ORIGINAL ARTICLE

INFLUENCE OF CONTINUING EDUCATION ON THE PREVENTION AND CARE OF THE FEET OF PEOPLE WITH DIABETES

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HIGHLIGHTS: (1) Continuing education training has expanded nurses' knowledge about the assessment and care of the feet of people with diabetes. (2) There has been an improvement in the use of protective sensitivity tests and in the assessment of appropriate footwear and socks. (3) Barriers related to work management and organization persist, thereby limiting the effectiveness of preventive measures.

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INFLUENCE OF CONTINUING EDUCATION ON THE PREVENTION AND CARE OF THE FEET OF PEOPLE WITH DIABETES

ABSTRACT

Objective: to analyze the influence of continuing health education on nurses' knowledge and perceptions about the prevention and care of the feet of people with diabetes mellitus. **Methodology:** a quasi-experimental intervention study with a quantitative-qualitative approach, conducted with 36 nurses from Primary Health Care, based on a training course grounded in the principles of continuing education in health and the nursing work process. Quantitative data were collected using a pre- and post-intervention assessment instrument and analyzed using McNemar's Test ($p<0.05$). The qualitative data were obtained through focus groups and subjected to thematic analysis and strategic focal analysis. **Results:** The training influenced nurses' knowledge regarding aspects related to foot assessment, the use of the 128 Hz tuning fork for screening protective sensation loss, the assessment of appropriate shoes and socks, and the availability of supplies. The qualitative analysis revealed a central theme — "The foot of a person with diabetes: a journey of knowledge and action — uncovering the challenges of care management and administration" and two subthemes that highlight facilitators and barriers linked to health system management and care administration, thereby emphasizing continuous education as a structuring axis. **Conclusion:** continuing health education positively influenced nurses' knowledge and perceptions regarding the prevention and care of the feet of people with diabetes, although challenges related to management and work organization still limit the effectiveness of preventive actions in Primary Care.

Keywords: Continuing Education; Nursing; Diabetic Foot; Primary Health Care.

INTRODUCTION

Diabetes Mellitus (DM) is a growing health issue. If current trends continue through 2045, 783 million people will be living with the disease[1]. In Brazil, there are 13 million people with DM, corresponding to a prevalence of 10.2% among people over the age of 18[2]. When uncontrolled, DM can lead to serious complications and death. Among these complications, it is estimated that 484,500 ulcers and 80,900 amputations occur among a population of 7.12 million people with type 2 DM in Brazil[3].

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Follow-up and prevention programs for the feet of people with DM have shown effectiveness in reducing amputation rates, which points to the need for the continuing education of Primary Health Care (PHC) teams[4]. In particular, training for nurses is essential, due to their closeness to people with DM and their ability to raise awareness among people with DM about self-care. A study points out that 90% of people with DM have access to consultations in basic units; however, less than half received guidance on foot care, reflecting gaps in health services[5]. Therefore, access does not guarantee the necessary care, according to the guidelines of the Brazilian Ministry of Health, which recommend foot assessment by properly trained nurses[6].

In view of these justifications, the theme of "prevention and care of the feet of people with DM" is essential and requires the training of nurses. Thus, this study is proposed with the objective of analyzing the influence of continuing health education on PHC nurses' knowledge and perceptions about the prevention and care of the feet of people with DM, as well as the challenges involved in implementing preventive and care measures for people at risk of diabetic foot in their work process. This study is an excerpt from a master's dissertation entitled "Influence of continuing education on the prevention and care of the feet of people with diabetes."

Considering that the prevention of complications in the foot of a person with diabetes directly depends on the qualified performance of PHC professionals, different studies point to the need for continuous training that promotes clinical decision-making, early screening, and proper management of risk factors. In addition, this study is anchored in the concepts of the nursing work process[7], structured around five axes: assisting, managing, teaching, researching, and participating politically, which guide professional practice and reinforce continuing education as an essential dimension to transform care and strengthen the resoluteness of primary care.

In the context of Brazilian Primary Health Care, this study contributes by highlighting the effects of a continuing education intervention on nurses' knowledge and perceptions about the prevention and care of the feet of people with diabetes, linking managerial and care dimensions of the work process.

METHODOLOGY

This is a quasi-experimental intervention study with a quantitative-qualitative approach, developed in two complementary stages: a quantitative one, of an evaluative nature, and a qualitative one, of an exploratory nature, with the objective of analyzing the influence of a continuing health education action on Primary Health Care (PHC) nurses' knowledge and perceptions about the prevention and care of the feet of people with diabetes mellitus.

