The foot care guidelines included: daily evaluation, nail cutting in straight line, non-cuticle removal, proper footwear, no bare feet, use of cotton socks without elastics, foot hydration and files [17-18, 20, 25].

Different approaches can be used to guide the education process. A study [28] based on Roy's model of adaptation in a church with African and American people pointed out excellent results, considering the influence of religious factors for the adoption and modification of care behaviors with the feet. A Brazilian study [19] that evaluated the discussion method to carry out educational activities highlighted significant changes in the process of managing foot care. The educational intervention based on this method allowed identifying and modifying habits and attitudes based on the dialogue, an emancipator educational practice. The intensity of the educational intervention is another corroborating factor for the reduction of foot ulcers incidence in diabetic patients [22]. Thus, patients who participate actively and regularly in educational programs had better performance and engaged more in the practice of self-care, reducing the number of complications [28].

For the promotion of behavioral changes, several resources and strategies have been used in the interventions, such as educational sessions [16-17, 20, 23, 25, 30], printed materials (letters, pamphlets, fliers) [18, 20-21], reinforcement phone calls [21, 25], educational videos [26], plays [30], professional update seminars [16-17], home and/or outpatient visits [20, 23, 28]. It is recommended that health services have, use, and promote resources and strategies to facilitate interventions for the prevention of foot injuries in diabetic patients, such as audio tapes, video tapes, pamphlets, fliers, magazines and books; reinforcement of social interventions (patient and family association); and further research on the evaluation of the impact of health education on diabetic patients [24].

The use of multimedia (video) resource about proper foot care is important for maintenance of healthy feet for people with diabetes. It promotes improvement in behavior over time, especially when the content of the video approaches positive aspects of adequate care. Thus, this resource emerges as a new education strategy to help health promoting behaviors [26].

It is important to have trained professionals capable to provide care and guidance on self-care. A study [18] showed that after the implementation of disease management program, the incidence of amputations decreased from 12.8/1,000 people

with diabetes/year to 6.2 ($p < 0.05$); the number of hospital admissions due to foot injury decreased from 22.8/1,000 limbs /year to 14.2 ($p < 0.05$); the mean time of hospitalization was reduced from 4.7 days to 3.7 days ($p < 0.05$). In addition, there was a reduction in the number of specialist nurses to provide care.

Considering that behavioral changes are achieved, another strategy that can be adopted is the simulation of techniques on foot care. This allows reflection about the practices, not only by people with the disease, but also by their caregivers and by the health team, who intends to offer better quality care and with resoluteness [30].

In the development of this research, the authors sought to review studies with evidence about nursing interventions in several strategies to promote behavioral changes in preventive care of foot injuries of diabetic patients. As observed, the participation of these professionals was essential and there was shared responsibility and satisfaction within the process of behavior change through interaction with patients in the search for care.

Conclusion

The evidence analyzed should consider the characteristics of the target population, socioeconomic and environmental conditions, as well as the use of media resources, which potentiate changes in positive behaviors.

Health education has proved to be an adequate tool in the prevention of diabetic foot and consequent amputations of lower extremities. It led to awareness of people on the development and the adoption of skills for self-care and improvement of the lifestyle.

The aim of this study is to encourage health professionals, especially nurses working with DM patients, to carry out intervention research with theoretical support, as well as methodological designs with a higher level of evidence, contributing to improvement of the evidence-based clinical practice.

Among the limitations of this study, we highlight the discrepancy in the levels of scientific evidence of the analyzed articles. Despite of this, we cannot make generalizations and state that nurses are not performing high-level intervention studies. However, this reveals a thin line regarding methodological designs on the use strategies to increase prevention of diabetic foot.

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