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Foot Care Behavior Among People with Type 2 Diabetes Mellitus: Overview and Sociodemographic Factors Impact

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ABSTRACT

Foot care behavior is essential to prevent the risk of diabetic foot ulcers among people with type 2 diabetes mellitus (T2DM). The sociodemographic predisposing factors had determined mainly behavior. The study aimed to analyze sociodemographic factors' effect on foot care behavior in people with T2DM. This study was an analytical observational study with a cross-sectional design. The sample size was 130 respondents, with multistage random sampling. The instruments used were a questionnaire. The results showed that most of the respondents were 56-65 years (45.38%), women (62.31%), married (86.15%), basic education (46.15%), and income level were less than the district minimum wage (56.92%), Madurese (54.62%), nuclear family type (46.15%), and had foot care behavior in the good category (71.54%). Income level was the sociodemographic factor that significantly affected foot care behavior (p=0.019). Respondents with low-income levels (less than regency minimum wage) showed poor foot care behavior. At the same time, other sociodemographic factors, such as age, gender, marital status, education level, ethnicity, and family type, did not affect foot care behavior (p-value > α = 0.05). The higher the income level, the better the foot care behavior. Providing diabetes education to increase awareness of diabetic patients about foot care is essential to paying attention to sociodemographic conditions, especially income levels. Good foot care behavior can reduce the risk of diabetic foot ulcers, minimize morbidity, and improve the quality of life of people with T2DM.

Keywords: type 2 diabetes; foot ulcers; demography; self-care

INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia due to defects in insulin secretion, insulin action or both. Type 2 diabetes mellitus (T2DM) occurs when a person's body cannot use insulin effectively. T2DM is a non-communicable disease (NCD), a global health problem usually associated with an unhealthy lifestyle (American Diabetes Association, 2021a; World Health Organization, 2019). The prevalence of people with diabetes (20 – 79 years) has continued to increase yearly, especially in the last decade. In 2011 the number of people with diabetes was 366 million, rising to 537 people in 2021 (46.72%). This figure is expected to increase to 643 million in 2030 and 783 million in 2045. The number of people with diabetes in Indonesia in 2021 was 19.5 million (ranked 5th in the world) and is estimated to be 28.6 million in 2045 (International Diabetes Federation, 2021). Based on RISKESDAS 2018 data, East Java province is one of the five provinces in Indonesia with the number of people with T2DM after DKI Jakarta, East Kalimantan, DI Yogyakarta, and North Sulawesi. The prevalence of people with T2DM in East Java Province is 2.6% or 875,745 people; specifically, in Jember Regency, the number is 35,921 people (Dinas Kesehatan Provinsi Jawa Timur, 2021; Kementerian Kesehatan RI, 2019).

Foot care behavior is one of the critical components in T2DM self-management. Foot care behavior is essential to be carried out regularly to prevent and delay potential complications (American Diabetes Association, 2020a, 2021b). One of the complications that often occur and is most feared by people with T2DM is diabetic foot complications which often lead to amputation. Amputation affects the quality of life of people with T2DM because it can cause pain and discomfort so that physical function is limited, dependent on medical care, and unable to work. Therefore, implementing an appropriate prevention strategy, namely foot care, is necessary. However, the foot care behavior of people with diabetes is still in the poor category, which can lead to severe problems, namely leg amputation (American Diabetes Association, 2020a; D'Souza et al., 2016; Syed et al., 2019). The incidence of limb amputation in people with diabetes

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mellitus is 10-20 times more common than in individuals who do not have diabetes. Both T1DM and T2DM are prone to developing diabetic foot ulcers, but the prevalence of diabetic foot complications in the world is higher in people with T2DM compared to T1DM (American Diabetes Association, 2020a).