The study was conducted with nurses working in PHC in 12 municipalities belonging to a Regional Health Directorate of the State of São Paulo. Recruitment took place through an institutional invitation, mediated by the Regional Health Directorate, which publicized the training course proposal to the municipalities in the region. Interested professionals voluntarily expressed their participation and were included in the study upon meeting the eligibility criteria.

Nurses with at least one year of experience in PHC units were included, and professionals who, during the data collection period and the training sessions, were on leave or absent for any other reason for a period equal to or greater than three months were excluded, as well as those who did not meet a minimum attendance rate of 75% in the scheduled activities, including asynchronous classes, face-to-face meetings, and forum participation in the Virtual Learning Environment.

The final sample consisted of 36 nurses, characterized as a non-probabilistic, voluntary sample, consistent with the quasi-experimental design of the study, where there is no randomization of participants.

The intervention consisted of a training course on the prevention and care of the feet of people with DM, based on the references of Continuing Health Education and the nursing work process[7-8]. The course was offered in a hybrid format, using the Virtual Learning Environment called *Moodle Academic* for asynchronous activities, in addition to four face-to-face meetings. It lasted four months, totaling 120 hours. Data collection took place from December 2023 to March 2024.

For the quantitative stage, questionnaires on sociodemographic and work characterization were used, as well as diagnostic assessment questionnaires, pre-

intervention, and final assessment questionnaires, post-intervention. The analyzed variables covered nurses' knowledge, skills, and attitudes related to DM management, with an emphasis on preventive and care practices focused on foot care. The quantitative data were analyzed using the McNemar Test, adopting a significance level of 5% ($p<0.05$), with processing in the R software. The results are displayed in a table, where the whole numbers correspond to the questionnaire questions, and the subitems (1.1, 2.1, etc.) refer to the previously defined alternatives, which the participants either marked or did not. The table was organized in a way to allow a clear comparison of pre- and post-intervention responses.

The qualitative stage was developed through focus groups, conducted at the end of the intervention, with the objective of deepening the understanding of nurses' perceptions about the facilitators and barriers to the prevention and care of the feet of people with diabetes mellitus in PHC. The focus groups were conducted based on pre-defined guiding questions, and the sessions were mediated by the researcher, recorded by audio and later transcribed in full.

The analysis of the qualitative data followed the assumptions of Reflexive Inductive Thematic Analysis[9], articulated with Strategic Focal Analysis[10], to organize and interpret the discussions. The analysis developed in six phases. Initially, there was familiarization with the data, with in-depth reading and literal transcription of the interviews, ensuring fidelity and allowing the identification of patterns and meanings. Next, coding was carried out, where initial codes were created aligned with the research objectives and theoretical frameworks. In order to organize this stage, a table was created with three columns containing excerpts from the interviews, codes, and reflections that guided the thematic construction. From that, the development of themes began, grouping similar codes and structuring broader thematic units.

In the next stage, the themes were reviewed and refined to ensure internal coherence and representativeness in relation to the overall dataset, with the aim of capturing the "essence" of each theme and the narrative emerging from the analysis. As a result of this process, the central theme "Diabetic foot: a journey of knowledge and action—uncovering the challenges of care management and administration" was defined, along with the

subthemes. The subthemes were defined as follows: Subtheme 1: “Health system management: nurses’ knowledge and perceptions of actions for the prevention of diabetic foot” and Subtheme 2: “Care administration: nurses’ knowledge and perceptions of actions for the prevention of diabetic foot.”

Ethical aspects were strictly respected, according to Resolutions No. 466/2012 and No. 510/2016 of the National Health Council. The study was approved by the Research Ethics Committee of the responsible institution, and all participants signed the Free and Informed Consent Form.

RESULTS

Sociodemographic and occupational characterization of Primary Health Care participants

The sociodemographic characterization showed a predominance of the female sex (97.2%), with a median age of 40 years. The professional profile of the participants indicates that young nurses in the profession have sought additional training in postgraduate courses for professional development. It was found that more than half of the nurses participating in the research (66.70%) were not part of continuing education or did not participate in the planning of training sessions.

Table 1 displays the results related to the analysis of the knowledge, skills, and attitudes of the nurses participating in this research.

