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ASSOCIATION BETWEEN PATIENT INTERPRETATION OF DIABETIC PERIPHERAL NEUROPATHY AND FOOT SELF-CARE BEHAVIORS

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Abstract: Foot-related disease is the most common cause of hospital admissions among the diabetic population. Diabetic foot ulcer-related morbidity could be ultimately prevented by positive patients' interpretation of peripheral neuropathy and active engagement in foot self-care.

Objective: To identify the association between patient interpretation of diabetic peripheral neuropathy and foot self-care behaviors.

Methods: A convenience sample of 121 adult diabetic patients with either type I or II diabetes were recruited from diabetic clinic at Gamal Abdel Nasar Hospital in Alexandria, Egypt. Four tools were used in the research study (Bio Sociodemographic Sheet, Modified Neuropathy Disability Score, Patient Interpretation Neuropathy (PIN) Questionnaire, and Foot Self-Care Behaviors Questionnaire).

Results: More than a third of patients have moderate peripheral neuropathy. Patients with no past history of foot ulcer obtained higher mean score of illness identity and causes. These differences were found to be highly statistically significant. The severity of peripheral neuropathy greatly affected patients' interpretation of peripheral neuropathy. The findings also indicated that there are significant differences between patients' foot self-care behaviors and their interpretation of peripheral neuropathy. Patients who have adequate foot self-care obtained higher mean score than those with inadequate foot self-care behaviors related to all items of peripheral neuropathy interpretations except items related to illness identity and causes.

Conclusion: The results highlight the importance of assessment and understanding patients' interpretation of peripheral neuropathy to promote foot self-care behavior and prevent diabetic foot complications.

Key words: Diabetic peripheral neuropathy, foot self-care behaviors

Introduction

Background

Foot ulceration and amputations cause an extensive burden on individuals with diabetes, the health care system, and society (Rathur & Boulton, 2007). However, diabetic foot ulcer-related morbidity could be ultimately decreased, as a significant proportion of foot ulcers could be prevented by patients' active engagement in foot self-care (American Diabetes Association, 2004). Causal pathways to foot ulceration are well defined, with diabetic peripheral neuropathy (DPN), the key risk factor, predisposing to foot ulceration through mechanisms that are either extrinsic to the foot (e.g., unperceived trauma) or intrinsic to the foot (e.g., DPN contributing to foot deformities and

high-pressure areas) (Bakker, 2015; Burker, Sherr, & Lipman, 2014). Therefore, it appears reasonable that a series of relatively simple foot self-care actions should be effective in reducing the effect of neuropathic risk factors and thereby decreasing the incidence of insensate foot ulcers. Published guidelines on diabetic foot self-care define two types of such behaviors: engagement in preventive foot self-care (e.g., having feet measured when buying a new pair of shoes) and avoidance of behaviors which, although appropriate for people with intact sensation in their feet, can potentially damage the feet of people affected by DPN (e.g., barefoot walking) (Lavery et al., 2004; Lone et al., 2008).

A previous research study used the Common-Sense Model of Illness Behavior (CSM) to develop an instrument to assess how patients interpret neuropathy, respond emotionally, and make decisions to engage in foot self-care. The CSM postulates that individuals construct cognitive representations (beliefs and understanding) of illness in terms of experienced symptoms and diagnostic labels (both comprising the presence or identity of an illness), antecedent conditions believed to have caused illness (causes), expected duration (timeline), perceptions of cure or controllability (control), and perceived impact of illness (consequences). The model proposes that cognitive representations of illness give rise to and interact with emotional responses in driving illness behaviors (Lone et al., 2008; Vileikyte et al., 2006).