The results of previous studies showed that 29.6% of people with T2DM had diabetic foot ulcers. Furthermore, the study showed that positive correlation between the increase in diabetic foot ulcers with poor foot care. Several previous studies have shown that people with T2DM had poor foot care behavior. The results of previous studies showed that 72.8% of people with diabetes have poor foot care behavior (Syed et al., 2019), only 14% of people with diabetes do regular foot care, even only 41% and 34% check their feet for lesions and sensory loss or loss (Al Sayah et al., 2015). A study in Indonesia also showed almost the same results; 65.2% of people with T2DM had poor foot care behavior (Sari et al., 2020). More specifically, there are only 38% of patients do foot checks every day, and there are 70% of patients wash their feet frequently, and there are only 42.3% of patients dry between their toes after washing their feet, and 42.8% never use moisturizers on their feet. About a third of the patients admitted that they often walk barefoot, wear shoes that are not the right size, use socks without stitches, and some patients place their feet near heat sources. It can be concluded that most people with T2DM have poor foot care behavior (Syed et al., 2019).

Diabetic foot ulcers usually occur due to neuropathic, vascular disorders, trauma followed by secondary infection, and decreased immune system (Bandyk, 2018). Hyperglycemia produces oxidative stress on nerve cells and leads to neuropathy. Glycosylation of cell proteins will cause ischemia, causing nerve cell damage which manifests in motor, autonomic, and sensory nerve damage (American Diabetes Association, 2020a). The results of previous studies indicate that damage to motor nerves in people with diabetes can increase foot injury (Nistiandani et al., 2021). Changes in the anatomical structure can trigger it. Peripheral neuropathy causes intrinsic muscle atrophy, thus triggering functional anatomical changes in the foot, such as hammer-toe formation and the development of high-pressure zones on the plantar surface of the foot at the metatarsal heads. Neuropathy, vascular disorders (arterial occlusive disease), and trauma accompanied by secondary infection can increase the risk of diabetic foot ulcers (Bandyk, 2018).

Based on the PRECEDE-PROCEED model, one of the dominant factors in shaping behavior is sociodemographic characteristics which are predisposing factors (Glanz et al., 2008). Individual sociodemographic characteristics are essential in self-care behavior as a diabetic foot ulcer prevention effort. Several previous studies have shown that sociodemographic factors influence foot care behavior, including age (Miikkola et al., 2019; Sari et al., 2020), gender (Domingos et al., 2021; Pourkazemi et al., 2020; Sharoni et al., 2017; Usta et al., 2019), marital status (Domingos et al., 2021; Pourkazemi et al., 2020), an education level (Ahmed et al., 2019; D'Souza et al., 2016; Pourkazemi et al., 2020; Sari et al., 2020; Syed et al., 2019), income level (D'Souza et al., 2016; Khaliq et al., 2019; Syed et al., 2019), family system/type or support (D'Souza et al., 2016; Sari et al., 2020), and ethnicity (Nwasuruba et al., 2007; Tan et al., 2020). Older people with T2DM often experience difficulty carrying out self-care, including foot self-care behavior (Miikkola et al., 2019). Gender differences also determine foot care behavior. Females showed good foot care behavior because they were more painstaking and capable of performing foot care (Usta et al., 2019). People with T2DM with a life partner have better foot care behavior associated with their partners' social support in daily self-management practices (Domingos et al., 2021; Pourkazemi et al., 2020). Higher education and income are associated with higher levels of knowledge and ability to access health services and health financing (Ahmed et al., 2019; D'Souza et al., 2016; Khaliq et al., 2019; Pourkazemi et al., 2020; Sari et al., 2020; Syed et al., 2019). In addition, specific ethnicities, such as white ethnicity, appear to be better at using insulin and monitoring blood glucose. However, in carrying out foot care practices at home, African Americans are better than other ethnicities. African Americans attend diabetes education classes more frequently and intensely than other ethnicities (Nwasuruba et al., 2007). Other research shows differences in the risk of lower extremity amputation according to race and ethnicity, which is associated with having health insurance (Tan et al., 2020).

However, several other research results showed different results; namely, there was no significant relationship between foot care behavior and age (Indrayana et al., 2019; Khaliq et al., 2019; Pourkazemi et al., 2020), gender (Indrayana et al., 2019; Khaliq et al., 2019; Sari et al., 2020), marital status (Khaliq et al., 2019; Sari et al., 2020), an education level (Alshammari et al., 2019), income level (Sari et al., 2020), family system/type (Khaliq et al., 2019), and ethnicity (Al Sayah et al., 2015). It shows that the influence of sociodemographic factors on foot care behavior shows inconsistent results. In addition, research has been widely carried out on the influence of sociodemographic factors on foot care behavior among people with T2DM in Indonesia. Therefore, this study aims to analyze whether sociodemographic factors of people with T2DM, such as age, gender, marital status, education level, income level, family system/type, and ethnicity, influence the foot care behavior of people with T2DM in Indonesia.

