

Factors associated with foot ulceration of people with diabetes mellitus living in rural areas



Fatores associados à ulceração nos pés de pessoas com diabetes mellitus residentes em área rural

Factores asociados a la ulceración en los pies de personas con diabetes mellitus residentes en área rural

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ABSTRACT

Objective: To analyze the factors associated with the risk of ulceration in the feet of people with diabetes mellitus living in rural areas.

Methods: This is a cross-sectional study conducted with 293 individuals with diabetes mellitus, aged 40 years or older, living in the south of Brazil, in 2014. We analyzed socioeconomic variables, clinical conditions and foot self-care. We used the Poisson multiple regression model and the Prevalence Ratio (PR) and p-value < 0.05 as a measure of association.

Results: 43.7% of the sample presented risk of foot ulceration. The highest prevalence of foot ulceration risk was associated with people with lower purchasing power (PRadjusted=1.62/IC95%:1.52-2.22), with retinopathy (PRadjusted=1.30/IC95%:1.12-1.68) and alteration in foot moisture (PRadjusted=1.57/IC95%:1.22-2.01). We identified low education level (64.2%), high prevalence of arterial hypertension (86.3%) and onychomycosis in the feet (72%).

Conclusions: Diabetic patients need an assessment of the risk of foot ulceration, especially those with longer diagnosis, chronic complications and low socio-educational level.

Keywords: Diabetes mellitus. Rural population. Diabetic foot. Nursing. Self-care.

RESUMO

Objetivo: Analisar os fatores associados ao risco de ulceração nos pés de pessoas com diabetes mellitus residentes em área rural.

Métodos: Estudo transversal realizado com 293 pessoas com diabetes mellitus, com 40 anos ou mais, residentes em município do sul do Brasil, em 2014. Analisou-se variáveis socioeconômicas, clínicas e o autocuidado com os pés. Utilizou-se o modelo de regressão múltipla de Poisson e como medida de associação a Razão de Prevalência (RP) e p-valor < 0,05.

Resultados: 43,7% da amostra apresentou risco de ulceração nos pés. A maior prevalência desse risco foi associada a pessoas com menor poder aquisitivo (RPajustada=1,62/IC95%:1,52-2,22), retinopatia (RPajustada=1,30/IC95%:1,12-1,68) e alteração na umidade dos pés (RPajustada=1,57/IC95%:1,22-2,01). Identificou-se baixa escolaridade (64,2%), alta prevalência de hipertensão arterial (86,3%) e onicomicose nos pés (72%).

Conclusões: Pessoas com diabetes necessitam de avaliação do risco de ulceração nos pés, principalmente, os com maior tempo de diagnóstico, complicações crônicas e baixo nível socioeducacional.

Palavras-chave: Diabetes mellitus. População rural. Pé diabético. Enfermagem. Autocuidado.

RESUMEN

Objetivo: Analizar los factores asociados al riesgo de ulceración en los pies de personas con diabetes mellitus residentes en área rural.

Métodos: Estudio transversal realizado con 293 personas con diabetes mellitus, con 40 años o más, residentes en una ciudad en el sur de Brasil, en 2014. Se analizaron las variables socioeconómicas, las condiciones clínicas y el autocuidado con los pies. Se utilizó el modelo de regresión múltiple de Poisson y para el análisis de la asociación fue utilizada la Razón de Prevalencia (RP) y p-valor < 0,05.

Resultados: 43,7% de la muestra presentó riesgo de ulceración en los pies. La mayor prevalencia de este riesgo fue asociada a personas con menor poder adquisitivo (RPajustada=1.62/IC95%:1.52-2.22), con retinopatía (RPajustada=1.30/IC95%:1.12-1.68) y alteración en la humedad de los pies (RPajustada=1.57/IC95%:1.22-2.01). Se identificó baja escolaridad (64,2%), alta prevalencia de hipertensión arterial (86,3%) y onicomicosis en los pies (72%).

Conclusiones: Los diabéticos deben ser evaluados cuanto al riesgo de ulceración en los pies, sobre todo, aquellos con diagnóstico a largo tiempo, complicaciones crónicas y bajo nivel socioeducativo.

Palabras clave: Diabetes mellitus. Población rural. Pie diabético. Enfermería. Autocuidado.

