

## *International Journal of Scientific Research and Reviews*

### **Barriers to Self-Foot Care Management in Type 2 Diabetes Mellitus Patients: An Institutional Cross-Sectional Descriptive Study in Eastern India**

**Bhattacharjee Kingshuk<sup>1\*</sup>, Naikwadi S. S<sup>2</sup> and Maiti Animesh<sup>3</sup>**

<sup>1</sup>Research Scholar, Department of Healthcare Management, Shri Jagadishprasad Jhabarmal Tibrewala University, Rajasthan, India

<sup>2</sup>Associate Professor, Department of Management, Shri Jagadishprasad Jhabarmal Tibrewala University, Rajasthan, India

<sup>3</sup>Associate Professor and Head, Department of Endocrinology and Metabolism, Medical College and Hospital, Kolkata, West Bengal, India.

#### **ABSTRACT:**

We aimed to enumerate the barriers to self-foot care management in Type 2 Diabetes Mellitus (T2DM) patients and factors associated with these barriers. A cross-sectional study of successive type 2 diabetes patients attending routine out-patient diabetes clinics in tertiary care hospitals in Kolkata, India from 1<sup>st</sup> June 2018 to 31<sup>st</sup> October 2018. All patients who matched our study eligibility criteria were interviewed by diabetes care providers using a structured questionnaire modeled after a systematic review of similar studies but tuned to regional preferences. Besides demographic details, patient particulars, laboratory investigations, the questionnaire included 2 direct questions on possible barriers to self-foot care management. The questions were grouped into five categories viz. environmental (4 questions), behavioral (9 questions), occupational (2 questions), physical inability (7 questions) and medical reason (1 question). An overwhelming 60% of the study population have more than one barrier to self-foot management. A larger proportion of females (68.9%) were not taking self-foot care management compared to their male counterparts (53.5%). Around one-third of the male participants cited lack of time as a major barrier to self-foot care management. Around, 30% females reported lack of foot care education and training as the major obstacle to self-foot care management. This study elaborates the need for awareness regarding possible barriers when counseling T2DM patients. Self-foot care management remains one of the cheapest pillars of diabetic foot care management, the benefits of which extend beyond glycemic control. This study also highlights the importance of physician advice regarding self-foot care management. Behavioral causes seem to be the commonest barrier to self-foot care and hence strategies to target the same needs to be thought of.

**KEY WORDS:** *Diabetes, Barriers, Self-foot care, India*

#### **\*Corresponding Author:**

**Kingshuk Bhattacharjee**

Research Scholar, Department of Healthcare Management,

Shri Jagadish prasad Jhabarmal Tibrewala University, Rajasthan, India

E-mail: [kingshuk.bhattacharjee7@gmail.com](mailto:kingshuk.bhattacharjee7@gmail.com); Mobile: 08334834560

## **INTRODUCTION:**

The vast majority of people with diabetes, around 80 %, live in ‘developing’ countries, and it is in these countries that the largest increases in the burden of diabetes will occur over the coming decades.<sup>1</sup> Diabetic foot problems are a major cause of morbidity and premature mortality in people with diabetes and contribute substantially to the health care costs associated with diabetes.<sup>2-4</sup> Interventions to reduce the burden of diabetic foot ulceration and amputation are estimated to be highly cost-effective, indeed cost saving, in both developed and developing country settings.<sup>5,6</sup> The challenge, particularly in less well-resourced health care systems, is how to implement effective foot care that realizes these potential health gains and cost savings.<sup>7-10</sup>

Studies aimed at finding these barriers to self-foot care management are scarce, especially in the Asian subcontinent. Moreover, most of the available studies have targeted a small population of patient with DM. With that in mind, this study was devised with a goal to describe the possible barriers to self-foot care management, in an Indian context.

## **OBJECTIVES/AIMS:**

1. To enumerate the barriers to self-foot care management in Type 2 Diabetes Mellitus (T2DM) patients.
2. To enumerate the relationship of the most common barriers to age, sex, lifestyle and duration of diabetes.