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METHOD

This research is an analytic observational study with a cross-sectional design, conducted in July - September 2022 in Jember Regency. The sample of this study was people with T2DM with inclusion criteria: (1) adult, (2) duration of diabetes of more than one year, (3) not being hospitalized, (4) no difficulty in communicating, (5) willing to be a respondent. The sample size was 130 respondents, calculated by G Power (f2 = 0.25; α= 0.05; and power = 0.9). The sampling technique used is multistage random sampling. The sampling procedure begins by dividing the Jember Regency area into five parts, namely east, west, north, south, and center, using a map of the Jember Regency. The researcher then randomly selected two health centers in each region; ten health centers were selected, namely Kencong, Kalisat, Mayang, Umbulsari, Bangsalsari, Tanggul, Arjasa, Jelbuk, Patrang, and Sumbersari Health Centers. The researcher then randomly selected five villages from each selected health center. Then choose 2-3 respondents from each village.

The study variables consisted of sociodemographic factors (age, gender, education level, income level, marital status, ethnicity, and family type) as independent variables and foot care behavior as the dependent variable. The research instrument was a questionnaire, namely a sociodemographic questionnaire containing questions about the sociodemographic condition of T2DM sufferers and a diabetic foot care behavior questionnaire adapted from the Nottingham Assessment of Functional Foot-care (NAFF) questionnaire (Lincoln et al., 2007). The diabetic foot care behavior questionnaire consists of 21 items with a Likert scale of 0–3. This questionnaire consists of 6 indicators, namely how the patient's foot care behavior is in examining the condition of the feet, maintaining foot hygiene, cutting toenails, maintaining and use of footwear, injury prevention, and injury management. The validity and reliability test results obtained the value of r=0.357–0.765 and Cronbach alpha=0.791.

Data were collected by conducting direct interviews with respondents. Researchers provide informed consent to prospective respondents by explaining to respondents about research procedures, objectives, benefits, and risks of harm. After the prospective respondent understands it, the researcher asks them to sign a consent form to become a research respondent. Data were analyzed descriptively with central tendency and dispersion (CI 95%) and inferential statistical tests with multiple logistic regression tests with SPSS software (α=0.05). This research has received ethical approval from the Health Research Ethics Committee, Faculty of Nursing, Universitas Jember, with certificate number 110/UN25.1.14/KEPK/2022.

RESULT

Based on Table 1, It can be seen that most of the respondents of this study were 56-65 years old (45.38%), women (62.31%), married (86.15%), with low socioeconomic, namely basic education (elementary school and junior high school) (46.15%) and income level was less than the district minimum wage (56.92%). Most respondents were the Madurese (54.62%), with the family type being Nuclear Family (46.15%). Most respondents had foot care behavior in the good category (71.54%). Based on multiple logistic regression tests (Table 2), it can be seen that only the income level variable had a significant effect on foot care behavior (p=0.019 < α=0.05). While age, gender, marital status, education level, ethnicity, and type of family have no significant effect on foot care behavior (p-value > α=0.05).

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Table 1. Sociodemographic Characteristic and Foot Care Behavior of People with T2DM (n=130)

Characteristics/Study Variables	Frequency	Percentage
Age		
45 – 45 years	18	13.85
46 – 55 years	53	40.77
56 – 65 years	59	45.38
Gender		
Male	49	37.69
Female	81	62.31
Marital status		
Married	112	86.15
Not married/Widow/Widower	18	13.85
Education Level		
No education	17	13.08
Basic education (elementary and junior high school)	60	46.15
Middle education (senior high school)	41	31.54
Higher education (college)	12	9.23
Income level		
Less than regency minimum wage	74	56.92
More than regency minimum wage	56	43.08
Ethnicity		
Madurese	71	54.62
Javanese	59	45.38
Family type		
Nuclear family	60	46.15
Single parent	10	7.69
Blended family	1	0.77
Extended family	43	33.08
Middle age/elderly couple	16	12.31
Foot Care Behavior		
Poor	37	28.46
Good	93	71.54
Total	130	100.00

