

ORIGINAL ARTICLE

A QUESTIONNAIRE BASED SURVEY ON AWARENESS OF DIABETIC FOOT CARE IN INDIAN POPULATION WITH DIABETES: A CROSS-SECTIONAL MULTICENTRE STUDY

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ABSTRACT

OBJECTIVE: To find awareness regarding foot care in Indian population with diabetes in various parts of India. **MATERIALS AND METHOD:** A cross-sectional study design was used to perform a multicenter, national level survey from August, 2011 to February, 2012 in various parts of India. Descriptive analysis was done using Statistical Package for Social Sciences (SPSS) 16. Awareness levels for diabetic foot care were calculated as absolute frequencies and were reported as overall percentages. Spearman test was used to find the correlation for foot problems and diabetic foot care with socioeconomic status. **RESULTS:** A total of 323 peoples were screened (there were 222 men and 101 women in the study with a mean age of 58.2 ± 8.6 years). 8.7% of men reported ulcer during the 1st year of onset of diabetes, where as 8.3% of women were prone for ulcers in 16-20 years of diabetes, 56.4% of the population in urban area and 46.6% of the population in the rural area had been educated regarding foot care in diabetes. However, only 30.5% of population in urban areas and 9.7% of population in the rural areas knew about the importance of shoe selection in diabetes. Spearman's correlation was significant for foot problems with family income and educational status, $P = 0.03$ and $P = 0.02$ respectively. **CONCLUSION:** There is a need to bridge the disparity in awareness regarding diabetic foot management in Indian masses. More aggressive measures are required to implement current preventive foot care strategies in India.

Key words: Diabetes, diabetic foot ulcers, diabetic peripheral neuropathy, risk factors in diabetes

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Access this article online

Quick Response Code:



Website:

www.indianjmedsci.org

DOI:

10.4103/0019-5359.109224

INTRODUCTION

Changing lifestyle, reduced physical activity and obesity have made the populations of the world vulnerable for diabetes. Diabetes is the most common chronic disease affecting nearly all the population of the world. An estimate of the problem by Shaw *et al.* in a study revealed that in 2010, there were 285 million people worldwide with diabetes, with considerable disparity between populations and regions. The highest regional prevalence was reported for North America (10.2%) followed by south Asia (6.7%).^[1]

In a survey in 2007, WHO estimated that 60% of the diabetic population will be from developing countries in Asia by 2025, that is the individuals with diabetes will increase from 240 million in 2007 to 380 million in 2025.^[2] Asia has undergone a great transition in economy and lifestyle due to growing globalization of the continent which have been accompanied by increasing population movements, changes in food supply and dietary patterns, technology transfer, and cultural admixtures. Ageing and urbanization are increasingly adding to the burden of diabetes in developing countries, where resources for dealing with the associated clinical problems are scarce.^[1] According to the Diabetes Atlas published in 2006 by the International Diabetes Federation, there are an estimated 40.9 million people with diabetes in India, which is expected to become 69.9 million by 2025.^[3]

Diabetic peripheral neuropathy (DPN) is the most common complication of type 2 diabetes mellitus requiring frequent referral for medical or surgical management.^[3] In a survey done in Italy by Fedele *et al.*, it was revealed that almost

10% of the population with diabetes at the time of diagnosis had DPN, whereas after 25 years more than 50% of the individuals with diabetes had DPN.^[3] Neuropathy results in loss of sensation in gloves and stocking pattern, which leads to loss of protective sensation to noxious stimuli, such as trauma induced by microtrauma to the skin and bone or trauma caused by stepping on a sharp object or skin injury due to ill-fitting shoes.^[4] Moreover, due to modulation of neuromuscular junction the muscles get deprived of their innervations leading to muscle atrophy and foot deformities. Thus, pressures are gradually abnormally distributed on the plantar aspect of the feet, causing an increased forefoot pressure than the rear foot, thereby increasing the risk for ulceration. Initially the situation looks trivial, but the problem posed by DPN in its due course progresses to deep tissue destruction.^[4]

Hence diabetic foot remains a global issue for individuals suffering from diabetes not only in South Asia but also in European nations. Diabetic ulcers have not only added to financial burden to the nation's economies worldwide but have also caused increased mortality and morbidity in population with diabetes. Due to its high chances of recurrence in an individual's life time it leads to a poor quality of life for an individual. However, primary prevention method like education seems to play a key role in the management of individuals suffering from diabetes. Hence it is important to educate and evaluate the population with diabetic and prediabetic state to minimize or control diabetes-related foot complications.