## **RESEARCH DESIGN & METHODOLOGY:**

All patients attending the Diabetes clinic in tertiary care hospital in Kolkata, India during the time 1<sup>st</sup> June, 2019 to 31<sup>st</sup> October 2019 were approached. Exclusion criteria included:

- (i) Refusal to provide written informed consent
- (ii) Pre-existing physical disability requiring long-term support
- (iii) Type 1 Diabetes Mellitus
- (iv) Pregnancy
- (v) Patients below age of eighteen
- (vi) Recent hospital admission for any cause within the last 6 months
- (vii) Any documented psychiatric illness likely to impair judgment

Consecutive patients attending diabetes clinic in the hospitals were approached and briefed about the study. Following written informed consent, willing candidates fulfilling our criteria were interviewed by diabetes care providers using a structured questionnaire available in English, Bengali and Hindi. The questionnaire was devised from but not limited to a systematic review of similar

studies(6) tailoring it to circumstances relevant to our regional population. They were offered 23 direct questions on possible barriers to self-foot care management. The responses were grouped into 5 categories viz.

- (i) Environmental (4 question)
- (ii) Behavioral (9 question)
- (iii) Occupational (2 question)
- (iv) Physical Inability (7 question)
- (v) Medical reasons (1 question)

The questionnaire also included demographic details, patient particulars(BMI, duration of T2DM, Insulin or anti-hypertensive use) and recent laboratory investigations (HbA1c, Fasting and Postprandial glucose levels).

**Statistical Methods:** Descriptive statistical analysis has been carried out in the present study. Significance is assessed at a level of 5%. Results on continuous measurements are presented as Mean  $\pm$  SEM and results on categorical measurements are presented in Number (%). Significance is assessed at a level of 5%.

The following assumptions were made of the data: 1) Cases of the samples should be independent, 2) The populations from which the samples are drawn have the same variance (or standard deviation) and 3) The samples are drawn from different populations are random. Normality of data was tested by Anderson Darling test, Shapiro-Wilk, Kolmogorov-Smirnoff test and visually by QQ plot.

**Statistical software:** The Statistical software namely SAS (Statistical Analysis System) version 9.2 for windows, SAS Institute Inc. Cary, NC, USA and Statistical Package for Social Sciences (SPSS Complex Samples) Version 21.0 for windows, SPSS, Inc., Chicago, IL, USA were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs and tables.

## **RESULTS:**

A total of 500 patients were included in our study. The demographic and clinical variables of the patients are shown in Table 1.

**Table 1: Study sample characteristics**

Clinical Profile Variables	
Age, Mean ± SD	49.39 ± 11.49
BMI, Mean ± SD	23.81 ± 3.31
Hip Circumference, Mean ± SD	90.53 ± 6.93
Waist Circumference, Mean ± SD	89.71 ± 7.63
Waist Hip Ratio, Mean ± SD	0.99 ± 0.08
WHR - No Risk (Male<0.95,Female<0.85)	40.12%
WHR - Risk (Male ≥ 0.95,Female ≥ 0.85)	59.88%
Neck Circumference, Mean ± SD	34.19 ± 2.59
Duration of Diabetes, Mean ± SD	8.68 ± 6.52
Duration of Diabetes < 1 year	34 (6.8%)
Duration of Diabetes 1- 5 year	160 (32%)
Duration of Diabetes 5 - 10 year	148 (29.6%)
Duration of Diabetes > 10 year	158 (31.6%)
Hypertension, %	190 (38%)
Smoking, %	160 (32%)
Ex-smoker, %	82 (16.4%)
Alcoholic, %	44 (8.8%)
Ex-Alcoholic, %	100 (20%)
Anti-diabetic Drug Intake-Insulin & Orals, %	128 (25.6%)
Anti-diabetic Drug Intake-Oral agents, %	372 (74.4%)
Married, %	388 (77.6%)
Family History of Diabetes, %	322 (64.4%)