Table 2. Analysis of the Influence of Sociodemographic Factors on Foot Care Behavior of People with T2DM (n=130)

Variable		Estimate	Wald	p
Age (years)	36 – 45	-1.274	3,404	0.065
	46 – 55	0.446	0.745	0.388
	56 – 65		Reference	
Gender	Male	-0.515	1.252	0.263
	Female		Reference	
Marital Status	Married	0.985	1,359	0.244
	Not married/Widow /Widower		Reference	
Education level	No school	-2.292	3.137	0.077
	Basic education (elementary and junior high school)	-1.440	1,451	0.228
	Middle Education (senior high school)	-0.672	0, 311	0.577
	Higher education (college)	0 [a]	.	.
Income level	Less than regency minimum wage	-1.187	5,456	0.019
	More than regency minimum wage	0 [a]	.	.
Ethnicity	Madurese	0.018	0.001	0.972
	Javanese	0 [a]	.	.
Family type	Nuclear family	-0.762	0, 923	0.337
	Single parent family	1,732	1.372	0.242
	Blended family	19,442	.	.
	Extended family	-0.892	1.242	0.265
	Middle age	0 [a]	.	.

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DISCUSSION

The results of the study (Table 1) show that most of the respondents are aged 56-65 years (45.53%), female (62.31%), married (86.15%), basic education (46.15%), income level less than regency minimum wage (56.92%), Madurese (54.62%), and family type is nuclear family (46.15%). The results of this study follow the report of the International Diabetes Federation, which shows that most people with T2DM are aged 55-65 (International Diabetes Federation, 2021). The results of this study are also consistent with previous research, which stated that most of the ages of people with T2DM were more than 50 years old (Bonger et al., 2018), with an average age of 60.14 years (Sari et al., 2020). The aging process will cause a decrease in the body's metabolic function which will affect glucose regulation in the body and decrease the function and performance of the body's hormones, including insulin, due to obesity, thereby increasing the risk of diabetes (American Diabetes Association, 2021a; International Diabetes Federation, 2021).

The results of this study are also consistent with the report of RISKESDAS 2018, which states that most people with T2DM in Indonesia were women, with the ratio of women to men being 2.4% Vs. 1.7% of Indonesia's population (Kementerian Kesehatan RI, 2019). The results of this study are also consistent with the results of previous studies, namely that people with T2DM are women (Bonger et al., 2018; Pourkazemi et al., 2020; Sari et al., 2020). Women are more at risk of experiencing diabetes due to low physical activity and obesity. It can trigger insulin resistance, impacting the emergence of the diabetes (American Diabetes Association, 2020b). In addition, women also experience a period of pregnancy which can increase the risk of diabetes due to hormonal changes. During pregnancy, there is an increase in human placental growth hormone and human placental lactogen, which causes an increase in blood glucose levels. In addition, pregnancy also causes an increase in the hormones estrogen and progesterone, which trigger insulin resistance, causing gestational diabetes, which increases the risk of T2DM in the future (American Diabetes Association, 2020b; International Diabetes Federation, 2021). A pregnancy history increases the risk of T2DM by 3.87 times higher (Diaz-Santana et al., 2022).

The results showed that the majority of respondents had a basic education level and an income level of less than the regency minimum wage (Table 1), indicating that the socioeconomic status of most of the respondents was in a low category. The results of this study are consistent with previous research, which stated that most people with T2DM had basic education, namely 41.9% (Pourkazemi et al., 2020) and 38% (Ahmed et al., 2019). In addition, the results of previous studies are also consistent with previous research, which showed that most people with T2DM had a low income of 48.3% (Syed et al., 2019), even the results of other studies in Indonesia showed that 84.8% of people with T2DM have low-income (Sari et al., 2020). People with T2DM are mostly residents of low-middle-income countries (89.64%), with the number of people with T2DM being 423.7 million people. Specifically, in low-income countries, it is 3.49%. However, almost 90% of people with undiagnosed diabetes live in low- and middle-income countries (International Diabetes Federation, 2021). Low socioeconomic status is a risk factor for diabetes. Low socioeconomic status makes a person have low purchasing power so that healthy food choices are limited, even the tendency for types of consumption to be dominated by carbohydrates to meet energy needs. Excessive carbohydrate intake can increase the risk of diabetes (Heerman et al., 2016). In addition, low socioeconomic status can also lead to an increased risk of complications and premature death due to low ability to access health services, so health care is not optimal (International Diabetes Federation, 2021).