Epidemiological studies have revealed the prevalence of distal lower limb neuropathy, ranging from 30% to 50% of the diabetic population. Because of its frequent occurrence, more than 60% of diabetic foot ulcers are primarily due to an underlying neuropathy. Foot-related disease is the most common cause of hospital admissions among the diabetic population. Foot complications among diabetic patients cause fifteen times more amputations than those among non-diabetic patients, with amputation leading to physical impairment and disability, psychological barriers, large social costs and medical expenses (Al-Geffari, 2012; Busui et al., 2017). Among health care providers, nurses are particularly active in their involvement in the prevention and early detection of diabetes and its complications. Their role may be exercised in clinical settings and direct patient care, improving quality of life, community education or health systems management. Diabetes nurses play their educating role in the field of prevention diabetic foot complications by improving foot care and preventing foot injury. In the care dimension, nurses are responsible for early detection of any changes in skin and foot sensation, foot care, dressing and applying novel technology. In the area of rehabilitation, they help patients suffering from diabetic foot ulcer or amputation to improve movement and undertake guided therapeutic activities (e.g. advising on appropriate exercises and liaising with a physiotherapist in some cases). Given the wide scope of responsibility accorded to nurses in the care of diabetic patients,

special training is required to familiarize them with the latest instructions of diabetic foot care in order to provide effective services to facilitate and promote diabetic patients health (Aalaa et al., 2012).

Aim

To identify the association between patient interpretation of diabetic peripheral neuropathy and foot self-care behaviors.

Research questions

- Which foot self-care behaviors are performed by diabetic patients?
- Does interpretation of diabetic peripheral neuropathy differ between patients with and without history of foot ulcer?
- Does interpretation of diabetic peripheral neuropathy differ between patients related to their severity of peripheral neuropathy?
- Are there any associations between patients' interpretation of peripheral neuropathy and foot self-care behaviors?

Materials

Research design: Descriptive co relational design.

Setting: The Diabetic Clinic at Gamal Abdel Nasar Hospital in Alexandria, Egypt.

Subjects: A convenience sample of 121 adult diabetic patients were recruited. Key inclusion criteria were diagnosis of type I or II diabetes and clinically determined peripheral neuropathy using Modified Neuropathy Disability Score (NDS). Patients were excluded if they had a history of amputation.

Tools

Four tools were used in the research study, as described below.

- ***Bio-Sociodemographic Sheet***

Includes patients' age, gender, level of education, occupation, marital status, residential type, diabetes type, diabetic duration, treatment type, co-morbidities, past foot ulceration history, and family history of diabetes.

- ***Modified Neuropathy Disability Score (NDS)***

It was developed by Vileikyte et al*,* (2006), NDS was used to assess the severity of peripheral neuropathy. It was derived from examination of ankle reflex with the tendon hammer, with Vibration Perception Threshold (VPT) tested with a tuning fork (128 Hz) placed at the apex of the big toe; pain sensation assessed using 10-g monofilament (plantar surface of distal hallux was tested on each foot); and temperature sensation on the dorsum of the foot assessed by a cold tuning fork. Patients were asked to close their eyes while being tested.

The sensory modalities were scored as either present = 0 or reduced / absent = 1 for each side; and reflexes were scored as normal = 0, present with reinforcement = 1 or absent = 2 per side.

The total maximum abnormal score is 10. Neuropathy scores of 2-5 indicated mild, 6-8 moderate and 9-10 severe.

- ***Patient Interpretation Neuropathy (PIN) Questionnaire***

Also developed by Vileikyteet al. (2006), PIN was used to assess cognitive and emotional factors associated with foot self-care, containing 36 items in 6 subscales: *illness identity* (7 items, e.g. 'Lost or reduced feeling means poor circulation in my feet'); *causes* (11 items, e.g. 'I could develop foot ulcer without feeling any pain'); *acute timeline*(3 items, e.g. 'Foot ulcer can develop very fast'); *Controllability*(5 items, e.g. 'Checking my feet every day can prevent foot ulcer from occurring); *Potential consequences*(4 items, e.g. 'Lost or reduced feeling in my feet could lead to foot ulcers); *Emotional representation*(6 items, e.g. 'Lost or reduced feeling in my feet makes me worry about losing a leg').

Responses to each statement were scored on a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree, and 5 = strongly agree).

- ***Foot Self-Care Behaviors Questionnaire***

Also developed by Vileikyte et al. (2006), the Foot Self-Care Behaviors Questionnaire assesses foot care behaviors with ten items assessing preventive foot self-care behaviors (e.g., "During the past week how often did you: Examine your feet? Wash your feet? Use moisturizing creams for your feet? Test water temperature with your hand/elbow? Check inside shoes? Change socks?" and "In general, how often do you: Have your feet measured when buying a new pair of shoes? Wear lace-up shoes? Cut toenails straight across?").