**Table 2: Gender wise barriers to self-foot care management:**

Parameters-Category (Total N)		Top 5 Barriers	N (%)
Gender	Male (N=250)	Lack of Time	88 (35.20%)
		I don't know how to take care	58 (23.20%)
		Lack of motivation	46 (18.40%)
		Barefoot walking is common in my place	34 (13.60%)
		I cannot afford to buy shoes	24 (9.60%)
	Female (N=250)	I don't know how to take care	74 (29.60%)
		I have a problem reaching my foot	66 (26.40%)
		I cannot afford to buy shoes	56 (22.40%)
		I don't think it is important to take care of foot	30 (12.00%)
	Lack of Time	24 (9.60%)	

We tried to explore the barriers to the self-foot care amongst our study participants. In the male subgroup, amongst all the reported barriers, the most commonly identified barrier for not being able to take care of the feet is lack of time which has been reported by 88 study participants (35.2%). In the female sub-group, the most common barrier which was reported by 74 (29.6%) of the study participants was that the patients were not able to take care of their feet due to lack of training and education. This was followed by a third most common barrier 66 (26.4%) primarily due to

musculoskeletal problem due to which the patients found it difficult to reach their feet and to perform foot care accordingly. The fourth most common barrier reveals that 58 (23.2%) of the study participants don't know how to take care of their foot which is primarily due to lack of education and proper training wither by the treating clinician or by the paramedical staff. The next barrier 56 (22.4%) which was sited is the lack of ability to buy expensive shoes, particularly in the female sub-group. On further exploratory analysis, most of the females reported that as they were financially dependent on their husband, it is difficult for them to convince their husband to generate fund for buying of the expensive diabetic shoes. The next most common barrier which was reported by males was lack of motivation. As considerable amount of time has to be spent on adequate self-foot care management on regular basis, it was found to be started by most of the study participants, but it was waned gradually in the long run. This was particularly highlighted in the male sub-group as compared to the female sub-group. The next common barrier reported by the male subjects is that bare foot walking is quite common in their place and it was found to be one of the reasons for inflicting injuries to the feet and further diabetic foot complications. Another barrier which was reported by 30 out of 250 females was that they don't think it is important to take care of their foot. When we have interviewed and conducted a case study we found that most of the women reported that there is much important work to perform in their day to day work rather than sitting and spending so much of time in taking care of their feet. The fifth most common reason cited by the females is that they also don't have time to take care of their feet due to competing priorities. (Table 2)

**Table 3: Age wise barriers to self-foot care management:**

Parameters-Category (Total N)		Top 5 Barriers	N (%)
Age Group (in years)	Age 20-40 (N=156)	I don't know how to take care	44 (28.21%)
		Poor communication between patient and health care provider	36 (23.08%)
		I don't know how to take care	28 (17.95%)
		I cannot afford to buy shoes	24 (15.38%)
		Inconvenience for my work	24 (15.38%)
	Age 41-60 (N=202)	Inconvenience for my work	82 (40.59%)
		Lack of motivation	58 (28.71%)
		I have a problem reaching my foot	36 (17.82%)
		I don't know how to take care	16 (7.92%)
	Age > 60 (N=142)	Poor communication between patient and health care provider	10 (4.95%)
		Lack of support from family	52 (36.62%)
		I have a problem reaching my foot	24 (16.90%)
		I can't see well enough	26 (18.31%)
Barefoot walking is common in my place		20 (14.08%)	
		I don't know how to take care	20 (14.08%)

