Diabetic foot: nurses' care

Pé diabético: o cuidado de enfermeiras

Pie diabético: cuidados de enfermeira

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RESUMO

Objetivo: Descrever o cuidado para prevenção do pé diabético realizado por enfermeiras. **Método:** revisão integrativa da literatura a partir do levantamento realizado em janeiro de 2024 através da biblioteca virtual da PubMed. Foram incluídos artigos nos idiomas inglês e português, artigos originais relacionados ao tema e disponíveis na íntegra com acesso gratuito, publicados entre os anos de 2012 até o ano de 2024. Como critérios de exclusão: artigos que não atendam o objeto de estudo, duplicados, teses, livros, revisões e artigos não originais. **Resultados:** O levantamento resultou na seleção de 15 artigos que evidenciaram que o cuidado para prevenção do pé diabético se desenvolvem a partir da atuação do enfermeiro, e por meio da aplicação de cuidados, como avaliação do paciente, educação em saúde para os pacientes e a educação permanente para os profissionais de saúde, controle glicêmico, verificação do Índice tibial braquial-ITB para diagnóstico de doença arterial obstrutiva periférica (DAOP), uso de termometria cutânea ou imagem infravermelha, criação de software e exames laboratoriais. **Conclusão:** O estudo poderá contribuir para melhoria da qualidade de vida dos pacientes diabéticos através do conhecimento dos profissionais de enfermagem acerca dos cuidados elencados para melhor atender aos pacientes bem como contribuir com a diminuição de casos de úlceras em pé diabético.

Descritores: Pé Diabético; Atenção Primária à Saúde; Tecnologia; Complicações do Diabetes; Cuidados de Enfermagem.

ABSTRACT

Objective: To describe the care to prevent diabetic foot provided by nurses. **Method:** integrative literature review based on the survey carried out in January 2024 through the PubMed virtual library. Articles in English and Portuguese were included, original articles related to the topic and available in full with free access, published between 2012 and 2024. Exclusion criteria were: articles that do not meet the object of study, duplicates, theses, books, reviews and non-original articles. **Results:** The survey resulted in the selection of 15 articles that showed that care to prevent diabetic foot develops from the role of nurses, and through the application of care, such as patient assessment, health education for patients and continuing education for health professionals, glycemic control, verification of the brachial tibial index-ABI for diagnosing peripheral arterial obstructive disease (PAOD), use of skin thermometry or infrared imaging, creation of software and laboratory tests. **Conclusion:** The study may contribute to improving the quality of life of diabetic patients through the knowledge of nursing professionals about the care provided to better serve patients as well as contributing to the reduction of cases of diabetic foot ulcers.

Descriptors: Diabetic Foot; Primary Health Care; Technology; Complications of Diabetes; Nursing care.

RESUMEN

Objetivo: Describir los cuidados para la prevención del pie diabético brindados por enfermeras. **Método:** revisión integrativa de la literatura a partir de la encuesta realizada en enero de 2024 a través de la biblioteca virtual PubMed. Se incluyeron artículos en inglés y portugués, artículos originales relacionados con el tema y disponibles íntegramente con acceso gratuito, publicados entre 2012 y 2024. Los criterios de exclusión fueron: artículos que no cumplan con el objeto de estudio, duplicados, tesis, libros, reseñas y artículos no originales. **Resultados:** La encuesta resultó en la selección de 15 artículos que mostraron que los cuidados para prevenir el pie diabético se desarrollan desde el rol del enfermero, y a través de la aplicación de cuidados, como la evaluación del paciente, la educación en salud de los pacientes y la educación continua de los profesionales de la salud, la glucemia. control, verificación del índice braquial tibial-ITB para el diagnóstico de enfermedad arterial obstructiva periférica (EAP), uso de termometría cutánea o imágenes infrarrojas, creación de software y pruebas de laboratorio. **Conclusión:** El estudio puede contribuir a mejorar la calidad de vida de los pacientes diabéticos a través del conocimiento de los profesionales de enfermería sobre los cuidados brindados para atender mejor a los pacientes, así como contribuir a la reducción de casos de úlceras del pie diabético.

Descriptores: Pie Diabético; Primeros auxilios; Tecnología; Complicaciones de la Diabetes; Cuidado de enfermera.