As there is a dearth in literature regarding the awareness of diabetic foot problems in Indian

population, our aim in the present study was to find the awareness of foot care among Indian population with diabetes.

METHODOLOGY

A cross-sectional study design, multicenter, national-level survey in various parts of India. The survey was conducted from September 2011 to February 2012. Ethical clearance of the study was obtained from the university ethical committee before the commencement of the study.

Development of the survey tool: Content and construct validation of the diabetic foot questionnaire was done using Delphi method^[5] by a panel of institutional experts, for identifying questionnaire suitability, comprehensibility for addressing the issues pertaining to diabetic foot care in India. According to the Delphi method, 10 professional experts constituted the panels that were further employed to do the content validation of the questionnaire which was originally adopted from the diabetic foot care programme of Nova Scotia.^[6] We had also included feedback from the diabetic population in the initial draft of the questionnaire before it was translated into different regional languages (mainly hindi, marathi, kannada, bengali, malyalam and telugu) for easy interpretation and categorization of the questions in order to have a compliance with the Indian social and cultural scenarios. All the translations of the survey were also validated in the similar fashion. Following which the questionnaires were sent to identified diabetic centers in each states [Figure 1]. A set of instruction lists were provided to all the selected centres regarding the administration

of the questionnaires (including inclusion and exclusion criteria). A total of 600 questionnaires were circulated in all the identified centres of the country. Individuals were selected from the daily outpatient clinics of the various centres of the country.

Individuals who were diagnosed with diabetes were included in the study (i.e., fasting blood-glucose levels >110 mg/dl, postprandial >146 mg/dl or glycosylated haemoglobin >7%); patients were excluded if they could not hear or comprehend instructions (due to neurological deficit) given by the professionals at the time of administration of the questionnaire. The entire questionnaires were suppose to return within the stipulated time period of 6 months to the diabetic centre at the department of physiotherapy, Kasturba hospital for further evaluation.

Data collection

Diabetic foot care questionnaire consisted of 11 parts, (a) regarding current foot or leg problems, (b) prior foot or leg problem, (c) physician or physiotherapist follow-up, (d) foot care education, (f) self-management, (g) questions regarding current care for the feet, (h) foot wears, (i) foot care education, (j) foot care programmes developed by the world diabetic foundation, (k) implementation of the programmes in daily life and (l) socioeconomic status. The individuals with diabetes were asked to check the appropriate boxes for the respective questions.

Statistical analysis

Descriptive analysis was done using SPSS 16. Awareness levels for diabetic foot care were calculated as absolute frequencies and