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Table 1 – Participants' knowledge, skills, and attitudes about prevention and care actions for the feet of people with DM (n=36) from the State of São Paulo, 2024

Variables	Before n(%)	After n(%)	p-value*
1 Actions for diabetes mellitus management			
1.2 Equipment, materials, medications and supplies	27 (75%)	34 (94.4%)	**0.0455**
2 Indicators for the care pathway for people with DM			
2.1 Proportion of people with DM who undergo retinography examination	15 (41.7%)	17 (47.2%)	0.7728
2.2 Amputation rate due to DM	22 (61.1%)	23 (63.9%)	1
3 Regarding the rights of people with DM			
3.1 Right to the free distribution of medications and materials	32 (88.9%)	35 (97.2%)	0.2482
3.2 Right to rapid-acting analog insulin, type 1 diabetes mellitus in the SUS (Brazilian Public Health System)	20 (55.6%)	23 (63.9%)	0.5791
3.3 Right to long-acting analog insulin, type 1 diabetes mellitus in the SUS	21 (58.3%)	22 (61.1%)	0.7893
4 Organization of care for people with DM			
4.1 Systematic updating of the information system	31 (86.1%)	33 (91.7%)	0.6831
4.2 Planning and organization of actions for the control of DM	33 (91.7%)	36 (100%)	0.2482
4.3 Prioritization in care	19 (52.8%)	24 (66.7%)	0.2673
5 Data to be collected during the nursing consultation			
5.1 Guidance on Lifestyle Changes (LC)	31 (86.1%)	33 (91.7%)	1
5.2 Request for laboratory tests (FPG and/or HbA1c)	22 (61.1%)	34 (94.4%)	0.4795
5.3 Capillary blood glucose testing and guidance on self-monitoring of blood glucose (SMBG)	28 (77.8%)	32 (88.9%)	0.3428
5.4 Systematic examination of oral cavity	21 (58.3%)	23 (63.9%)	0.8026
5.5 Systematic examination of feet and footwear	33 (91.7%)	36 (100%)	0.2482
6 Pathophysiological aspects of the diabetic foot			
6.1 Skin and appendage changes	34 (94.4%)	35 (97.2%)	1
6.2 Structural foot changes/deformities	32 (88.9%)	34 (94.4%)	0.6171
6.3 Biomechanical foot changes/joint limitation	29 (80.6%)	33 (91.7%)	0.2207
6.4 Diabetic vasculopathy/peripheral arterial disease	31 (86.1%)	35 (97.2%)	0.2207
6.5 Trauma/plantar pressure	34 (94.4%)	35 (97.2%)	1
6.6 History of ulcers and/or amputation	34 (94.4%)	35 (97.2%)	1
7 Gold standard test for PSP screening			
7.1 Application of the 10g monofilament	29 (80.6%)	35 (97.2%)	0.071
7.2 128 Hz tuning fork	13 (36.1%)	31 (86.1%)	**0.00006**
8 Skin assessment of the feet			
8.1 Identification of moisture/maceration in the interdigital spaces	35 (97.2%)	36 (100%)	1
8.2 Identification of nail changes	29 (80.6%)	35 (97.2%)	0.0771
8.3 Identification of hair thinning	20 (55.6%)	25 (69.4%)	0.3017
9 Assessment of footwear and socks			
9.1 Width, length, and material of manufacture	31 (96.1%)	32 (88.9%)	0.6831
9.2 The appropriate model is closed, protecting the entire foot	11 (30.6%)	29 (80.6%)	**0.0001439**
9.3 The correct size is 1 cm longer than the foot	11(30.56%)	27 (75%)	**0.0007962**

9.4 The material of manufacture should be soft leather or canvas	10 (27.8%)	21 (58.3%)	**0.009823**
9.5 The footwear meets the four specified characteristics	23 (63.9%)	29 (80.6%)	0.1824
9.6 The appropriate socks are made of cotton	23 (69.9%)	35 (97.2%)	**0.001496**
9.7 The socks should be light-colored	23 (63.9%)	35 (97.2%)	**0.000512**
9.8 The socks should have little or no seams	31 (86.1%)	32 (88.9%)	1
10 Wound care			
10.1 Cleaning must be performed with a stream of saline solution	22 (61.1%)	28 (77.8%)	0.1489
10.2 Dry the perilesional skin, leaving the wound bed moist	19 (52.8%)	24 (66.7%)	1
11 Supported self-care			
11.1 Close collaboration between the health care team and the user	28 (77.8%)	31 (86.1%)	0.505
11.2 Community support is essential	13 (36.1%)	20 (55.6%)	0.1213
12 Guidelines for foot self-care			
12.1 Pulse palpation must be recorded, noting temperature, hair, skin and muscle conditions	28 (77.8%)	29 (80.6%)	1
12.2 Assessment of protective sensitivity and foot integrity	30 (83.3%)	33 (91.7%)	0.4497
12.3 Moisturize feet, file toenails into a square shape with slightly rounded sides, and do not remove calluses	29 (80.6%)	30 (83.3%)	1