Introduction

Foot ulcers in diabetic people are one of the most frequent complications of Diabetes Mellitus (DM) and are directly related to diabetic foot and a high risk of amputations. This reality, in addition to increasing morbidity and mortality rates and consequent occupancy of hospital beds, compromises people's quality of life. Thus, it is believed that nursing actions aimed at screening the risk of foot ulcers in diabetic people should be developed in order to prevent ulceration.[1]

As a serious public health problem, DM is a problem that exists worldwide. In 2010, the International Diabetes Federation[2] estimated that by 2025 there would be about 438 million people with this disease in the world, however, in 2020 it is already estimated that 25 million more than expected. The data is even more alarming if we consider that the estimates for 2030 and 2045 are 578 million and 700 million, respectively.[2] Brazil, in 2019, had more than 16 million people with diabetes, which places it in fifth place in the world ranking, behind China, India, the United States of America and Pakistan.[2] Although diabetes occurs worldwide, the projection of 170% for developing countries, where the disease tends to appear in earlier stages of life, is worrying, unlike in developed countries where the disease develops after the age of 65.[3] These data show that the evolution of this disease, especially in developing countries, can accompany people's lives for a long time and cause complications.

Several factors are associated with the increase in cases of diabetes, and contribute to a series of repercussions on people's lives. Factors such as the aging of the population, obesity, urbanization, sedentary lifestyle, inadequate diet, which can be attributed to the speed required in modern times, have contributed to the occurrence of diabetes.[2] In the face of the disease and prolonged coexistence with high glycemic levels, there are greater chances of developing complications, such as retinopathy, nephropathy, cardiovascular diseases and neuropathies.[4] These complications are chronic and affect the quality of life of people with diabetes. World indices, in turn, have shown that diabetes can have consequences in several areas and it should be noted that some of these can trigger other diseases.

Among the complications of diabetes, peripheral neuropathy is one of the most common and responsible for diabetic foot, a situation in which there is a loss of sensitivity, which can contribute to the formation of ulcers, associated with the difficulty of healing after the damage occurs.[3] Still on the diabetic foot, the International Working Group on the Diabetic Foot[4] defines it as an infection, ulceration and/or destruction of soft tissues associated with neurological alterations and various degrees of Peripheral Arterial Disease (PAD) in the lower limbs. These alterations, without due care, can worsen and culminate in amputation of the limb. Among a population of 7 million Brazilian diabetics, it is estimated that more than 400,000 have developed foot ulcers, which impacts more than 160,000 hospital admissions and more than half of these resulting in amputations.[4]

When referring to the annual medical expenses within the scope of the Unified Health System (SUS), for the care of people with diabetic foot, these expenses differ according to the type of care provided, ranging from the outpatient follow-up of a diabetic foot without ulcer, to the treatment of the infected or non-infected wound. Annual medical expenses total an estimated

value of R$ 586.1 million for the whole of Brazil, and most of the costs (85%) are for the care of people with ulcerated neuroischemic foot, about R$ 498.4 million.[5]

In this context, it is urgent that actions be taken by nurses in order to reduce medical costs, control factors that predispose to diabetes and also to avoid further complications due to foot ulcers. Such actions require that these nurses are prepared to assess, guide and monitor people with diabetes who are at risk or have already developed the disease. Study points to the importance of good care from professionals to improve the treatment of diabetes and reduce complications.[6]

It is understood that, due to the high prevalence of diabetic foot associated with the high costs that are generated to health systems, it is essential to contribute to the reduction of this complication. In view of this, it was motivated to study how the care for the prevention of diabetic foot performed by nurses is developed. Therefore, the general objective of this study is: To describe the care provided by nurses for the prevention of diabetic foot. The relevance of this study, as mentioned above, consists of social, professional and scientific impacts. It is important to emphasize that, when referring to the repercussions, it is understood that the visibility and deepening of the theme will result in the provision of a qualified, humanized and effective service for the assisted diabetic people, with a reduction in preventable diseases, expansion of screening and prevention of foot ulcers in these people, reduction of morbidity and mortality, improvement of healthy lifestyle habits and reduction of costs for the SUS.

Method

This is an integrative literature review, which consists of the construction of an analysis of the literature, with the purpose of contributing to discussions about research methods and results, in addition to obtaining a deep understanding of the phenomenon to be studied based on previous studies. The study was carried out based on the six stages that constitute the process of elaborating an integrative review.

In the first stage, identification of the theme and selection of the research question, the PICo strategy was used, which represents the acromion for problem/population (P), interest (I), context (Co), as shown in chart 1. Based on this strategy, the following question was defined: What care is provided by a nursing professional for the prevention of diabetic foot?