Eight items assessed potentially foot-damaging behaviors (e.g., "During the past week how often did you: Walk barefoot indoors/outdoors? Wear shoes without socks?" and "In general, how often do you: Use heating pads to warm cold feet? Use chemical agents to remove corns? Treat corns /calluses with the blade? Wear sandals or slip-ons?").

Responses were rated on a 6-point scale for "during the past week" questions (twice a day, daily, every other day, twice a week, once a week, or never) and on a 4-point scale for "in general" questions (always, most of the time, occasionally, or never). Higher scores indicate more preventive and potentially foot damaging behaviors.

Method

Procedure

The study was accomplished as follows:

- Permission to conduct the study was obtained from the Director of Hospital and the Head of Department to collect the data after explanation of the aim of the study.
- The tools were translated into Arabic by the researcher.
- The content validity of the questionnaire was assessed by a panel of five experts for clarity, validity, and comprehensiveness of the questionnaire items. A pilot study with 12

participants was conducted to determine the clarity and feasibility of the questionnaire and the time required from each patient to complete the questionnaire.

- The reliability of the tools was tested, and the internal consistency of the tools ranged from 0.79 to 0.92, indicating that the tool was reliable.
- Patients who agreed to participate in the study and who met the inclusion criteria were asked to sign a written informed consent form. After neurological examination by modified neuropathy disability score, the data were collected through individualized interviews with patients in the outpatient diabetic clinic of the hospital.

Ethical consideration

The participants' rights were protected by explaining to them the purpose and significance of the study. Participants were reassured that their responses would remain anonymous, and no remarks were made that could identify any individual participants. The clients were informed that their participation was entirely voluntary and they could withdraw at any time, and that their withdrawal would not affect the care they receive at the hospital. Participants' privacy was guaranteed as well as confidentiality. Written consent to take part in the study was obtained from the patients before data collection.

Statistical analysis

SPSS V 23.0 was used for the analysis of the data. Frequency tables and cross-tabulations with percentages were used to illustrate the results of categorical data. Quantitative data were summarized by the arithmetic mean and SD. Comparison of means was done by student t-test for comparison of two independent means and one-way analysis of variance (ANOVA) for comparison of more than two means. Effect size for ANOVA was measured by means of eta squared (η^2). Binary logistic regression analysis was used to determine the significance and odds ratios for possible risk factors.

Results

Demographic characteristics

Table (1) shows that more than half of the patients (54.5%) were female. The mean age of the participating patients was 49.4years, and more than one quadrant of patients (26.4%) have bachelor's degree level of education, and 40.5% of them have secondary school qualifications. Regarding occupation, the majority of patients (74.4%) are still working, and more than two-thirds (68.6%) are from urban areas. The findings also indicated that approximately two-thirds of patients are married (66.9 %) and have type II diabetes mellitus(65.3%)

Table (1) Bio-sociodemographic characteristics of participants

Bio-Sociodemographic Characteristics		Count	%
Sex	Male	55	45.5
	Female	66	54.5
Age(mean = 49.4years)	20 <30	10	8.3
	30<40	16	13.2
	40<50	32	26.4
	50<60	35	28.9
	60<70	28	23.1
Education	Illiterate	21	17.4
	Primary	19	15.7
	Secondary	49	40.5
	Bachelor	32	26.4
Occupation	Retired	31	25.6
	Still work	90	74.4
Residential type	Rural	38	31.4
	Urban	83	68.6
Marital status	Single	20	16.5
	Married	81	66.9
	Widow	11	9.1
	Divorced	9	7.4
Diabetes type	Type I	42	34.7
	Type II	79	65.3

Table (1) Bio-sociodemographic characteristics of participants (cont.)