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■ INTRODUCTION

Diabetes mellitus (DM) is one of the main public health problems in the world, due to the high rates of morbidity and disability related to chronic complications. Type 2 DM (DM2) is the most prevalent DM variation in adults and is generally associated with overweight, sedentary lifestyle, smoking habits and family history of the disease⁽¹⁾.

Among the chronic complications of DM, diabetic foot and limb amputation are some of the most serious and of greatest impact on the individual's quality of life and productivity. The diabetic foot is conceptualized as an infection, ulceration and/or destruction of the soft tissues associated with neurological changes and various degrees of peripheral arterial disease (PAD) in the lower limbs⁽²⁾. An international study reveals that the annual incidence of foot ulcers in people with DM ranges from 2% to 4% and that people with this morbidity have a 25% higher risk of developing foot ulcers in their lifetime compared to those without the disease. In 85% of cases, the ulcers precede the amputations, with diabetic foot accounting for about 50% to 70% of non-traumatic amputations⁽¹⁾.

In order to prevent the diabetic foot and other complications related to DM, it is necessary to modify the lifestyle of the people as soon as they are diagnosed with this disease. The follow-up of the therapeutic plan combined with the educational intervention for self-care is one of the most indicated strategies, including the achievement of normal blood glucose levels in some cases. Studies demonstrate the effectiveness of strategies and programs developed in primary health care by nursing professionals, which involve assistance and education for self-care in improving DM control, reducing the prevalence of foot ulcers, and lower limb amputations⁽²⁻⁴⁾.

However, it is a fact that the implementation of strategies for monitoring people with DM residing in rural areas cannot be performed as a reproduction of the urban model. This is an intersectoral challenge and it has decisive effects on the living conditions of individuals, families and communities. Geographic barriers, large distances, transportation difficulties and low income are some of the factors that restrict access to health services for the rural population⁽⁵⁾.

Although studies have shown a direct relationship between socioeconomic factors, lifestyle, self-care measures and the incidence of ulceration in the feet of people with diabetes⁽⁶⁻⁸⁾ no research has been conducted on populations living in the rural areas that analyzed the factors associated with this DM complication. In view of the above, the research question was: what are the factors associated

with the risk of foot ulcers in people with DM2 living in rural areas? Thus, this study aimed at analyzing the factors associated with the risk of foot ulcers in people with DM2 living in rural areas.

■ METHOD

A cross-sectional study has been carried out with a sample of 293 people with DM2, aged 40 years old or over, representing all the 12 Basic Health Units (UBS) in rural areas of a large city in southern Brazil. The data collection took place in February and March 2014. For the calculation of the sample, it was estimated that 11% of the population aged 40 years old or over had DM2⁽⁹⁾ and a significance level of 5%. A simple random selection of the study participants has been carried out through a raffle of the people enrolled in the Hypertensive and Diabetic Registration System in a list provided by each UBS until the percentage of each unit has been reached.

The inclusion criteria were: to be diagnosed with DM2 and be 40 years old or older. The patients who have been excluded from the sample were those with active ulcers in the lower limbs, with blindness or severe visual deficit, and those with no logical reasoning and judgment preserved. Individuals who did not present the inclusion criteria or those who had some exclusion criteria have been replaced by others in a new raffle until the sample has been completed.

For data collection, an instrument⁽⁶⁾ with variables of evaluation of the lower limbs and risk of ulceration; socioeconomic variables (gender, age, marital status, education, self-reported skin color and socioeconomic classification); clinical conditions (diagnosis time, type of treatment, chronic complications, obesity and arterial hypertension) and feet self-care has been used. The lower limbs of the participants have been evaluated for dermatological, orthopedic, neurological and vascular aspects. Diabetic neuropathy has been identified by the Semmes-Weinstein mono-filament test of 10g⁽¹⁾. The risk of foot ulceration has been classified as grade 0 when there was no loss of the protective sensitivity (PSP) and no peripheral arterial disease (PAD); degree 1 in the presence of PSP with or without deformity; degree 2, presence of PAD with or without PSP; degree 3 in cases of previous ulcer. For the analysis of the associated factors, this variable has been categorized as "without risk of ulceration (degree 0)" and "with risk of ulceration (degrees 1, 2, 3)".⁽¹⁾

The alteration in the foot moisture has been identified in the presence of anhidrosis (dryness), hyperhidrosis (excessive moisture) or bromidrosis (moisture with

an unpleasant odor) and categorized as altered and unchanged. The presence of mycosis in nails and/or interdigital spaces has also been evaluated: categorized as present and absent.