Chart 1 – Implementation of the IPCC strategy

Strategy	Definition	Application
P	Problem	Diabetic Foot
I	Interest	Care
Co	Context	Hospital and Primary Health Care

The second stage, referring to the bibliographic survey and search, was carried out in January 2024, through consultation of the PubMed virtual library, which comprises more than 33 million titles of biomedical and biological sciences literature from the National Library of Medicine of the National Institutes of

Health of the United States of America (USA). and in the Portal of Journals of the Coordination for the Improvement of Higher Education Personnel (CAPES), which gathers and makes available to teaching and research institutions in Brazil international scientific productions. For the search, the Health Science Descriptors (DeCS) in English were used, in order to expand the search, together with the PICo strategy, as shown in chart 2.

Chart 2 – Table of Search Strategies

Virtual Library	Search Strategy
CAPES	Diabetic Foot and Nursing Care and (Primary Prevention or Primary Health Care or Disease Prevention) and Hospitals
PUBMED	("Medical Informatics Applications"[Mesh]) AND "Diabetic Foot"[Mesh] AND "Hospitals"

The following inclusion criteria were considered: articles in English and Portuguese, original articles related to the theme and available in full with free access, published between the years 2012 and the year 2024. The exclusion criteria were: articles that do not meet the object of study, duplicate publications, theses, books, reviews and non-original articles.

In the initial survey, 549 manuscripts were found in CAPES and 147 in PubMed, totaling 696 publications. To assist in the selection and reading of these materials, both were submitted to Mendeley's bibliographic manager.

The initial screening of the research was performed by two reviewers independently, following the pre-established inclusion and exclusion criteria. A total of 389 studies were excluded due to unavailability free of charge and in full, 22 due to not meeting the established period, and 15 duplicates, leaving 307 studies. These were submitted to the reading of their titles and abstracts, and it was found that 262 were not related to the object of study. The remaining 45 articles were read in full, of which 30 did not present or did not make clear the care for the prevention of diabetic foot, leaving 15 articles selected for review. The process of identification, eligibility and inclusion of the study followed the recommendations of the Reporting Systematic Reviews and Meta-Analyses of Studies (PRISMA).

In order to better organize the collected materials that constitute the analytical corpus, a synoptic table was created, which contains information such as reference, year, title, objective, country, language, method.

The interpretations of the results were discussed based on the theoretical framework of the 2023 IWGDF Guidelines manual on the prevention and treatment of diabetic foot, the most updated version and translated into Portuguese.

Results

Reference/ year	Title/ Country of Publication	Methodology	Goals
FERREIRA et al., 2019[7]	Rehabilitation technology for self-care: Customised foot and ankle exercise software for people with diabetes/EUA	Software Development and Structure.	Develop, analyze and validate free software for the web that can be accessed through computers or smartphones, targeting people with DM..
RANUVE, MALAKAI RANUVE, MASOUD, 2022[8]	Healthcare workers' perceptions on diabetic foot ulcers (DFU) and foot care in Fiji: a qualitative study	Qualitative, descriptive study	To explore health care workers' (ER) perception of diabetic foot ulcers (UPD) and foot care in Rotuma, Fiji.
SARI et al; 2020[9]	Foot self-care behavior and its predictors in diabetic patients in Indonesia/ Indonêsia	This is a descriptive cross-sectional study.	To investigate whether peripheral neuropathy, diabetes, family support, depression, and knowledge affect the self-care of diabetic feet.
WANG et al; 2020[10]	Guidelines on multidisciplinary approaches for the prevention and management of diabetic foot disease/ China	Based on guidelines, combined with the clinical experience and research results of Chinese experts.	Contribute with medical team colleagues in China to improve diabetic foot management.
KAYA; KARACA; 2018[11]	Evaluation of Nurses' Knowledge Levels of Diabetic Foot Care Management/Turquia	Descriptive cross-sectional study	To assess the levels of nursing knowledge of the management of diabetic foot care and to determine influencing factors.