Bio-Sociodemographic Characteristics		Count	%
Diabetes duration (mean = 12.7)	<5	9	15.7
	5 - <10	35	28.9
	10 - <15	23	19.0
	15 - <20	12	9.9
	20 or more	32	26.4
Types of treatment	None	2	1.7
	Oral anti diabetic drug(OAD)	62	51.2
	Insulin only	32	26.4
	Insulin & combined OAD	25	20.7
Have you been taught diabetes foot care?	Yes	42	34.7
	No	79	65.3
Comorbidity	None	32	26.4
	Heart disease	22	18.1
	HTN	33	27.2
	Kidney disease	8	6.6
	Liver disease	7	5.7
	Hyper lipidemia	17	14.4
	Eye disease	2	1.6
Past foot ulceration	Yes	38	31.4
	No	83	68.6
Past foot ulceration since (yrs)	<5	26	68.4
	5 or more	12	31.6

Concerning duration of diabetes, more than one quadrant (26.4%) of patients had diabetes for 20 years or more (the mean years of diabetes duration was12.7 years). In addition, more than half of patients (51.2%) were taking oral antidiabetic drugs as treatment for diabetes. More than two-thirds (68.6%) have no history of foot ulceration (mean years of foot ulceration history =3.7). The majority (73.6%) of participants reported having a co-existing medical condition. Hypertension was the most common medical condition reported by 27.2%of those with co-morbidities, followed by heart diseases (18.1%).

Foot self-care behavior

Table 2 shows that 57.9% of patients have inadequate foot self-care behavior and 42.1% of patients have adequate foot self-care behavior.

Table (2): Foot self-care behavior

Foot self-care behavior	N	%
Adequate	51	42.1
Inadequate	70	57.9

Table (3) shows the relation between patients' characteristics and their foot self-care behaviors. Regarding patients' education, illiterate patients had a higher risk for inadequate foot self-care behavior than patients with bachelor's degrees, with a significant odds ratio of (5.208) (P = 0.036*). Also, the primary education group had higher risk behavior than those with a bachelor's degree, a significant Odds ratio of (5.886) (P = 0.031*). As regard working status, retired patients had a higher risk mounting to 10 times than working patients (P = 0.002*)

Table 3: Relation between patients' characteristics and their foot self-care behaviors

Patient's characteristics	B	S.E.	Sig.	Exp(B) Odds Ratio	95% C.I.for EXP(B)	
					Lower	Upper
Sex (Male)	.005	.467	.992	1.005	.402	2.512
Age	-.002	.033	.949	.998	.936	1.064
Education			.023*			
Illiterate	1.650	.787	.036*	5.208	1.114	24.341
Primary	1.773	.823	.031*	5.886	1.174	29.512
Secondary	.001	.534	.998	1.001	.352	2.849
Retired	2.303	.761	.002*	10.004	2.250	44.477
Rural	.396	.507	.435	1.486	.550	4.017
Single	.448	.874	.608	1.565	.282	8.682
Diabetes duration	-.006	.036	.861	.994	.926	1.067
Taught Foot Care	-.325	.513	.526	.722	.264	1.975
Constant	-.629	1.597	.694	.533		

*** P ≤ 0.01 (significant)**

Concerning preventive foot self-care behaviors, the findings indicated that more than a third (36.4%) of participants never examine their feet, more than half of them (55.4%) do not use moistening cream for their feet, and the vast majority (95.9%) never test the water temperature with their elbow. Nearly half of them (49.9%) never check inside their shoes. The findings also revealed that more than a third of participants (34.7%) occasionally wear lace-up shoes and nearly one quadrant of them (24.8%) occasionally cut their nails straight across.

Potentially damaging behaviors, including walking bare foot indoors daily, were mentioned by 27.3% of participants, and wearing shoes without socks every other day was reported by 26.4%. In addition, more than a third of participants (35.5%) wear sandals or slip-ons most of the time.

Interpretation of peripheral neuropathy

Table 4 shows that patients have no past history of foot ulcer obtained higher mean score of illness identity and causes than those with history of foot ulcer (27.35 VS. 24.21) (42.53 VS. 40.32) respectively. In addition, these differences were found to be highly statistically significant (P = 0.000**). The results also revealed that there were significant differences between patients' interpretation of peripheral neuropathy (acute time line item) and their past history of foot ulceration (P = 0.013*). Regarding other items of patient interpretation of peripheral neuropathy (controllability, potential consequences, emotions), the results revealed no significant differences between these items and history of foot ulceration

Table (4): Differences between patients' interpretation of peripheral neuropathy regarding their past history of foot ulceration