The results showed that most respondents had good foot care behavior (71.54%). The results of this study are consistent with previous research, which stated that most people with T2DM have foot care in the good category (Indrayana et al., 2019). However, the results of this study were inconsistent with several previous studies, which stated that most people with T2DM have poor foot care behavior (Al Sayah et al., 2015; Sari et al., 2020; Syed et al., 2019). The difference between the results of this study and several previous studies is that all respondents already have insurance or health insurance, and they regularly participate in the chronic disease management program (PROLANIS) to gain knowledge and skills through education about diabetes self-care from health workers, including in foot care actions. Education makes a person understand the problems faced and be able to make decisions about what to do. Diabetes self-management education and support enables people with T2DM to receive the necessary support to facilitate knowledge, decision-making, and mastery of skills necessary for diabetes self-care (American Diabetes Association, 2021b)

The results showed that age, gender, marital status, education level, ethnicity, and family type did not significantly affect foot care behavior in people with T2DM. Only the income level factor significantly affects foot care behavior in people with T2DM (Table 2). The results of this study are inconsistent with previous research, which stated that age significantly affects foot care behavior (Miikkola et al., 2019; Sari et al., 2020). However, the results of this study are consistent with several previous studies which stated that there was no significant relationship between foot care

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behavior and age (Indrayana et al., 2019; Khaliq et al., 2019; Pourkazemi et al., 2020). It is probably because most respondents have foot care behavior in the good category. All age categories mostly show good foot care behavior. Respondents of the elderly can also perform good foot care due to more experience and skills. Younger age is associated with the ability to access information. However, an increase in age will be followed by an increase in experience and skills. It is the possibility that causes no significant difference from the age factor to foot care behavior. The results of previous studies stated that increasing age could enhance the experience and self-skills in self-management of people with diabetes mellitus will also increase (Rondhianto et al., 2020). Therefore, elderly respondents can also do good foot care because they have more experience and skills, so they are wiser in doing foot care.

The results of this study are inconsistent with previous research, which stated that gender has a significant effect on foot care behavior (Domingos et al., 2021; Pourkazemi et al., 2020; Sharoni et al., 2017; Usta et al., 2019). Females look better in foot care, painstaking, and more capable of doing foot care than males (Usta et al., 2019). Meanwhile, males seem to pay less attention to foot care, which may be related to their social habits and daily life, which require them to work outside the home (Domingos et al., 2021). It differs from previous studies' results, which stated that males have better foot care abilities than females (Sharoni et al., 2017). The results of this study are consistent with previous research, which states that gender differences do not significantly affect foot care behavior (Indrayana et al., 2019; Khaliq et al., 2019; Sari et al., 2020). The absence of the effect of gender differences on foot care behavior is probably due to people with T2DM, both men and women, responding according to directions and recommendations from health workers in disease management.

The results of this study are inconsistent with previous studies, which stated that marital status has a significant effect on foot care behavior. People with T2DM with a life outlook show better foot care behavior than those who do not have a life partner (Domingos et al., 2021; Pourkazemi et al., 2020). The existence of a life partner will make it easier for someone to adapt to new behavior. In addition, if there are obstacles, they will find it easier to modify their behavior by taking the necessary care measures for health in connection with the support of their partner (Kaakinen & Denham, 2015). The results of this study are consistent with several previous studies that state that marital status does not significantly affect foot care behavior (Khaliq et al., 2019; Sari et al., 2020). It is because even though they do not have a life partner, they still get support from other family members. In addition, the partner's role in managing diabetes depends on many factors, including the willingness and ability of the spouse to manage the disease (Kaakinen & Denham, 2015). Spouses unable or do not care about diabetes self-management sometimes become obstacles for sufferers in managing diabetes (American Diabetes Association, 2021b).