(Of the instruments, 2024)

Table 1 displays the alternatives with the most significant values in relation to the assessment carried out. Alternative 1.1, regarding actions for the control of diabetes mellitus, showed a statistically significant result ($p<0.0455$), showing the influence of training on participants' knowledge. In alternatives 2.1 and 2.2, concerning the indicators for the care line of people with DM, there was a percentage increase in responses in the post-intervention assessment. Regarding knowledge about insulin, there was an increase in the percentage in the post-intervention assessment for option 3.2, as well as in options 3.1 and 3.3. These results indicate that, despite the increase in the percentage in the post-intervention assessment, nurses' knowledge about the right to insulin/medications for the treatment of type 1 diabetes mellitus is still considered incipient.

As for the organization of care for the person with DM, a percentage increase was observed in the following responses: 4.1, 4.2, and 4.3. As for the responses referring to question 4.3, it is believed that the participants did not prioritize urgent care for people with DM in organizing activities related to scheduled and spontaneous demands.

Regarding the questions about the nursing consultation, it was found that the training reinforced or improved knowledge regarding the items that should be included in the

nursing consultation, with emphasis on the responses in 5.2 and 5.5, although it did not show a statistically significant result. Nonetheless, in the responses related to 5.4, although there was a percentage increase post-intervention, it is still not an aspect assessed in the nursing consultation, which indicates the need for a better focus in this area to ensure comprehensive care.

It is important to highlight that, in the question regarding the gold standard test for screening the loss of protective sensitivity, question 7.1 showed a percentage increase in participants' knowledge post-intervention. In addition, a statistically significant result was observed in question 7.2, with a value of ($p < 0.00006$), indicating that the intervention had a positive effect on knowledge of this test. This result suggests that the strategies used contributed to improving knowledge about the screening of the loss of protective sensitivity in the feet of people with DM, thereby ensuring a more effective assessment.

In the skin assessment of the feet, prior knowledge was observed regarding questions 8.1, 8.2, and 8.3. Regarding the assessment of shoes and socks, five alternatives showed statistically significant results: 9.2 ($p<0.0001439$), 9.3 ($p<0.0007962$), 9.4 ($p<0.009823$), 9.6 ($p<0.001496$), and 9.7 ($p<0.000512$). An increase in the percentage of responses in the post-intervention was also observed for the three alternatives, 9.1, 9.5, and 9.8.

Although in issues related to wound care it did not show a statistically significant result, an increase in the percentage of responses was observed in the post-intervention regarding alternatives 10.1 and 10.2.

The knowledge about supported self-care did not show a statistically significant result. Nonetheless, a percentage increase was observed in two alternatives, being: 11.1 and 11.2, which demonstrates that the training had a positive influence on the knowledge about the framework of supported self-care.

Regarding the guidelines on self-care for the feet, there was a percentage increase in the post-intervention responses in three options: 12.1, 12.2, and 12.3. These results show that the training, together with prior knowledge, contributed to a better understanding of pulse palpation, systematic sensitivity assessment, and foot care in people with DM. This learning is essential to improve clinical practice and ensure more effective care.

Qualitative analysis

The results of the qualitative analysis revealed the complexity involved in diabetic foot care, linking the dimensions of health system management and care management based on nurses' knowledge and perception about prevention and treatment actions. Participants' narratives highlighted structural and operational challenges, while also pointing out potentialities present in daily care, allowing an understanding of how these professionals mobilize knowledge, practices, and resources to qualify care and address existing limitations. As detailed in the method, the central theme "The diabetic foot: a journey of knowledge and action – uncovering the challenges of care management and administration" and two subthemes: "Health system management: nurses' knowledge and perception of actions for the prevention of diabetic foot" and "Care management: nurses' knowledge and perception of actions for the prevention of diabetic foot."

The central theme addresses the complex reality of care for the diabetic foot, combining the perspectives of health system management and care management from nurses' point of view.

Subtheme 1: Health system management: nurses' knowledge and perception regarding control actions for the prevention of foot problems in people with diabetes mellitus.

In this subtheme, nurses' understanding and perception about barriers and facilitators in the management context are addressed, including aspects such as training, knowledge of indicators, information systems, tools, provision of financial and human resources, municipal size, institutional partnerships, and the Health Care Network. These conditions are aligned with the dimensions of managing and participating ethically and politically, as recommended in the nurse's work process[7].