Patient interpretation of peripheral neuropathy	Past foot ulceration	N	Mean	SD	t-value Sig
Illness Identity Score	Yes	38	24.21	3.960	4.869
	No	83	27.35	2.940	0.000**
Causes Score	Yes	38	40.32	3.884	3.297
	No	83	42.53	3.202	0.000**
Acute Timeline Score	Yes	38	10.32	1.165	2.508
	No	83	9.73	1.190	0.013*
Controllability Score	Yes	38	19.08	1.699	1.107
	No	83	19.41	1.440	0.271
Potential Consequences Score	Yes	38	15.87	2.304	0.521
	No	83	15.57	3.213	0.603
Emotions Score	Yes	38	25.29	2.931	0.675
	No	83	24.92	2.781	0.501

*** P ≤ 0.01 (significant)**

Patients with a history of foot ulcer obtained a higher mean score more than patients with no history in all items of interpretation of peripheral neuropathy except illness identity and causes.

Table (5) shows that more than a third of patients (38.8%) have moderate peripheral neuropathy, and more than half of them (50.4%) have mild peripheral neuropathy according to neuropathy disability score.

Table (5) Distributions of patients according to their neuropathy disability score

Neuropathy disability score	Count	Percent
Mild	61	50.4
Moderate	47	38.8
Severe	13	10.7
Total	121	100.0

Table (6) shows that the severity of peripheral neuropathy had a great impact on patients' interpretation of peripheral neuropathy with significant differences found between neuropathy disability score and all items of patient interpretation of peripheral neuropathy except the emotion item.

The results also revealed that patients with mild peripheral neuropathy have high mean of illness identity score, controllability score and emotion score (with means of 27.9, 19.7 and25.3, respectively). On other hand, the findings indicated that patients with moderate peripheral neuropathy have high mean of acute timeline score and consequences score (10.4 and 16.3), while patients with severe peripheral neuropathy have a high mean of causes score (43.7).

Table (6) Differences between patients' interpretation of peripheral neuropathy regarding their neuropathy disability score

Patient interpretation of peripheral neuropathy	Neuropathy disability score						F	Sig.	Eta Squared
	Mild		Moderate		Severe				
	Mean	SD	Mean	SD	Mean	SD			
Illness identity	27.9	2.79	24.5	3.64	25.8	3.51	15.574	0.000**	.209
Causes	43.2	3.58	39.6	2.48	43.7	2.46	21.136	0.000**	.264
Acute timeline	9.9	1.05	10.4	.90	8.2	1.48	21.182	0.000**	.264
Controllability	19.7	1.25	18.9	1.79	18.6	1.12	5.537	0.005*	.086
Potential consequences	15.8	3.15	16.3	1.80	12.8	3.79	8.217	0.000**	.122
Emotions	25.3	2.75	25.0	2.82	23.9	3.09	1.318	0.272	.022

*** P ≤ 0.01 (significant)**

Interpretation of peripheral neuropathy and foot self-care behaviors

Table 7shows that there are statistically significant differences between foot self-care behaviors and some subscales of interpretations the peripheral neuropathy. Foot self-care behaviors were positively significant with illness identity, causes, acute timeline, and controllability (P = 0.25, .004, .000, and.026 respectively).Also, patients who have adequate foot self-care obtained higher mean scores than those with inadequate foot self-care behaviors related to all items of peripheral neuropathy interpretations except items related to illness identity and causes.

Table 7: Relationship between patients' interpretation of peripheral neuropathy and their foot self-care behaviors

Interpretation of peripheral neuropathy	Total foot self-care level	N	Mean	SD	t-value Sig
Illness identity score	Adequate	51	25.51	4.017	2.272*
	Inadequate	70	26.99	3.128	.025
Causes score	Adequate	51	40.75	3.180	2.960**
	Inadequate	70	42.63	3.644	.004
Acute timeline score	Adequate	51	10.49	.946	4.852**
	Inadequate	70	9.50	1.213	.000
Controllability score	Adequate	51	19.67	1.306	2.257*
	Inadequate	70	19.04	1.628	.026
Potential consequences score	Adequate	51	16.14	1.721	1.523
	Inadequate	70	15.31	3.565	.130
Emotions score	Adequate	51	25.43	2.352	1.329
	Inadequate	70	24.74	3.105	.186