Nail mycosis is characterized by the loss of the natural structure of the nail or its integrity, opacity or farinaceous appearance. The interdigital mycosis corresponds to the identification of maceration between interdigital spaces, loss of the skin integrity at the local, alteration in the natural coloring or pruritus complaint⁽¹⁻²⁾.

With regard to self-care, the participants have been questioned if they had the habit of drying the interdigital spaces; if they used to make a periodic evaluation of the feet; if they used to walk barefoot often and if they used to scald their feet. The nail cut has also been evaluated and considered appropriate when cut in a straight or square format, without being close to the end of the finger or without the removal of the corners. Hygiene was considered adequate when feet were clean, dry and with normal odor. The minimum presence of dirt like dust from the floor of the house to the place of assessment has not been considered. Footwear has been considered appropriate when closed, one to two centimeters longer than the foot itself, the internal width equal to the width of the foot and the height that could allow enough space for the toes, made of soft leather-like material or canvas/cotton^(1-2,8,10).

The measure of association was the prevalence ratio (PR) for both bivariate and Poisson regression. The signifi-

cance level of 5% has been adopted in the Wald chi-square test. Variables with p value <0.20 in the bivariate analysis have been selected to compose the model adjusted by Poisson regression.

The Committee of Ethics in Research Involving Human Beings of the Universidade Estadual de Londrina, opinion No. 139/2013, has approved the research. All the participants have signed the Free and Informed Consent Term and the researchers have granted a copy to the Units of the Commitment Term for Data Use.

■ RESULTS

In this study, 43.7% of the sample presented a risk of foot ulceration, 13.3% of which was degree 1, 21.5% degree 2 and 8.9% degree 3. The orthopedic alterations found during the clinical examination of the participants were: halux valgus (17.0%), claw toe (15.4%), hammer toe (4.4%) and bony prominences (29.7%). Dermatological, neurological and vascular changes are presented in table 1.

In the analysis of the foot ulceration risk, the higher prevalence of risk has been associated with the presence of interdigital mycosis (PR=1.34/CI: 95%: 1.03-1.74/p-value=0.025) and foot anhidrosis=1.69/CI 95%: 1.31-2.18).

As for the population profile, the majority were women, the elderly (average age of 63.7 and average age 64) and low educational level (Table 2).

In the bivariate analysis, the highest prevalence of foot ulceration risk has been associated with age equal to or

Table 1 – Distribution of the dermatological, neurological and vascular alterations according to the risk classification for foot ulcers in people with diabetes mellitus living in rural areas. Brazil, 2014. (N=293)

Variables	N	Degree 0 (%)	Degree 1 (%)	Degree 2 (%)	Degree 3 (%)	Total (%)
Onychomycosis	210	43,0	10,2	14,3	4,4	71,9
Interdigital mycosis	82	15,0	5,5	4,8	2,7	28,0
Callosities	198	42,3	8,9	13,7	2,7	67,6
Feet moisture						
Anhidrosis	104	17,1	5,8	9,9	2,7	35,5
Hyperhidrosis	09	1,8	0,3	0,3	0,7	3,1
Bromidrose	69	9,2	5,8	6,8	1,7	23,5
Loss of Protective Sensitivity	53	0,0	12,3	4,1	1,7	18,1
Decreased Pedicular Pulse	33	0,0	0,0	9,2	2,0	11,2
Lower Tibial Pulse Decreased	52	0,0	0,0	16,0	1,7	17,7
Changed Capillary Filler	08	0,0	0,4	1,4	1,0	2,8

Source: Research data, 2014.