The participants identified the following facilitators for the organization and planning of actions for the care of people with DM: the importance of tools and resources, an effective information system that facilitates the identification and monitoring of people with DM, thereby ensuring proper follow-up. For care management, the use of protocols from the Brazilian Ministry of Health is considered essential:

> We use the protocol established by the Ministry of Health (P03). These protocols promote continuity and quality in care, being fundamental for more serious cases. Protocols are excellent for us to proceed and monitor cases of patients who do not adhere to the guidelines and show worsening of their health (P02).

A comprehensive information system, such as *e-Gestor*, contributes to the monitoring of indicators.

> Knowing the indicators of people with DM who need follow-up during the four-month period through the *e-Gestor* tool (P20).

Material and financial resources, as well as medications and supplies, are considered essential for the prevention and control of DM.

> The availability of materials and supplies for the care of the person with DM is required, as well as medications, laboratory tests, and dressing materials (P49).

The geographical size of some municipalities and the adequate infrastructure were perceived as facilitators of access and identification of people with DM at higher risk.

> It is possible to organize actions in the municipality, because the municipality is not large and this facilitates access to information and the identification of people with diabetes who are at higher risk to prevent diabetes complications (P05).

Another important aspect was the teaching-service integration, which enabled training with an innovative and practical nature, offered by the University.

> I consider that this training was excellent, very up-to-date, the video lessons were excellent, and it helped me put into practice what I learned. We need more training, especially related to dressings (P06).

The training of professionals is reflected in the promotion of health education actions and support groups.

> There are groups to provide guidance on all care (P21).

Home visits and the connection with the community were also considered essential for the control of DM, as they strengthen trust and cooperation.

> In the areas where family units are present, in connection with the unit, the nurse and the CHW directly contribute to the patient's adherence to treatment (P35).

Conversely, the participants pointed out barriers such as the unpreparedness and turnover of professionals, the lack of support for management, the high workload, and the lack of training on the topic, all of which hinder the implementation of personalized action plans.

> The main barrier is the lack of time, huge teams, few professionals, which makes it difficult to attend to each one individually (P33).
>
> I think there is a lack of training, including for the technicians, which I consider a difficulty. The course that was offered can also include the nursing technicians (P08).

The difficulty of access to specialists compromises the control of DM.

> Difficulty also in going to specialists when referred, either because there is no one to take them and, many times, they do not have money for transportation (P06).

Participants' perceptions indicate that successful care management depends on managers who are committed and technologically proficient, particularly in wound treatment.

> One of the difficulties is having managers who have knowledge of the real importance of using new technologies (P38).

They pointed out the need for up-to-date, customized protocols because outdated guidelines may lead to inconsistencies in care.

> The lack of a protocol directly impacts the provided care. Each unit does it in its own way. The protocol we have from *Hiperdia* is outdated. It needs revision (P25).

The lack of infrastructure and resources impacts the prevention and care of the feet of people with DM.

> You can't get the materials you need to provide good service (P11).

The scarcity of continuing education actions and training is also a hindrance, as it compromises the effectiveness in implementing the protocols.

> There is a lack of training and qualification; it was only introduced, presented to the FHS teams, but we did not have training focused on these protocols (P30).

Subtheme 2: Care management: nurses' knowledge and perception about actions for the prevention of foot problems in people with diabetes mellitus.

The participants highlighted the barriers and facilitators for preventive care of the feet of people with DM, addressing actions such as nursing consultations, health education, supported self-care, and integrated collaboration. These practices are aligned with the principles of care, ethics, and policy in the nurse's work process[8].

They emphasized the importance of teamwork for the control of DM. Health units have multidisciplinary teams that provide individualized support, support groups, and discussion circles focused on education, prevention, and strengthening of bonds. Collaborative work is essential to promote trust and cooperation between people with DM and professionals, thereby improving patients' quality of life.

> We win as a team with doctors, nutritionists, and other health professionals, and this is fundamental for the success of DM treatment (P1).

They highlighted the relevance of collaborative practice among nurses as a resolving element in the care of patients with wounds.

> I help my fellow nurses a lot, whenever there is a case of a patient with a wound they refer me to assess it, this is very good (P13).

Health education actions offered by the multidisciplinary team are essential for the prevention and control of DM.

> I believe that health education is very important for the control of diabetes. We teach patients to examine their feet, looking for wounds, calluses, found. We also provide guidance on the importance of wearing appropriate shoes and keeping the skin moisturized (P13).