When we tried to identify the barriers in different age groups from 20 to 40 years, 41 to 60 years and age greater than 60 years, we found a mixed bag of barriers amongst the three sub-groups. There were a sizeable number of subjects in all the three sub-groups with 156 in the 20 to 40 years of age group, 202 subjects in the age group of 41 to 60 years and 142 subjects in the age group greater than 60 years. In the age group of 20 to 40 years, we found that the top most barriers are that the 44 patients (28.21%) don't know how to take care of their foot. The next common barrier was reported by 36 patients (23.08%) as poor communication between the patient and the healthcare provider, followed by 28 patients (17.95%) who reported that they don't know how to take care of their feet, followed by 24 participants (15.38%) who reported that they can't afford to buy shoes with same number of patients reporting that taking care of the feet is causing inconvenience to their work. In the next age sub-group ranging from 41 to 60 years, we see that the barrier namely "inconvenience for my work" jumps to the top position. In contrast to only 24 patients reporting that taking foot care is causing inconvenience to their work, the number of patients soared up to 82 (40.59%) which found foot care activities as causing inconvenience to the work. This rise in 25% can be attributed to the fact that these patients are more working class and have many other responsibilities to bear. The second top most reason was reported by 58 (28.71%) of the patients is lack of motivation which is quite common in the middle-aged group. The third common reason is the difficulty in reaching the foot which is most common in the middle-aged group which is a total of 36 patients accounting for 17.82%. Sixteen (7.92%) of the middle-aged patients told that they don't know how to take care of their foot and 10 (4.95%) patients found the communication between them and their clinicians as difficult to understand or poor communication as a result of which they were not being able to take care of their foot properly. In the elderly age group which primarily comprised of individuals greater than 60 years of age, 52 (36.62%) reported that they lack support from their family. On further exploratory research, it was found that most of the elderly individuals don't have any income and hence are fully dependent on their family members for financial support, but they don't get adequate funds for the management of diabetes. A total of 24 (16.9%) of the study subjects have reported that they found it extremely difficult to reach their feet due to age related musculoskeletal disorders and ailments of degeneration due to increased age. A total of 26 (18.31%) of the study subjects have reported that they were not able to see properly due to eye related disorders like diabetic retinopathy, diabetic macular edema etc. and hence was not able to take care of their feet. Twenty patients (14.08%) in the elderly group reported that they were commonly engaged in barefoot walking due to which they are highly prone to get foot related injuries leading to diabetic foot ulcers and infections. When we tried to convince these elderly patients on the hazards of bare foot walking especially in diabetes patients, we found it very difficult to convince them against their traditional contradictory

belief of the various benefits of bare foot walking. It was far easier to convince the younger age group as well as the middle-aged age group as compared to the elderly population. The last barrier in the elderly age group as reported by 14.08% of the individuals was that they don't know how to take care of their feet. On interacting with them, we found out that though these patients were adequately educated by the patients, but these patients were not receptive of the teachings and learning due to diminished neurocognitive changes. On reviewing the reports of some of the patients it was found that some of them had a differential diagnosis of dementia as well as Alzheimer's disease. We tried to find much literature on the proper and effective techniques of diabetic foot care education in this subset of patients who have been diagnosed with neurological changes and have associated senile dementia, but we couldn't find any. Overall, we observed that it was much easier to motivate the younger and middle-aged patients and accordingly the compliance to medications and adherence to therapeutic lifestyle modifications was found to be much better in this population. (Table 3)

**Table 4: Barriers to self-foot care management according to duration of diabetes:**

Parameters-Category (Total N)		Top 5 Barriers / Number	N (%)
Duration of Diabetes (in years)	Less than 5 years (N=124)	I don't know how to take care	44 (35.48%)
		Inconvenience for my work	32 (25.81%)
		Lack of Time	24 (19.35%)
		I have a problem reaching my foot	14 (11.29%)
		I don't think it is important to take care of foot	10 (8.06%)
	5-10 years (N=310)	Lack of motivation	130 (41.94%)
		Lack of Time	84 (27.10%)
		I don't know how to take care	56 (18.06%)
		I have a problem reaching my foot	24 (7.74%)
		Lack of support from family	16 (5.16%)
	Greater than 10 years (N=74)	Lack of Time	32 (43.24%)
		Lack of motivation	22 (29.73%)
		I don't know how to take care	12 (16.22%)
		I have a problem reaching my foot	4 (5.41%)
		I cannot afford to buy shoes	4 (5.41%)

Our next analysis tried to identify different barriers to self-foot care education with regards to the duration of diabetes. We have tried to segregate our study patients based on the duration of diabetes because diabetes duration itself is an independent predictor of complications and depression was found to be higher in patients with long standing diabetes due to which the barriers can markedly vary in the study participants as influenced by the duration of diabetes. If we consider the 124 subjects in the group with duration of diabetes less than 5 years of diabetes duration, we found that a total of 44 subjects (35.48%) reported that they don't know how to take care of their foot. This was followed by 32 subjects (25.81%) who found taking adequate care of their feet to be causing