SHIH, CHIA-DING et al. 2024[12]	Effectiveness of a Continuous Remote Temperature Monitoring Program to Reduce Foot Ulcers and Amputations: Multicenter Postmarket Registry Study China	Retrospective analysis of a real continuous remote monitoring program	To evaluate the effectiveness of a real-world continuous remote temperature monitoring program in preventing neuropathic foot ulcers and amputations in patients with diabetes.
SCHMIDT; 2019[13]	A Tale of Two Eras: Mining Big Data from Electronic Health Records to Determine Limb Salvage Rates with Podiatry/EUA	Cross-sectional study that extracted and analyzed data.	To assess the impact of establishing an integrated, specialized podiatry service in the University of Michigan Health System (UMHS).
NETTEN et al; 2013[14]	Infrared thermal imaging for automated detection of diabetic foot complications /Holanda	Research through a thermal camera that had the results analyzed.	To analyze the applicability of high-resolution infrared thermal imaging for non-invasive automated detection of signs of diabetic foot disease.
LAZO-PORRAS et al.; 2020[15]	Foot thermometry with mHeath-based supplementation to prevent diabetic foot ulcers: A randomized controlled trial/ Peru.	Blinded evaluator study, randomized clinical trial with two parallel arms.	To compare the incidence of diabetic foot ulcers between patients receiving thermometry plus mobile health (mHealth) reminders versus those receiving thermometry alone.
CHI FAN et al; 2012[16]	Pulse Pressure and Michigan Neuropathy Screening Instrument are Independently Associated with Asymptomatic Peripheral Arterial Disease among Type 2 Diabetes Community Residents: Community-based	A screening program was carried out through questionnaires.	To examine the risk of factors in asymptomatic adults with type 2 diabetes for peripheral artery disease.

	Screening Program in Taiwan/ Taiwan		
MORI et al; 2013[17]	Morphological Pattern Classification System for Plantar Thermography of Patients with Diabetes/ Japão	A cross-sectional observational study was conducted at the Outpatient Clinic of the University of Tokyo Hospital.	Propose a new system for classifying thermographic patterns of the plantar front using a segmentation image technique.
LIU et al; 2013[18]	Statistical analysis of spectral data: a methodology for designing an inteligente monitoring system for the diabetic foot/Holanda	Determine appropriate subsets of optical filters for the SI system, investigating discrimination performance of blemishes on the skin.	Describe the methodology for designing an intelligent monitoring system involving spectral imaging for the diabetic foot, with spectral data acquired from spectrometer measurements on skin patches.
CHAVES, et al., 2021[19]	Elaboration and validation of a serial album for the prevention of diabetic foot/ Brazil	Methodological study.	To develop and validate the content of a serial album on diabetic foot prevention for use by Primary Health Care professionals
HIDALGO ; RAMÍREZ, 2023[20]	Assessment of Diabetic Foot Prevention by Nurses/ Espanha	Cross-sectional and observational descriptive study	To assess whether or not the nursing team follows the recommendations of national and international organizations regarding the prevention and treatment of diabetic foot.

Discussion

Nurse care for the treatment and prevention of diabetic foot

According to the selected literature, the following mild technologies were found for the prevention of diabetic foot in primary health care (PHC): establishment of relationships for the implementation of care by the multidisciplinary team, especially by the nurse, welcoming and promotion of self-care. In addition, the evaluation of the patient by the nursing team, health education for the patients and the continuing education for the health professionals were listed. In addition, it is necessary to know the risk factors for the development of diabetic foot in order to minimize them. Other forms of care listed were: glycemic control, verification of the Tibial Brachial Index (ABI) for the diagnosis of peripheral arterial obstructive disease (PAD), use of cutaneous thermometry or infrared imaging, creation of software and laboratory tests. It should be noted that these measures are also cited by the IWGDF.[4]

When it comes to the prevention of standing ulcers in diabetic people, the participation of nurses in this process is essential. In this context, nursing stands out for being the category that is in constant contact with the community, and it is their responsibility to ensure comprehensive care in health promotion and protection, disease prevention, diagnosis, treatment, rehabilitation and health maintenance, in addition to promoting educational actions to raise awareness among diabetic people.[3] It is the responsibility of nurses working in PHC to provide care to this population according to health needs. control and monitoring of diseases, registration, home visits, participation in the reception of diabetic people, as well as nursing consultations, procedures and management of supplies.[1]

Among the care provided to people with diabetes is the prevention of UPD, which has been discussed by several authors.[21] In this sense, the first International Consensus on Diabetic Foot was created in 2001, which recommends the following pillars to prevent these ulcers: (1) identification of the foot at risk; (2) regular examination of the feet; (3) educational approach; (4) ensure the use of appropriate footwear and (5) treatment of risk factors.[4, 18.]