However, the difficulty of people's adherence to treatment was pointed out as an important barrier, because it impacts the effectiveness of prevention and care actions.

> First, the barrier comes from the patients themselves, who often do not follow an adequate diet, do not use the medications, thereby making our prevention difficult (P23).

> The scarcity of material resources limits the application of best practices. Sometimes, there is a lack of appropriate material (P21).

For the control actions related to DM and its complications to be effective, an integrated articulation between management and care administration is essential, thereby strengthening support for prevention and follow-up practices.

DISCUSSION

The findings of this study reinforce the role of continuing health education (CHE) as a structuring element of nursing work processes[7] and highlight the need to integrate management, care, and teaching. Nonetheless, unlike the framework proposed by CHE, nurses reported significant gaps in continuous training, revealing a gap between recommendations and actual practices in PHC.

Management in the health system is a fundamental activity that involves the administration of coordination, articulation, and assessment functions[11]. Care management refers to the administration of a health unit or body, for example, an outpatient clinic, a hospital, or an institute.

The results pointed to the facilitators that positively impact the quality of care. Among these are adequate infrastructure, the presence of specific protocols and suitable information systems, training, and the strengthening of institutional partnerships.

Nurses identified significant barriers in management, such as the lack of financial resources and insufficient training, conditions that limit the implementation of prevention actions and the care of the feet of people with diabetes.

The identification of adequate infrastructure as a facilitator of care aligns with a study that highlights its direct relationship with patient safety. However, the author[12] describes advancements in the qualified use of *e-SUS APS* to monitor indicators, whereas nurses in this study reported ongoing challenges with system use, revealing a gap between recommendations and routine practice. This contrast reinforces the need to strengthen digital skills and ensure ongoing institutional support.

The improvement in knowledge regarding the indicators, especially retinography examinations and the amputation rate, reiterates the importance of preventive measures and early diagnosis[14].

Although knowledge about indicators such as retinography and amputations increased after the intervention, the participants highlighted operational limitations in recording and monitoring such data, differing from the scenario described by studies[15], which point to a broader implementation of risk stratification practices. This suggests that, despite cognitive progress, organizational barriers continue to prevent the full implementation of preventive guidelines.

Another facilitating aspect that the participants of the present study reported was regarding training. Investments in training have a significant impact on the management of nurses' work, thereby promoting changes in work processes[16]. Such actions ensure that nurses acquire greater technical and scientific knowledge, enabling them to provide more qualified care and supporting the achievement of goals for the control of DM[17].

The findings show that training has a positive impact on technical knowledge[16-17] and on the transformative role of continuing education. However, the participants in this study described sporadic and insufficient access to training processes, making CHE a barrier rather than a facilitator. This discrepancy highlights the need to institutionalize continuing educational actions so that the gains produced by training are not limited to the short term.

Personalized care[19] appears in a limited way in participants' reports, who point out difficulties in adjusting practices to individual needs due to overload and lack of time.

Thus, even though the literature recognizes individualization as an essential component of the prevention of diabetic foot, this study reveals working conditions that make its implementation difficult.

One of the facilitating actions pointed out by the participants is institutional partnership, that is, the teaching-service integration, because it provides support and knowledge sharing. This partnership is essential for the integration between teaching and service, being seen as a fundamental strategy for professional qualification. Investments in continuous educational processes are essential in the context of PHC, generating positive impacts on the SUS[20].

Therefore, the results demonstrate the need for management committed to continuing education, which promotes the training of professionals and uses health indicators as a basis for decision-making.

Conversely, the lack of financial resources, the deficiency in training, the overload and turnover of professionals, and the insufficiency of human resources were considered barriers. The frequent transfer of professionals between units prevents the establishment of deeper bonds with the served population, compromising the effectiveness of treatment and resulting in one-off interventions that often do not meet the real needs of the community. This situation goes against the principles of expanded clinical practice and network-based work, which aim for a comprehensive and broad approach to the person[21].

In addition, challenges such as inadequate team sizing and the overload of activities emphasize the need for management that recognizes and addresses the system's weaknesses, ensuring better working conditions and the effective integration of the Health Care Network. Interdisciplinarity[22] is fundamental to ensure that a line of care is comprehensive and effective, strengthening communication, bonding, and the humanization of care.

Another barrier identified is the lack of a support network for people with DM. Health professionals form the link in the support network with the family and the health system, providing guidance that addresses social realities. It is important that this interaction uses accessible language to promote self-care and improve the quality of life of people with chronic diseases. The family plays a crucial role, offering emotional and caregiving

support, and social networks can facilitate the exchange of experiences that help people maintain healthy habits and assist in treatment[23].