inconvenience to work. Lack of time was another important barrier which was reported by 24 (19.35%) of the study subjects. Since, this sub-group has lesser duration of diabetes and inherently less micro vascular and macro vascular complications, hence they don't want to devote sufficient time to the care of diabetes and found it causing inconvenience to their work because they attribute more priority to work and less to their health. Only 14 subjects reported that they find it difficult reaching their feet due to musculoskeletal or joint related problems which is quite natural to be low in this younger age group. And as already reported vide-supra that they don't have any complications and so they don't think it is important to take care of their feet. In the next sub-group with duration of diabetes between 5 to 10 years which is comprised of 310 subjects, we found that lack of motivation was primary barrier which has been reported by 130 subjects. The next barrier was lack of time which was reported by 84 (27.1%) of the subjects. On further exploratory analysis, it was found that most of these subjects either work in private industries, have long travelling time to office or they work in low positions. The next reason for barrier which has been reported by 56 participants is that they don't know how to take care of their foot. On further exploratory analysis, it was noted that most of these participants have not received formal education with regards to self-foot care management in diabetes. It is noteworthy that though the participants have received education on diabetes as a whole but there was not any learning disseminated on foot care. The next barrier was reported by 24 participants who reported that they cannot reach their foot due to some musculoskeletal or joint related problems. Now this problem is not very uncommon in the middle-aged population, especially it was reported to be much higher in the post-menopausal women as compared to the males of similar age. Nowadays also the incidence of andropause and pre-mature ovarian failure are on the rise due to which there was a myriad of musculoskeletal problems being reported in the middle-aged population. The incidence of musculoskeletal problems is particularly heightened in diabetes especially the cases of adhesive capsulitis and muscle infarctions, DISH etc. Sixteen of the patients reported that they don't get adequate support from their family members due to which they were not able to take proper care of their foot. Interestingly, it was found that all these sixteen participants were females and they complained of lack of monetary and time resources from their family members who led to poor care of the feet. The last category comprised of 74 participants with duration of diabetes greater than 10 years. In this category, the most common barrier is lack of time which has been reported by 32 subjects. The next common barrier is lack of motivation which has been reported by 22 subjects. On subsequent exploratory analysis, it was found that there were equal numbers of subjects in the male and female sub-group which reported lack of motivation, but substantially greater numbers of females have reported lack of time as compared to males. We have also observed in our study as reported vide-supra as well as in other studies that lack of motivation is



directly proportional to the duration of diabetes. Furthermore, twelve patients have reported that they don't know how to take care of their feet and have attributed it to lack of proper education and training by their treating primary care physician. Also, four patients have reported that they have a problem reaching their feet due to which they were not able to take care of their feet. Another four patients have reported that they were not able to take adequate care of their feet as they were not able to buy expensive shoes. Hence, the lack of self-foot care management was due to combined effect of lack of resources, lack of time and lack of motivation. Hence, the strategy should be focused on addressing all the components via developing a multi-pronged approach as in a trident rather than a single faceted approach. The impact of education can be measured on multiple occasions to determine the effect of education on self-foot care management of diabetes. (Table 4)

**Table 5: Barriers to self-foot care management according to degree of glycemic control:**

Parameters-Category (Total N)		Top 5 Barriers	N (%)
HbA1c (in %)	Less than 7% (N=118)	Lack of Time	46 (38.98%)
		I don't know how to take care	34 (28.81%)
		Lack of support from family	18 (15.25%)
		I cannot afford to buy shoes	12 (10.17%)
		I have a problem reaching my foot	8 (6.78%)
	7%-9% (N=136)	Lack of Time	66 (48.53%)
		Lack of motivation	26 (19.12%)
		I cannot afford to buy shoes	22(16.18%)
		Inconvenience for my work	14 (10.29%)
		Poor communication between patient and health care provider	10 (7.35%)
	Greater than 9% (N=246)	I have a problem reaching my foot	52 (21.14%)
		Poor communication between patient and health care provider	34 (13.82%)
		Lack of support from family	28 (11.38%)