Adequate = Score ≥70%
Inadequate Score <70%
*** P ≤ 0.01 (significant)**

Discussion

Because optimal self-care has the potential to reduce long-term complications, a better understanding of how disease interpretations influence foot self-care behavior in patients with diabetic peripheral neuropathy as they begin to assume responsibility for maintaining and promoting their own health is important (Bruschiet al., 2017; Huston& Christopher, 2011).Illness interpretation is increasingly being shown to be related to important outcomes in a number of illnesses. Interpretation refers to how patients

understand and make sense of disease and/ or disabilities. Patients with the same illness may have different interpretations of their conditions and different emotional reactions to it, thus they essentially experience and are affected by the same biomedical illness categorization differently (Broadentet al., 2006).

Generally, the findings indicated that more than half of participating patients have inadequate foot self-care behavior. Poor behaviors were pronounced in the areas of feet examination, use of moistening cream for feet, shoes inspection, cutting nails straight across, walking bare foot indoors, wearing shoes without socks and wearing sandals or slip-ons for prolonged periods. Inadequate foot self-care behaviors highlight critical gaps in the care provided to patients with diabetes. These findings confirm reports from South Africa that most patients with diabetes do not regularly care for their feet, and when they do, the level of self-care is poor (Randiks&Olufemi, 2013).

This low level of foot care behavior identified by this study corroborates previous research that revealed inadequacies of foot care practice, and indicated that the majority of patients fail to get the appropriate size of footwear, and they do not inspect inside their footwear or indeed inspect their feet sufficiently (Waaijman, 2013). In this respect, Bell et al. (2005) reported that the degree to which a person is able to perform diabetes foot self-care is likely to be influenced by a number of factors, including personal health, access to medical care and foot care education, and formal and informal support. Similarly, certain segments of the population may be more likely to not receive appropriate medical foot care and not perform diabetes foot self-care, including the elderly, ethnic minorities, and people who live in rural communities. When patients are diagnosed with an illness, they generally develop an organized pattern of beliefs about their condition, which are the key determinants of behavior directed at managing illness. Illness perceptions or cognitive representations directly influence the patients' emotional response to the illness and their coping behavior, such as seeking treatment (Verhoofet al., 2014).

The results of the study highlight the importance of assessment and understanding patients' interpretation of peripheral neuropathy. Leventhal's Common Sense Model (CSM) that is used to understand people's responses to illness. The model proposes that illness perceptions directly influence coping strategies, which in turn influence outcomes. Illness perceptions are lay interpretations of information and personal experiences the patient has acquired. They are posited to include one non-cognitive domain (emotional perceptions) and five main cognitive domains: (1) identity (label and symptoms), (2) timeline, (3) consequences, (4) cause, and (5) perceived controllability or curability (Farquharson, Johnston &Bugge, 2011; Huston &Christopher, 2011).

It was found that illiterate patients were five times more likely to have inadequate foot self-care

behaviors than patients who have a bachelor's degree or who have finished high school. The explanation could be that more educated patients are more able and likely to read some educational booklets and use the internet to obtain more information about the disease, which helps them to improve their health behavior. Kayaniyilet al, (2009) stated that patients with less than a high school education had a lower knowledge and awareness about their illness. Furthermore, more educated patients have a better personal understanding of the disease (Fletchera&Frisvold, 2009). The relationship between education and foot care among DM patients has been observed in similar studies in Iran and Pakistan, where illiterate patients were the least knowledgeable (Al Odhayani, Tayel, & Al-Madi, 2015). The information of effective foot care has been proposed to be positively affected by patient education, which conversely decreases the hazard of foot ulceration and amputation in high-risk diabetics (Monamiet al., 2015;Tavakoliet al., 2017). While this study underlines the need for educational interventions to increase patients' knowledge and reduce diabetic foot complications, particularly for illiterate patients, Harvey (2015) stated that many patients do actually know appropriate behaviors but their adherence to an optimum regimen remains only partial for numerous reasons. Clearly, knowledge alone does not determine behavior, and the broader context of health beliefs and general lifestyle factors must be taken into account. For instance, this study found that retired patients had significantly higher risk of inadequate foot self-care behavior than those who were still working. This might be related to decrease physical functioning after sixty years old, which is associated with general cultural conditioning iterating that the proper role of the elderly is to relax in the house, doing as little as possible, in which case they may perceive foot care to be unnecessary. Previous research has shown that an important consideration in evaluating foot self-care practices among the elderly is physical limitations due to factors such as reduced visual acuity and poor joint flexibility. Self-examination of the entire foot requires flexion of the spine, flexion and lateral rotation of the hips, knee flexion, and inversion of the foot (Bell et al., 2005).