Management faced barriers regarding access to specialized services. The lack of complete information about patients' clinical status can result in inadequate referrals and mask problems that could be resolved in primary care. In order to improve this flow, it is essential to adopt well-defined clinical protocols that guide the regulation team and ensure accurate referrals[24]. Furthermore, health regulation in Brazil frequently prioritizes the creation of normative waiting lists, compromising the comprehensiveness of care and the connection between people's expectations and the available services[25].

Updating the user registration database is another critical issue, since errors and outdated information can lead to the return of referral requests, thereby prolonging waiting times and hindering access to essential services[25]. Thus, optimizing these processes is crucial to reduce access barriers and ensure a more effective health system while respecting the principles of universality and equity[26].

The research results also emphasized the importance of using protocols and tools for nurses, which provide greater autonomy and support in implementing the principles of the National Primary Care Policy. The use of protocols contributes to continuity of care and coordination of actions, thereby improving accessibility and clinical practice[27]. Additionally, these protocols are essential for the dissemination of knowledge and communication among professionals, promoting safety and efficiency in professional practice[16].

Nonetheless, the absence of adequate protocols was identified as a barrier that hinders a systematized and standardized approach in care. It is essential to create adherence to the use of protocols, highlighting their relevance to the quality of care. Regular screening of people with DM, carried out through protocols, is an effective strategy to prevent complications[16].

The research revealed a percentage increase in nurses' understanding of the integration of the Health Care Network through the use of protocols and care flows, contributing to the organization of networked work and increasing the effectiveness of care actions[27].

Investment in training also stood out as a crucial facilitator in the management of nurses' work, directly impacting the quality of care[16].

Professionals' CHE is essential to ensure the quality of the provided services and the improvement of patients' quality of life[18]. Nonetheless, although training has been recognized as relevant, it is still incipient, presenting significant challenges in the area of care for people with DM. It is important to implement CHE through a participatory approach, involving professionals in all stages of the process, from planning to execution of training activities[31].

Individualized care is a fundamental principle, and training should allow therapeutic approaches to be adjusted to the specific needs of each individual[19]. Research revealed a percentage increase in participants' understanding of the importance of a trained multidisciplinary team to welcome and individually care for people with DM. This approach should consider not only clinical conditions but also the social and emotional situations that influence the patient's health, highlighting the importance of empathetic and adapted communication[32].

The institutional partnership, or the integration between education and service, was pointed out as a facilitating action. This collaboration is essential for professional qualification and the strengthening of the SUS, since continuous educational processes have significant positive impacts[20]. It is necessary for the health sector to effectively meet the population's needs, promoting participatory management that involves educational institutions and encourages relevant research in the area[33].

However, a distorted perception of continuing education by many managers sometimes reduces it to a mere technical mechanism, instead of considering its transformative potential. It is necessary to see continuing education as a tool that promotes real changes and a systematized standardization of health care[34].

The nursing work processes[7] are complex and multifaceted, requiring knowledge, skills, and attitudes that interrelate. The integration between the dimensions of managing, assisting, teaching, researching, and participating politically results in more effective and coordinated care.

Subtheme 2: Care management – nurses' knowledge and perception about actions for the prevention of foot problems in people with DM reveal the importance of collaboration among health professionals. Nurses identified barriers, such as lack of adherence to treatment and scarcity of resources but also highlighted facilitators such as CHE and the nursing consultation (NC) [35-36].

The statistically significant results showed an increase in nurses' knowledge after training, regarding foot assessment and glycemic control. Data also showed an increase in the implementation of protocols in NC, which is fundamental for a more resolute Primary Health Care (PHC) [37].

The training contributed to the percentage increase and statistically positive result in the use of protective sensitivity tests (PST), such as the Semmes-Weinstein monofilament and the 128 Hz tuning fork, respectively, which are essential for the identification of risk factors and the reduction of the likelihood of amputations[38]. However, the assessment practice still faces significant barriers, such as lack of knowledge and the absence of adequate equipment[39].

Continuing health education has been pointed out as a crucial element in the prevention and control of diabetes, thereby promoting self-care actions. Although nurses have recognized the importance of oral cavity examinations and systematic foot assessments, greater emphasis still needs to be placed on these practices to ensure comprehensive care, in accordance with the guidelines of the Brazilian Ministry of Health[6].

Care for a person with DM is a continuous process that requires regular assessment and multidisciplinary strategies. The intervention has proven effective in increasing nurses' knowledge about self-care. With appropriate training, nurses can significantly improve patients' quality of life and reduce comorbidities[40].