If we segregate the patients based on the baseline glycosylated hemoglobin levels into three sub-groups HbA1c less than 7%, HbA1c between 7% to 9% and HbA1c greater than 9%. There is a total of 118 patients in the relatively well controlled group. When we enquired about the barriers to adequate and effective self-foot care management, 46 of the patients replied that they lack time for self-foot care management due to their busy lifestyle and even some patients argued that since they have a good glycemic control they don't have to give time to proper self-foot care management since only hyperglycemia leads to various micro vascular and macro vascular complications. The next common category comprising of 34 patients (28.81%) responded that they don't know how to take care of their foot. On further exploratory analysis, it was found that though they have received diabetic foot care education by the health care physician they have ignored the learnings and haven't taken care of their feet. The next category of patients who found it difficult to take proper care of their feet complained that they don't get proper support from their family members which are interfering with

proper care of their feet. In this group, 12 patients admitted that they were not able to buy the expensive specialized diabetic foot wears and hence they were not able to take proper care of their feet. These patients have requested their treating physician if the specialized diabetic foot wears could be made available at affordable cost, but they didn't receive any support or special incentive from their physician or from the foot wear manufacturing companies. The last of the barrier which has been reported by eight patients is that they have some problem reaching their feet due to musculoskeletal or joint related problems. In the second sub-group which comprised of 136 subjects with HbA1c between 7%-9%, a total of 66 patients (48.53%) described lack of time as one of the important barriers towards fulfilling self-foot care management; lack of motivation was also reported by 26 subjects (19.12%). (Table 5)

## **DISCUSSION:**

Although studies highlighting barriers to self-foot care management in T2DM come up from time to time, to our knowledge this is one of the largest studies addressing the barriers to self-foot care management in T2DM patients.

Foot conditions are highly prevalent amongst diabetic patients. Globally the lifetime risk of a diabetic patient developing a foot ulcer is 15%. They potentially result in decreased function and quality of life for patients. They result in either loss of limb and loss of life and diabetes is by far the leading cause of amputation in the developed world. Such negative outcomes are preventable. To a large extent, these negative outcomes occur due to late diagnosis and improper diabetic foot care. In fact, the majority of people with diabetes do not receive or practice the foot care recommended by current guidelines.<sup>11-14</sup>

The present study is the first of its kind to enlighten on the perceived barriers to self-foot care in the Indian population. Our study results confirm that self-foot care is low in the Indian T2DM diabetes population, with an overwhelming 60% of the study population have more than one barrier to self-foot management. A larger proportion of females (68.9%) were not taking self-foot care management compared to their male counterparts (53.5%). Around one-third of the male participants cited lack of time as a major barrier to self-foot care management. Around 30% females reported lack of foot care education and training as the major obstacle to self-foot care management.

One of the significant findings of our study is depression was found to be highly prevalent in the individuals who lack motivation. Around 22 (16.18%) reported that they were not able to buy shoes due to the high cost of the diabetic shoes. A small number 14 (10.29%) have described that taking care of their feet are causing great inconvenience to their work. Ten subjects with HbA1c between 7% & 9% have complained of poor communication by their health care provider due to

which they were not having proper knowledge of self-foot care management. The last bracket included a total of 246 individuals with HbA1c greater than 9%. These patients are having uncontrolled hyperglycemia along with osmotic as well as catabolic symptoms. This sub-group of patients is often found to have poor adherence and compliance in all aspects of healthcare management. Thus, it is very interesting to observe the behavioral trend of these subjects when it comes to self-foot care management. A total of 52 (21.14%) have reported that they have problem reaching their feet and hence were not able to take proper care of their foot. The remaining 34 (13.28%) of patients revealed that there was a poor communication between the patient and the health care provider due to which they were confused and lacked clarity as well as proper understanding with regards to the techniques of foot care. They expressed that though they received overall diabetes education, but they didn't receive any education with regards to best practices of foot care. The smallest of all the categories which comprised of only 28 (11.38%) have disclosed that they don't get adequate support from their family members either in terms of monetary or psychosocial support.

**LIMITATIONS OF THE PRESENT STUDY:** All the patients did not have HbA1C done at the time of survey and hence correlation of self-foot care management with good glycemic control could not be done.