Table 2 – Prevalence of foot ulcers risk in people with diabetes mellitus living in rural areas, according to socioeconomic variables. Brazil, 2014. (N=293)

Variables	Total		With foot ulcers risk		P	Gross RP	CI _{95%}
	N	%	N	%			
Gender							
Female	189	64,5	81	63,3	-	1	-
Male	104	35,5	47	36,7	0,689	1,05	0,50-1,37
Age							
40 – 60	103	35,2	36	28,1	-	1	-
60 or more	190	64,8	92	71,9	0,034	1,38	1,02-1,87
Skin color							
White	184	62,8	77	60,2	-	1	-
Not white	109	37,2	51	39,8	0,405	1,11	0,86-1,45
Marital Status							
With partner	268	91,5	114	89,1	-	1	-
Without partner	25	8,5	14	10,9	0,150	1,31	0,90-1,91
Education							
1-8 years	188	64,2	91	71,1	0,037	1,37	1,01-1,85
8 years or more	105	35,8	37	28,9	-	1	-
Socioeconomic classification *							
A/B	42	14,3	15	11,7	-	1	-
C	187	63,8	75	58,6	0,607	1,12	0,72-1,74
D/E	64	21,8	38	29,7	0,028	1,66	1,05-2,61

Source: Research data, 2014.

Gross RP: Gross prevalence ratio; 95% CI: 95% confidence interval; P: Level of significance considering the distribution of Wald Chi-Square.

* The socioeconomic classification has been determined according to data regarding the possession of goods and the degree of education of the head of the family, which are scored generating a sum that allows to classify the population in the following classes: A (35 to 46 points), B (23 To 34 points), C (14 to 22 points), D (8 to 13 points), E (0 to 7 points).

greater than 60 years old, low schooling, and belonging to the D/E economic class (Table 2). There has been a high prevalence of people with hypertension associated with DM (Table 3) and that the chronic complications retinopathy, stroke and acute myocardial infarction have been associated with the risk of ulceration in the unadjusted analysis.

Regarding foot care, there was no statistically significant association with the risk of ulceration, but alarming figures such as the high percentage of people with inadequate shoes and inadequate nail clippings are highlighted (Table 4).

In the multiple analysis model, the highest prevalence of foot ulcers risk belonged to socioeconomic status D/E (adjusted PR=1.62/95% CI: 1.52-2.22/p-value= 0.024), having the diagnosis of retinopathy (adjusted PR=1.30/95% CI: 1.12-1.68/p-value=0.040) and presented anhidrosis (adjusted PR= 1.57/95% CI: 1.22 -2.01/p-value <0.001).

■ DISCUSSION

A high prevalence of foot ulceration risk among the participants has been identified (43.7%). In a study carried out in the urban area of the same city, with a sample of 1,515 individuals with DM2 and 40 years old or more, the prevalence of ulceration risk in diabetics was 13.5%⁽¹¹⁾. The prevalence of the ulceration risk was also higher than that found in a study carried out with people with DM living in a rural region of the state of Santa Catarina, Brazil, in which 26.5% presented some degree of risk, and 20.3% 1, 12.3% degree 2 and 4.4% degree 3⁽¹²⁾.

This result allows to infer the existence of inequality in the supply and health care for the resident population in the urban and rural area and that this inequality probably exists in most of the cities of Brazil. A study that analyzed the prevalence of DM reported by adults in Brazil, through

Table 3 – Prevalence of foot ulcers risk in people with diabetes mellitus residing in rural areas, according to variables of clinical conditions. Brazil, 2014. (N=293)

Variables	Total		With foot ulcers risk		P	Gross RP	CI _{95%}
	N	%	N	%			
Diagnostic time							
Up to 10 years	164	56,0	66	51,6	-	1	-
Above 10 years	129	44,0	62	48,4	0,179	1,19	0,92-1,54
Insulin-dependent							
No	190	64,8	75	58,6	-	1	-
Yes	103	35,2	53	41,4	0,043	1,30	1,00-1,86
Obesity							
No	138	47,1	66	51,6	-	1 -	-
Yes	155	52,9	62	48,4	0,178	0,83	0,64-1,08
Arterial hypertension							
No	40	13,7	17	13,3	-	1 -	-
Yes	253	86,3	111	86,7	0,872	1,03	0,70-1,51
Retinopathy							
No	206	70,3	81	63,3	-	1 -	-
Yes	87	29,7	47	36,7	0,016	1,37	1,06-1,77
Nephropathy							
No	276	94,2	118	92,2	-	1	-
Yes	17	5,8	10	7,8	0,137	1,37	0,90-2,09
Stroke							
No	274	93,5	116	90,6	-	1	-
Yes	19	6,5	12	9,4	0,034	1,49	1,03-2,16
Heart attack							
No	268	91,5	113	88,3	-	1	-
Yes	25	8,5	15	11,7	0,048	1,42	1,00-2,01

Source: Research data, 2014.
Gross PR: Gross prevalence ratio; 95% CI: 95% confidence interval; P: Level of significance considering the distribution of Wald Chi-Square.

a household survey conducted in 2013, found that the disease was more reported by urban dwellers (6.5%), corresponding to 8 million cases, than of the ones living in the rural area (4.6%), which is equivalent to 934 thousand cases. This result may be associated with a lower frequency of diagnoses performed in the rural residents, due to the greater difficulty of these individuals to access health services and diagnostic tests⁽¹³⁾.