The results of this study are inconsistent with several previous studies that state that education level is a predictor that influences foot care behavior. A high level of education is assumed with adequate knowledge of disease management (Ahmed et al., 2019; D'Souza et al., 2016; Pourkazemi et al., 2020; Sari et al., 2020; Syed et al., 2019). However, the results of this study are consistent with several other studies. Foot care differences do not influence by educational level. Differences in diabetic foot care behavior are more influenced by experience, where someone who has had diabetes for longer (> 5 years) seems to have better foot care behavior (Alshammari et al., 2019). The experience of living with diabetes will make a person directly or indirectly gain the knowledge needed in the diabetes self-management (American Diabetes Association, 2021b). Advances in information technology today enable respondents with high and low levels of education to access health information through various media, including the internet, making it easier to get information on foot care.

The results of this study are inconsistent with several previous studies that state that differences in ethnicity can affect foot care behavior. Black ethnicity seems to have better daily foot care behavior than white, Hispanic, and other ethnicities (Nwasuruba et al., 2007), so it can increase the risk of diabetic foot ulcers and foot amputation (Tan et al., 2020). However, the results of this study are consistent with previous studies. Differences in diabetic foot care behavior are determined more by other factors. Older age, female, longer duration of diabetes, and health literacy were significantly associated with better foot care (Al Sayah et al., 2015). Ethnicity will affect beliefs, service practices, and the use of health services. In this study, researchers assume that respondents who are ethnic Madurese and Javanese have relatively the same beliefs in utilizing health services and foot care. In addition, health workers providing health services also use languages understood by the two ethnic groups, namely Javanese and Madurese.

The results of this study are inconsistent with several previous studies that state that family support influences foot care behavior (D'Souza et al., 2016; Sari et al., 2020). Family support allows people with T2DM to receive adequate informational, appraisal, emotional, and instrumental support in the disease management (Kaakinen & Denham, 2015). Families who understand the disease process and management make it easier for people with T2DM to manage their illness (International Diabetes Federation, 2021). The results of this study are consistent with previous studies, which state that the family system or family type does not influence diabetic foot care behavior (Khaliq et al., 2019). There is no difference in the family type or family system for diabetic foot care behavior, possibly because family members from the

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nuclear family and extended family both show adequate support so that people with T2DM behavior for diabetic foot care is in the high category. Only people with T2DM who come from single parents show poor behavior.

The results showed that income level significantly affected diabetic foot care behavior (Table 2). The results of this study are consistent with several previous studies, which stated that income level was a predictor and significantly influenced diabetic foot care behavior (D'Souza et al., 2016; Khaliq et al., 2019; Syed et al., 2019). High-income levels positively impact foot care behavior, while low-income levels negatively impact foot care behavior (Khaliq et al., 2019). Income level can increase foot care behavior efficacy to prevent injury, use proper footwear, and find information regarding foot care (D'Souza et al., 2016). A high-income level is also associated with a person's ability to access health services and information (Tan et al., 2020). It can increase the self-efficacy of people with T2DM to increase positive coping mechanisms Field (Kurniyawan et al., 2022), increase positive perceptions of the disease and improve foot care behavior (Indrayana et al., 2019). Good foot care behavior can prevent nerve damage, thereby reducing the risk of injury to the feet (Nistiandani et al., 2021). Adequate information about the importance of foot care and how to do proper foot care. Someone with a low-income level, in general, tends to focus on working to meet the economic needs of the family, so they may not attend diabetes self-management educational activities from health workers. It is likely to cause poor foot care behavior.

CONCLUSION

The results of this study indicate that most people with T2DM have good foot care behavior. Sociodemographic factors are essential in influencing foot care behavior in people with T2DM. The results showed that the sociodemographic factor that had a significant influence and was a predictor of diabetic foot care behavior was income level. Income level has a positive influence on foot care behavior. The higher the income level, the more positive impact on foot care behavior. On the contrary, the lower the income level, the negative impact it will have on diabetic foot care behavior. Other sociodemographic factors, such as age, gender, marital status, education level, ethnicity, and family type, do not predict diabetic foot care behavior in people with T2DM. Preventive and promotive foot care efforts through diabetes education provided by health workers to increase awareness of diabetic patients about foot care are critical to do by considering sociodemographic conditions, especially income levels. Good foot care behavior could reduce the risk of diabetic foot ulcers, reduce morbidity, and ultimately improve the quality of life for people with T2DM and mortality from diabetes.

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