Therefore, the implementation of an effective NC, together with continuous training and the strengthening of communication between professionals and people with DM, is essential to ensure comprehensive and person-centered care, improving adherence to self-care and minimizing the risks of diabetic foot complications.

During NC, nurses must inform people about their rights, such as free access to medications and materials for blood glucose monitoring. People with type 1 DM must be

informed about the right to analog insulin, both rapid-acting and long-acting, provided by the Brazilian Unified Health System (SUS, as per its Portuguese acronym)[41-43]. The training provided to nurses resulted in a percentage increase in knowledge about these rights and about lifestyle changes (LC), which are essential for treatment.

Health education should be a continuous process, starting at the first consultation and involving the person's collaboration in the development of the care plan, which includes LC. This approach not only improves treatment adherence but also strengthens the patient's autonomy regarding his/her health[6]. The adoption of LC promotes a healthy lifestyle, empowering people to manage their health condition and strengthening the trust relationship with health professionals[44].

Recommendations for the use of closed shoes and cotton socks that allow sweat evaporation are essential to prevent complications such as foot disease in people with DM. The assessment of footwear, covering style, width, length, and material, is also vital. Nurses recognized the advancement of knowledge about adequate care, reflected in statistically positive results, contributing to the prevention of serious complications, such as amputations[38].

The implementation of comprehensive and multidisciplinary care is necessary for health care management. Collaboration among nurses, doctors, and other health professionals, as advocated by the SUS guidelines, is an essential facilitator to meet health needs in a comprehensive and effective manner[45]. Furthermore, supported self-care is an important approach, allowing patients to become protagonists in their health management, promoting autonomy and responsibility.

Despite the recognition of the support needs of people with DM, nurses identified treatment adherence as a barrier. Factors such as lack of knowledge about foot care and low levels of education were associated with decreased self-care, highlighting the need for educational campaigns[46-47].

In order to prevent diabetic foot disease, it is crucial that professionals develop skills through CHE, aligning practice with the SUS guidelines. Nonetheless, many nurses still do not participate in CHE in their municipalities, highlighting the need for greater engagement from managers to promote an environment that supports continuous training[48]. Managers

must plan actions that integrate CHE into nurses' daily routines, thereby ensuring critical and reflective improvement on health challenges.

CHE should be seen as a collaborative process, essential to qualify services and improve professional skills, promoting equitable access to training programs that respond to the needs of the population and strengthen Primary Health Care.

Study limitations

The number of participants in the pre-intervention phase did not remain the same in the post-intervention stage, since it coincided with the dengue epidemic period, making participation in the course and commuting to in-person activities difficult. This situation highlights the need to consider external factors that may impact adherence to CHE actions.

In addition to the sample loss between the pre- and post-intervention periods, this study has other limitations. The quasi-experimental design, without a control group, and the use of a convenience sample composed of nurses from 12 municipalities within a single Regional Health Directorate, limit the generalization of the findings. Furthermore, the use of self-report instruments to assess knowledge does not allow for direct inference of changes in clinical practice, and the relatively short follow-up period restricts the analysis of long-term effects. These aspects must be considered when interpreting the results and proposing future studies.

CONCLUSION

The study results show that the intervention based on continuing health education had a positive influence on Primary Health Care nurses' knowledge and perceptions about the prevention and care of the feet of people with diabetes mellitus. There was an expansion of knowledge, with emphasis on aspects related to foot assessment, the use of tests to screen for loss of protective sensation, guidance on appropriate shoes and socks, as well as a greater understanding of care organization, supported self-care, and the rights of people with diabetes. These findings reinforce the strategic role of nurses in the early detection of risks and in the implementation of preventive actions.

Furthermore, the study highlights that the challenges to the implementation of these actions go beyond the individual scope of the professional, involving issues related to health system management and care management, such as resource availability, use of protocols, continuous training, and integration of the Health Care Network. In this sense, continuing education proved to be a powerful tool to enhance nurses' work processes, strengthen care and managerial practices, and contribute to the reduction of complications related to diabetic foot. The findings signal the need for continuous investments in educational strategies linked to management, aiming to improve the quality of care offered to people with diabetes in Primary Health Care.

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INFLUENCE OF CONTINUING EDUCATION ON THE PREVENTION AND CARE OF THE FEET OF PEOPLE WITH DIABETES

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INFLUENCE OF CONTINUING EDUCATION ON THE PREVENTION AND CARE OF THE FEET OF PEOPLE WITH DIABETES

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