Another research developed with elderly people with resistant DM in the rural area has identified the distance of the urban centers, that concentrate specialized ambulatory care and emergency services, the lack of transportation and of financial resources as some of the main dif-

ficulties for the access and continuity of the treatment⁽⁵⁾. Primary health care needs to develop strategies that take into account the specificities of the rural area, since difficulties such as distance, poor transportation conditions and lack of information make it difficult for people with diabetes to receive professional follow-up and adequate self-care guidelines.

All the people diagnosed with DM should be periodically evaluated, in what refers to laboratory tests, effectiveness of the therapeutic plan and the appearance of chronic complications. During the healthcare, the health professional must carry out the risk classification for foot ulceration and identify the factors that may predispose to

Table 4 – Prevalence of foot ulcers risk in people with diabetes mellitus living in rural areas, according to the variables of feet self-care. Brazil, 2014. (N=293)

Variables	Total		With foot ulcers risk		P	Gross RP	C _{195%}
	N	%	N	%			
Drought between the toes							
Yes	176	60,1	76	59,4			
No	117	39,9	52	40,6	0,831	1,02	0,79-1,34
Assesses the feet							
Yes	189	64,5	85	66,4			
No	104	35,5	43	33,6	0,553	0,91	0,69-1,21
Scalds the feet							
No	188	64,2	87	68,0			
Yes	105	35,8	41	32,0	0,242	0,84	0,63-1,12
Walks barefoot							
No	224	76,5	104	81,3			
Yes	69	23,5	24	18,8	0,108	0,74	0,52-1,06
Proper footwear							
Yes	83	28,3	35	27,3			
No	210	71,7	93	72,7	0,744	1,05	0,78-1,40
Proper nail clipping							
Yes	175	59,7	77	60,2			
No	118	40,3	51	39,8	0,895	0,98	0,75-1,28
Proper hygiene							
Yes	202	68,9	83	64,8			
No	91	31,1	45	35,2	0,171	1,20	0,92-1,56

Source: Research data, 2014.
Gross PR: Gross prevalence ratio; 95% CI: 95% confidence interval; P: Level of significance considering the distribution of Wald Chi-Square.

injury. This information will provide planning for the steps that will be taken in order to avoid complications and prevent amputations⁽¹⁻³⁾.

It has been verified an association between the low socioeconomic level and the greater risk of foot ulceration. The low purchasing power is a constraint regarding the necessary aspects for the appropriate treatment of the disease, such as the consumption of adequate food and with a menu variability for better adherence to the diet; access to health care services; medications and non-standardized treatments granted by the Unified Health System and, considering the risk of foot ulceration, the acquisition of adequate shoes for injury prevention^(4-5,8).

The identification of areas where low social indicators predominate is an essential measure for the Family Health Strategy teams to identify at an early stage the person with chronic disease at greater risk of developing complications

and who needs more attention. The professionals that compose this service must carry out the active search of these cases in the rural areas and, thus, promote the equity in its territory of action⁽¹⁴⁾.

The low educational level was another factor which was associated with a higher prevalence of foot ulceration risk, which is also related to the socioeconomic status. The average of the years of study found that three years is much lower than the national average which is 8.8 years. This result corroborates with other studies carried out with this population, which showed one to four years of study for the vast majority of participants⁽¹⁵⁻¹⁶⁾. During the data collection, the participants expressed difficulties in studying during their childhood, related to the limitations of the rural area in relation to schools, distance and even the prohibition of parents, who preferred that the children dedicated themselves to work, in most of the times to the

detriment of education. Considering the limitations found in the learning process, it is up to the health professionals to create differentiated and appropriate educational strategies to attend to this population, being then facilitators of the process of self-care⁽³⁻⁴⁾.