The findings indicated that peripheral neuropathy was higher among patients with type II diabetes mellitus. Numerous studies revealed that DPN, a common and troublesome complication in patients with type II diabetes mellitus, contributes to a higher risk of diabetic foot ulcer and lower limb amputation (Guttormsen& Chadwick, 2017; Ryan, 2017; Seung &

mean scores than patients with no history in all items of interpretation of peripheral neuropathy except illness identity and causes. Similarly, Vileikyteet al,(2006) noted that patients with past history of ulcer were less likely to mention misperceptions that the foot ulcer would be painful. In addition, past history of foot ulcer was positively associated with interpretation the relation between DPN and foot ulcers. Furthermore, past history of

foot ulcer was positively associated with worry about consequences of DPN. The interpretation might be that patients with history of foot ulcer passed the illness experience and knew that foot ulcers can develop very fast, and they are aware that potential consequences such as reduced feeling in feet could lead to feet injuries and amputation. Also, they experienced the emotional impact of their feet injuries, such as the fear of losing their legs.

According to The Common-Sense Model (CSM), people hold personal beliefs about their illness that to a large extent determine how they respond to their condition. Illness perceptions are constructed within the context of medical information, social communication and personal experience, all of which are dynamic, changing over time in response to new information and experiences (Huston & Christopher, 2011). In this concern, Puffelena et al, (2015) stated that the importance of the perceived seriousness and experienced distress resulting from diabetes-related complaints, for the performance of self-care appears to be supported by the finding that emotional representations were more strongly associated with checking one's feet more regularly once complications were present.

CSM stresses the importance of concrete experience in forming illness perceptions and, in turn, coping behaviors, including the self-care behaviors of individuals. Also, the results suggest that patients are more triggered to engage in certain self-care behaviors when they experience diabetes-related complications (Puffelenaet al., 2015).From a cognitive-behavioral perspective, it is interesting to study the cognitive factors that can be modified to promote healthy diabetes behaviors. Clinicians and diabetes educators can target some of these cognitive factors to help people with diabetes perform self-care behaviors with the frequency necessary to preserve their health (Ghermanet al., 2011).

The results revealed that the severity of peripheral neuropathy had high effect on patients' interpretation of peripheral neuropathy. In addition, significant differences were found between neuropathy disability score and all items of patient interpretation of peripheral neuropathy except the emotion item. The result also revealed that patients with mild peripheral neuropathy have high mean of illness identity score, controllability score and emotion score. The interpretation may be that diabetic patients who have knowledge of disease, symptoms and precautions have good control of the condition and thus decrease complications such as peripheral neuropathy (although they still experience them to a milder degree). Patients with severe peripheral neuropathy have high mean cause's scores. The interpretation may be nearly one third of patients pass the experience of foot ulcer and know the important causes of foot ulcer, such as reduced feeling in feet, poor foot self-care, dry skin, callus formation and that foot ulcer could develop without pain. On the other hand, Koliopouloset al. (2010) reported that it is possible that symptoms of neuropathy drive foot self-care interventions. More illness stimuli, such as

symptoms, lead to stronger emotional representations, possibly resulting in more foot care.

Patients who have adequate foot self-care obtained higher mean scores than those with inadequate foot self-care behaviors related to all items of peripheral neuropathy interpretations, except items related to illness identity and causes. This could be because the fear and/or perceived risk of amputation will be positively associated with foot self-care behavior. As the results of this study indicated, more than half of patients mentioned that loss or reduced feeling in their feet makes them worry about foot ulcer and amputation. This was supported by Koliopouloset al. (2010), who stated that motivation for foot self-care behavior may be driven by risk perception and emotional responses. Decisions to engage in self-care behavior are made not only by what one knows, but what one expects, values about benefits and harms, certainty, how the opinions of others are perceived, risk perception and emotional states and representations of illness.