In view of the above-mentioned pillars, studies have proven that interventions, especially those that include regular examination of the feet, together with risk classification and educational actions, reduce the prevalence of ulcers by half The identification of the foot at risk or risk factors that may develop UPD can be easily detected by the nurse through the clinical history and through the recommended risk classification system, where, depending on the identified risk, there is a need for frequent evaluation and examination of the feet.[4,18]

Regarding regular foot examination, experts recommend that people diagnosed with DM should be examined and evaluated, preferably, by the PHC nurse, as recommended by the Diabetic Foot Manual (2016), at least once a year. When presenting risk factors, these people should be examined more frequently to reduce this complication.[1,4] This clinical examination, associated with the clinical history and anamnesis, can identify the two most important risk factors for foot ulcerations, peripheral neuropathy and PAD.[1,7]

The examination should include the clinical history, the evaluation of the anatomy of the feet to check for deformities in the feet characteristic of DN, evaluation of skin color, hydration, temperature, presence of calluses, edema, and ulcerative signs; palpation of the pulses of the feet; assessment of tactile and protective sensitivity; and observe foot hygiene. Tactile evaluation can be done with the Semmes-Weinstem monofilament, which is a recommended method for DN tracking and the protective one with a 128 Hz tuning fork.[1,8]

Education is the first line of defense to prevent UPD and aims to modify the person's behavior regarding self-care, improve knowledge, and teach them to recognize ulcers and potential problems in their own feet and promote adherence to the instructions received, such as the use of appropriate shoes, glycemic control, among others.[10,11] In addition to diabetic people, health education should be aimed at health professionals and family members, when daily care involves these people.[4,9] Research has shown that these educational interventions, when applied, are effective and reduce foot ulcers.[10]

Educational actions for the prevention of diabetic foot should include encouraging daily inspection of the feet, glycemic control, the development of skills to identify and notify any changes in the lower limbs, in addition to explaining the importance of wearing appropriate shoes, moisturizing the skin and cutting the nails correctly.[4,16] Among these educational actions is guidance on the use of inappropriate footwear and the habit of walking barefoot, which are the main causes of trauma that precedes ulcerations in people with diminished tactile sensitivity and deformities, so it is necessary to encourage appropriate footwear in all environments, external and internal.[4,18]

The fifth pillar of UPD prevention states that people with diabetes should treat any risk factor or any sign indicative of ulcerations. Examples of this treatment include removal of calluses, protection of blisters, drainage (if necessary) and antifungal treatment for fungal infections.[4] There is also treatment in PHC of ulcers when they have already developed, however, depending on the degree of the ulcer, there may be a need for hospitalization.[6] According to the recommendations of the IWGDF[4], treatments can be performed by means of weight bearing and protection of the ulcer, restoration of tissue perfusion, treatment of infections, metabolic control, treatment of comorbidities, Local treatment of the ulcer through cleaning and dressing.[4,6]

Although guidelines, manuals and protocols emphasize the importance of preventing diabetic foot, prevention has not been developed effectively, and is considered a challenge for nursing in PHC.[19] The difficulty of the growth of cases of the disease, the lack of time of diabetic people and the shortage of nurses and diabetes educators. Other authors also bring as challenges the lack of knowledge of nurses, inadequate infrastructure, excessive demand, low level of education and age of the diabetic person and the lack of continuing education.[6]

Several of these ulcers could have been avoided or not resulting in amputations if nurses had been prepared to assess the risk and, consequently, guide people, and it is pertinent that these specialists have resources for such follow-up.[6] In addition, the exercise of ulcer prevention also involves self-care, it is understood that it is important to train the professional, but also to raise awareness to build their own responsibility with the assisted individual.[13]

Thus, it is believed that greater knowledge about care through social technologies for risk screening of standing ulcers in diabetic people in PHC can

support nurses to perform more qualified. In this context, it is of paramount importance that these professionals are trained and know the technologies to be used in the prevention of foot ulcers in diabetic people, based on scientific recommendations, improving the quality of care, acting from a holistic perspective and with the interaction of various disciplines.[21] It is worth mentioning that technological advances are constant, so it is also important to constantly update the knowledge of these nurses.

Conclusion

In the synthesis of the knowledge produced, it was evidenced that the care for the prevention of diabetic foot is developed from the performance of a multidisciplinary team, with the nurse as the main actor, and through the application of care, ranging from patient reception, serial albums to thermometry machines, help in the prevention of this disease.

The present study aims to benefit academics and professionals about a greater knowledge about diabetic foot and the role of nursing in its prevention. In addition, to improve the quality of preventive care for foot ulcers for diabetic patients and thus reduce the incidence of this serious health problem.

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