The low schooling can directly interfere with knowledge and education for self-care. It was possible to verify in the results of this study that many people did not have the habit of drying between the toes and assess their own feet, in order to maintain hygiene and the appropriate nails clipping. This type of care is related to the prevention of lesions and infections in the lower limbs^(2,10). Although they represent a minority, those who have the habit of walking barefoot are also a reason for concern, especially because they are residents in the rural area, and many still raise animals such as pigs and goats at home. Thus, they are exposed to the footprints of these animals, so there is the risk of barbs or other foreign bodies and even injuries resulting from accidents with barbed wire.

In addition, daily washing of the feet followed by effective drying of the entire limb extension and interdigital spaces is a positive measure in the prevention of ulcers, since the humidity in these places favors the development of fungi and consequently of interdigital mycoses⁽¹⁷⁾. Inadequate hygiene may also be associated with the rural environment where much of the work with the land is carried out without the protection of boots or closed shoes, leading to the accumulation of dirt. Therefore, the practice of scalding the feet is common among this population, especially among women who reported taking advantage of the time to take care of the nails to scald the feet and that this practice produces a comfort sensation and relaxation of the lower limbs. However, it is important to emphasize that foot-scalding can favor burns and that these can evolve and cause more serious injuries⁽¹¹⁾.

Regarding the foot evaluation, the presence of interdigital mycosis and anhidrosis have been related to the higher risk of ulceration. Interdigital mycoses and onychomycosis act as gateways for acute infections, as well as small lesions due to inadequate shoes, common traumas and chronic ulcers^(11,17).

In a study carried out with a group of 75 people with diabetic foot and a control group of people not affected by DM, it has been identified a significantly higher prevalence of mycosis in nails and interdigital spaces in the diabetic group, of which 69.3% had some type of mycosis infection. Moreover, the presence of this infection has been associated with higher amputation rates⁽¹⁸⁾. This type of infection is common among the population with DM, however, it can be easily identified through clinical evaluation of the feet

and can be treated in the primary health care context. This action can significantly reduce the risk of infected lesions in the feet of people with DM, which is the main factor that precedes amputations⁽¹⁻²⁾.

The anhidrosis of the lower limbs, due to the inactivation of the sweat glands, is an important risk factor for the development of ulcers, since the reduction of sweating leaves the skin thin and dry, which facilitates the formation of cracks, callosities and loss of sensitivity. It is caused due to the lesions of the autonomic nervous system, in particular the sympathetic nerves⁽¹⁰⁾. A research developed in Thailand has analyzed two groups of people with DM with polyneuropathy, with and without alteration in the sympathetic response of the skin, it has been found that this alteration was associated with an increased risk of anhidrosis, reduction of thermal and pain sensation, paresthesia and history of ulcer in the inferior limbs⁽¹⁹⁾.

People with DM who have these signs and symptoms are at an increased risk of their lesions progressing to amputations. The fragility of the skin combined with loss of the sensation triggers the onset of lesions, since the absence of pain prevents individuals from perceiving repetitive surface trauma, cracking or damage to the feet. The foot injury is a predisposing factor to the development of ulcers or the development of deformity^(8,11). This condition is even more worrying among the rural population, since people are daily exposed to traumas resulting from rural activities, such as the management of animals and the care for the land.

Another important result which has been identified in this study was the association between the diagnosis of retinopathy and the risk of foot injuries. The diabetic retinopathy accounts for approximately 12% of blindness, and its development is closely related to the time and severity of hyperglycemia, which can develop on average seven years before the diagnosis of DM⁽¹⁾. A prospective study, which has been conducted in Costa Rica, found that retinopathy was a risk factor for amputation in patients with DM, as well as the longer time of diagnosis, elevated glycated hemoglobin and insulin therapy⁽²⁰⁾.

Moreover, the visual deficit interferes in the individual's capacity for self-care, especially in this sample in which the majority of participants were elderly. In this sense, it is important that health professionals train and involve family members to contribute to the care of the person with DM⁽⁵⁾. Family support is an important factor in the care of the person with DM, since the disease requires modifications in the family's lifestyle and adaptations, which should be oriented to assist in foot inspection, correct nail cutting and hygiene. This is a positive factor for the rural popula-

tion, which presents a more traditional family structure and with the cooperation and care with the elderly present in their culture and routine.