Other previous researches showed that diabetes usually requires substantial life-long self-management by the patient. Psychological factors and the patients' health beliefs are important determinants of self-care behavior (Harvey, 2015;Snyder, Gibbs, & Lindsay, 2016).Patients' interpretation of illness has been found to be an important determinant of behavior and associated with treatment adherence and functional recovery(Petrie, Jago, &Devcich, 2007). Positive interpretation acts as a stimulator and supporter for creating new attitudes, which are considered more effective in patients' behavior.

The diagnosis of diabetes has a major psychological impact. Adjustment of the individual to this psychological blow is critical. Positive adjustment is required, by which individuals accept the diagnosis and the need for lifestyle change. Self-care behavior may be influenced by cognitive function, which can show premature decline in diabetes, or by depression, which is more common among diabetes patients than in the general population. Patients are motivated by their views on the likelihood that adverse events will occur, the perceived impact on their everyday life, perceived personal control and perceptions of effectiveness of preventive strategies. These views contribute to health beliefs, illness representations or personal model of illness (Harvey & Lawson, 2009).

Seung and Bong (2012) mentioned that despite increased prevalence and clinical significance, most diabetes mellitus patients unaware of the presence of diabetic neuropathy, and do not report their symptoms to physicians or other health care providers. Therefore, DPN is usually undiagnosed and undertreated. For early detection and appropriate intervention, a careful history, proper assessment of patients' illness interpretation, neurologic examination and immediate treatment are needed in diabetic patients. Poor patients' interpretation of peripheral neuropathy may be due to lack of communication between the health team and the patients and also lack of advice given by doctors and nurses as result of their

busy clinical schedule and the biomedical focus of clinical care delivery, which makes it difficult to provide ancillary and supportive care such as patient education due to the overwhelming prioritization of immediate clinical care delivery(Desaluet al., 2011).

Conclusion

The findings of this research concluded that there are associations between patient interpretation of diabetic peripheral neuropathy and foot self-care behaviors, which in turn affect coping strategies and health outcomes. As the findings indicated, there are significant differences between patients' foot self-care behaviors and their interpretation of peripheral neuropathy. Patients who have adequate foot self-care obtained higher mean score than those with inadequate foot self-care behaviors related to all items of peripheral neuropathy interpretations, except items related to illness identity and causes. In addition, patients 'interpretation of peripheral neuropathy had been affected by the severity of peripheral neuropathy and history of foot ulcer. In essence, illness interpretation is one's plan to engage in particular behavior. It is a cognitive process involved in acquiring, interpreting, selecting and organizing information. Illness interpretation refers to how patients understand and make sense of disease and/or disabilities. The patients first form the perception of the illness, then they adopt behaviors to cope with this illness, and finally they appraise the efficacy of these behaviors. The results of this study highlight the importance of assessment and understanding the patients' interpretation of peripheral neuropathy to promote foot self-care behavior and prevent diabetic foot complications.

Recommendations

- Diabetic patients should be screened periodically for peripheral neuropathy in order to pick up the signs, improving early diagnosis and management.
- A training program about foot examination and foot self-care behavior should be provided to diabetic patients.
- Enough time should be provided for diabetic patients to express their interpretation about disease (i.e. during consultation with nurses)and to discuss illness identity, causes, controllability, potential consequences of DPN as well as to express their concerns about feet injuries.
- Nurses should instruct patients and their care givers how to control blood glucose level, identify early signs and symptoms of peripheral neuropathy, and prevent foot injuries.
- Nurses should actively encourage patient participation and engagement in their foot care regimen and ensure guidelines to prevent foot injuries are followed. Training about selecting the right shoes is necessary as well.
- Health teams should take into account any disabilities, including visual impairment, when planning and delivering care for people with diabetes.
- All staff involved in patient education should have demonstrated competency in communication skills and establish the most effective way of

communicating with each patient, using multimedia tools such as picturesand videos, to ensure optimum communication tailored to patient needs.

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