**STRENGTH OF THE PRESENT STUDY:** On the other hand, the interview-based design ensured more complete response for this study. Participants were offered the chance to discuss the questionnaire with the care providers before they filled in the form. This gave the educators and physicians a chance to integrate the study within the scope of their routine counseling and identify those who did not perform self-foot care management, particularly clarifying recommendations. Absence of a validated questionnaire prompted us to select the barriers from existing literature and modifying them to our local population. This emphasizes the need of such a tool in evaluating the barriers in subsequent studies.

## **CONCLUSION:**

This study elaborates the need for awareness regarding possible barriers when counseling T2DM patients. Self-foot care management remains one of the cheapest pillars of diabetic foot care management, the benefits of which extend beyond glycemic control. This study also highlights the importance of physician advice regarding self-foot care management. Behavioral causes seem to be the commonest barrier to self-foot care management and hence strategies to target the same needs to be thought of.

## REFERENCES:

1. Richard.S, Shah.J, Zimmet.P,The Global burden In: the world fact book. Available at <http://www.cia.gov/library/publications/the-world-factbook/> (accessed 2018-07-26).
2. Cavanagh P, Attinger C, Abbas Z, Bal A, Rojas N, Xu ZR. Cost of treating diabetic foot ulcers in five different countries. *Diabetes Metab Res Rev.* 2012;28(Suppl 1):107–111.
3. Cawich SO, Islam S, Hariharan S, Harnarayan P, Budhooam S, Ramsewak S, Naraynsingh V. The economic impact of hospitalization for diabetic foot infections in a Caribbean nation. *Perm J.* 2014;18(1):e101–104.
4. Singh N, Armstrong DG, Lipsky BA. Preventing foot ulcers in patients with diabetes. *J Am Med Assoc.* 2005;293(2):217–228.
5. Li R, Zhang P, Barker LE, Chowdhury FM, Zhang X. Cost-Effectiveness of Interventions to Prevent and Control Diabetes Mellitus: A Systematic Review. *Diabetes Care.* 2010;33(8):1872–1894.
6. Mohan V, Mathur P, Deepa R, Deepa M, Shukla MDK, Geetha R.M, Anand K, Nimesh G.D, Prashant P.J, Mahanta J, Thankappan K.R, Shah B. Urban rural differences in prevalence of self-reported diabetes in India-The WHO-ICMR Indian NCD risk factor surveillance. *Diabetes research and clinical Practice,* 2008; 80(1):159–68.
7. Hennis AJM, Fraser HS, Jonnalagadda R, Fuller J, Chaturvedi N. Explanations for the high risk of diabetes-related amputation in a Caribbean population of black African descent and potential for prevention. *Diabetes Care.* 2004;27(11):2636–2641.
8. Gale L, Vedhara K, Searle A, Kemple T, Campbell R. Patients' perspectives on foot complications in type 2 diabetes: a qualitative study. *Br J Gen Pract.* 2008;58(553):555–563.
9. Fox A. Innocent beginnings uncertain futures: exploring the challenges of living with diabetic foot ulcers. *Canadian Journal of Diabetes.* 2005; 29:105–110.
10. Ramachandran A, Ramachandran S, Chamukuttan S, Christina ANM, Viswanathan V, Kapur A. Increasing expenditure on health care incurred by diabetic subjects in a developing country: A study from India. *Diabetes Care* 2007; 30: 252-56.
10. Bakker K, van Acker K, Morbach S, Perry A: Promoting foot care education in developing countries: the Caribbean Diabetic Foot Programme. *Diabetes Voice.* 2009; 54(3):15-18.
11. Boulton AJ, Vileikyte L, Ragnarson-Tennvall G, Apelqvist J. The global burden of diabetic foot disease. *Lancet.* 2005;366(9498):1719–1724.
12. Ferguson LD, Sattar N. Reducing cardiovascular disease risk in type 2 diabetes: is the focus on glycaemia warranted? *Diabetes Obes Metab.* 2013;15(5):387–391.

13. Yudkin JS, Richter B, Gale EA. Intensified glucose lowering in type 2 diabetes: time for a reappraisal. *Diabetologia*. 2010;53(10):2079–2085