Adherence to the treatment is one of the greatest challenges for people with diabetes and it requires the involvement of the family and caregivers of the individual. People can adhere to only a few aspects of the therapeutic regimen but do not adhere to others, thus hampering disease control. The main factors that may influence adherence to self-care are: personal characteristics, socioeconomic condition, culture, beliefs and values, expectations related to the treatment and illness^(5,11). It should be emphasized that even with family support for the care of the person with DM, care by health professionals is essential for adequate disease control and prevention of chronic complications. Nursing, as a field of health sciences and historically providing teaching and research for autonomy and practice of self-care, is one of the professions that most contributes to the prevention of chronic diseases and rehabilitation of people diagnosed with DM.

A study that has evaluated the effectiveness of a nursing care program among people with DM for two years has identified that this strategy provided a reduction in the risk of ulceration in the lower limbs and prevention of the emergence of new ulcers in those with a previous history of injury. The assistance measures implemented in this program have included periodic feet assessment, education for self-care, treatment of lesions and mycoses, hydration of the skin, referral to medical specialties in the most serious cases, among others⁽³⁾.

A survey, which has been conducted in China with 185 people with DM and with a high risk of foot ulceration, demonstrated that participants in an individualized nursing education program, who provided teaching on DM control and instructions on podiatric care, presented a statistically significant improvement in glycemic control, blood pressure and cholesterol levels. Furthermore, it has identified a reduction in the prevalence of foot ulceration and a reduction in the amputation rate⁽⁴⁾. These results confirm that the diabetic foot can be avoided through actions that involve the integral and individualized attention to the health of the people with DM, mainly those who are more vulnerable to the risk factors for chronic complications.

It is also necessary to invest in the improvement and effectiveness of public health programs aimed at health promotion and prevention of aggravations, especially of the most vulnerable, as in the case of the population from the rural areas, in order to reduce the prevalence of chronic non-communicable diseases. The early referral of patients with vasculopathy and neuropathy to the care of greater

complexity of the health system can prevent amputations^(1,11). However, if for the primary care service there are already obstacles, when the clinical condition of the person with DM residing in rural areas requires specialized care or examination, it is even more complicated, due to the distance of the large centers and the need for transportation.

The primary health care nurse should make the classification of the risk, accompany the patients with greater risk of developing diabetic foot and guide them regarding self-care. These attitudes can prevent injuries/ulcerations and prevent amputations. The degree of risk of redirecting the number of assessments or appointments for each individual, and at least those without the risk of ulcers and other chronic complications of DM should be evaluated every six months. Nursing appointments and home visits are good moments to classify the risk of foot ulceration and to identify self-care deficits, the individuals' ability to take care of themselves and the family support network.

■ CONCLUSION

This study has identified a high prevalence of the ulceration risk in the feet of people with diabetes residing in the rural areas of a large city in southern Brazil. The study sample consisted mostly of the elderly, with a lower schooling and socioeconomic level, and with a high prevalence of complications related to DM and associated arterial hypertension. The higher prevalence of the risk of foot ulceration has been associated with people with the socioeconomic status D/E, with retinopathy and changes in the foot moisture.

The ulcerations in the lower limbs of people with DM can be avoided, and the stratification of the risk of ulceration is the first step in reducing the prevalence of lower limb amputation, since it allows a more efficient allocation of the resources available for prevention and treatment of this grievance.

It is expected that, in order to contribute to the training of nursing professionals, they should develop a holistic view regarding the assistance to people with DM, considering the factors involved in the health-disease process, the context in which they live and the individual characteristics. Further research is suggested in order to analyze the effectiveness of the programs that provide periodic evaluation of the feet of the person with DM, associated with teaching actions for self-care in order to prevent the risk of ulceration.

The limitations of this study were those related to the origin of data regarding the feet self-care, since they have been self-referenced by the participants and the cross-sectional design, which prevents the association of cause and effect.

■ REFERENCES

1. American Diabetes Association (US). Standards of medical care in diabetes-2015. *Diabetes Care*. 2015;38(Suppl. 1):S1-S93.
2. Morey-Vargas OL, Smith SA. BE SMART: strategies for foot care and prevention of foot complications in patients with diabetes. *Prosthet Orthot Int*. 2015;39(1):48-60.
3. Fujiwara Y, Kishida K, Terao M, Takahara M, Matsuhisa M, Funahashi T, et al. Beneficial effects of foot care nursing for people with diabetes mellitus: an uncontrolled before and after intervention study. *J Adv Nurs*. 2011;67(9):1952-62.
4. Ren M, Yang C, Lin DZ, Xiao HS, Mai LF, Guo YC, et al. Effect of intensive nursing education on the prevention of diabetic foot ulceration among patients with high-risk diabetic foot: a follow-up analysis. *Diabetes Technol Ther*. 2014;16(9):576-81.
5. Valentim SA, Haddad MCL, Rossaneis MA. Dificuldades vivenciadas pelo portador de diabetes mellitus residente em distrito rural. *Rev Enferm UFPE online*. 2015;9(4):7330-7.
6. Jiang Y, Ran X, Jia L, Yang C, Wang P, Ma J, et al. Epidemiology of type 2 diabetic foot problems and predictive factors for amputation in China. *Int J Low Extrem Wounds*. 2015;14(1):19-27.
7. Jupiter DC, Thorud JC, Buckley CJ, Shibuya N. The impact of foot ulceration and amputation on mortality in diabetic patients. I: from ulceration to death, a systematic review. *Int Wound J*. 2016;13(5):892-903.
8. Bortoletto MS, Andrade SM, Matsuo T, Haddad MC, González AD, Silva AM. Risk factors for foot ulcers: a cross sectional survey from a primary care setting in Brazil. *Prim Care Diabetes*. 2014;8(1):71-6.
9. Ferreira CLRA, Ferreira MG. Características epidemiológicas de pacientes diabéticos da rede pública de saúde: análise a partir do sistema HiperDia. *Arq Bras Endocrinol Metab*. 2009;53(1):80-86.
10. Caiafa JS, Castro AA, Fidelis C, Santos VP, Silva ES, Sitrângulo Jr CJ. Atenção integral ao portador de pé diabético. *J Vasc Bras*. 2011;10(4Supl. 2):1-32.
11. Smanioto FN, Haddad MCFL, Rossaneis MA. Self-care into the risk factors in diabetic foot ulceration: cross-sectional study. *Online Braz J Nurs*. 2014;13(3):343-52.
12. Braga DC, Bortolini SM, Rozetti IG, Zarpellon K, Nascimento JC, Neris JE. Avaliação de neuropatia e complicações vasculares em pacientes com diabetes mellitus em um município rural de Santa Catarina. *Rev AMRIGS*. 2015;9(2):78-83.
13. Iser BPM, Stopa SR, Chueiri PS, Szwarcwald CL, Malta DC, Monteiro HOC, et al. Prevalência de diabetes autorreferido no Brasil: resultados da Pesquisa Nacional de Saúde 2013. *Epidemiol Serv Saúde*. 2015;24(2):305-14.
14. Santos ICRV, Nunes ENS, Melo CA, Farias DGF. Amputações por pé diabético e fatores sociais: implicações para cuidados preventivos de enfermagem. *Rev RENE*. 2011;12(4):684-91.
15. Santos EA, Tavares DMS, Rodrigues LR, Dias FA, Ferreira PCS. Morbidity and quality of life of elderly individuals with diabetes mellitus living in urban and rural areas. *Ver Esc Enferm USP*. 2013;47(2):393-400.
16. Silva EF, Paniz VMV, Laste G, Torres ILS. Prevalência de morbidades e sintomas em idosos: um estudo comparativo entre zonas rural e urbana. *Ciênc Saúde Coletiva*. 2013;18(4):1029-40.
17. ChegourH, El AnsariN, El Mghari G, Tali A, Zoughaghi L, Sebbani M, et al. Quels agents incrimines dans les mycoses du pied? enquêteauprès des diabétiques consultant au CHU Mohammed VI de Marrakech. *Pan Afr Med J*. 2014;17:228.
18. Papini M, Cicoletti M, Fabrizi V, Landucci P. Skin and nail mycoses in patients with diabetic foot. *G Ital Dermatol Venereol*. 2013;148(6):603-8.
19. Gerawarapong C. Association of peripheral autonomic neuropathy and sympathetic skin response in the patients with diabetic polyneuropathy: a pilot study in Thailand. *J Med Assoc Thai*. 2015;98(12):1222-30.
20. Laclé A, Valero-Juan LF. Diabetes-related lower-extremity amputation incidence and risk factors: a prospective seven-year study in Costa Rica. *Rev Panam Salud Publica*. 2012;32(3):192-8.

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