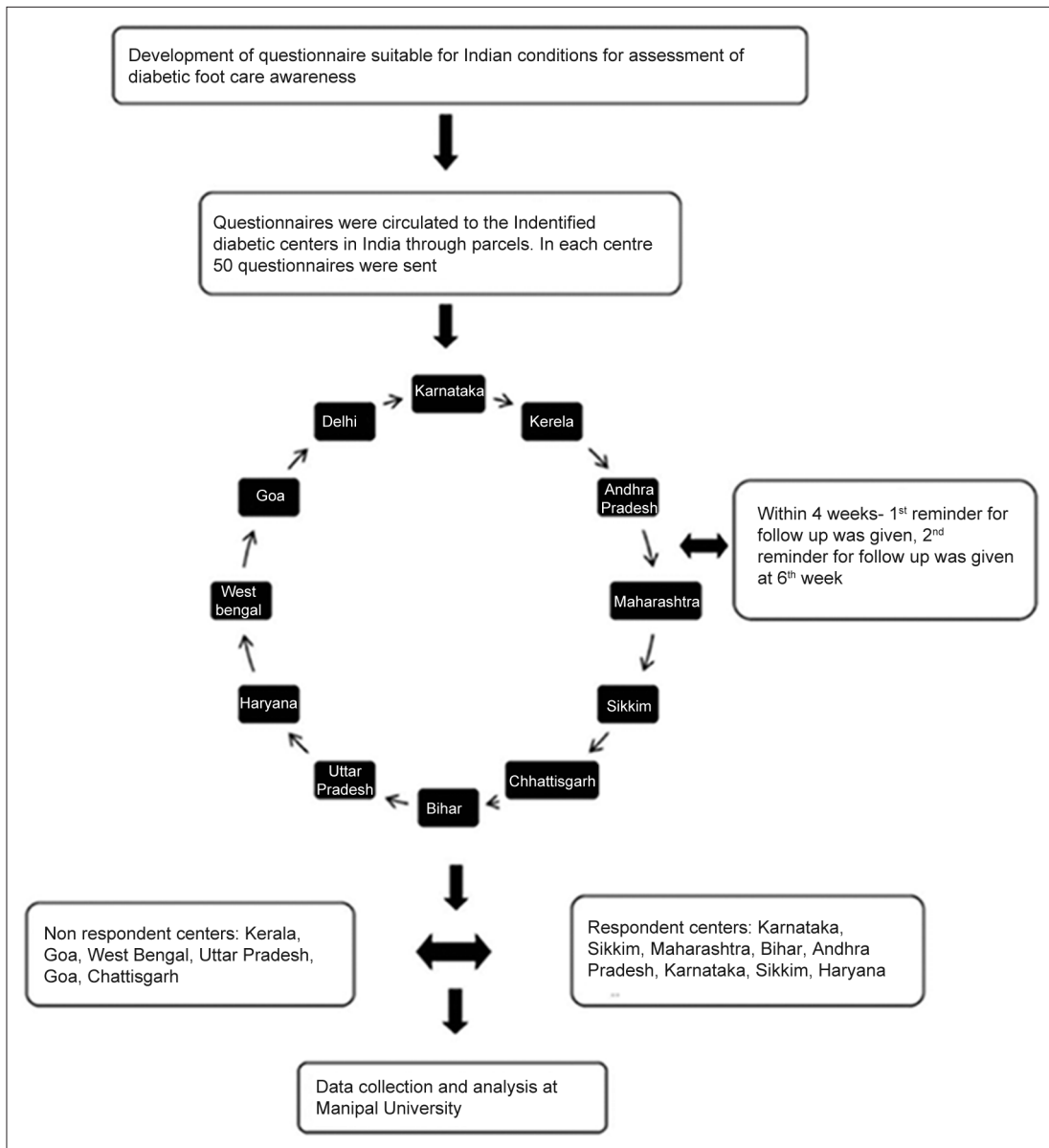


Figure 1: Diagrammatic overview of the study

were reported as overall percentages. The estimated sample size of 500 participants was required to be screened, with an acceptable relative error of 10%, assuming α error of 0.05 and power of 80%. Spearman test was used

to examine the correlation between current foot problems experienced by participants and their socioeconomic and educational status. Correlation was also done to know their current foot care practices and occupation,

socioeconomic, educational status and footwear selection among the population.

RESULTS

A total of 323 participants with diabetes agreed to participate in the study from Karnataka, Sikkim, Maharashtra, Bihar, Andhra Pradesh, Haryana and Delhi. Whereas, the non-respondent centers were Kerala, Goa, Uttar Pradesh, West Bengal and Chhattisgarh. Fourteen individuals during the course of the study didn't give their consent for participation, and two were excluded due to neurological deficit. There were 222 men and 101 women in the study with a mean age of 58.2 ± 8.6 years. There were 60% of men and 40% women participants within the age group of 20-29 years and 30-39 years, 68% men and 31% women under the age group 40-49 years, 62% men and 37% women under the age group of 50-59 years, 76% men and 24% were between the age group of 60-69 years and 74% men and 26% were above 70 years. We found educational status, living environment; age and duration of diabetes had an influence on diabetic foot complications [Table 1] and its management.

Duration of diabetes

Duration of diabetes in the study was defined as from the time of their first diagnosis of diabetes. Population in the study had a duration of diabetes ranging from less than one year were 10.4% men and 8.9% women, 1-5 years of duration there were 15.8% men and 16.8% women, 5-10 years of duration there were 29.3% men and 19.8% women, 10-15 years of duration there were 23.9% men and 19.8% women, 15-20 years of duration there were

7.7% men and 11.9% women and above 20 years duration 13.1% were men and 14.9% were women.

Living environment and educational status

Living environment and educational status (rural and urban) is a complex of social, education, and cultural conditioning influencing an individual's health or disease process at community level. The study population had 64% men population residing in urban areas, where as 36% belonged to rural parts of India. In the study 78% of the women population resided in urban areas, whereas only 22% resided in rural parts of India. Educational status of men with diabetes were as follows, 35% men had education below high school, 9.9% had high school education, 1.8% was diploma holders, 41.9% of them were graduates and 12% were either post-graduates or super specialized in their respective fields. In women population, 40.6% had education below high school, 10.9% had education till high school, 2% were diploma holders, 42.6% were graduates and only 4% were postgraduates in various fields.

Management of diabetes and diabetic foot care

In diabetes, every Individual is required to adhere to medical follow-up with their respective physician or therapist for at least once in 2 months, to keep a check on their glycemic level and as well for evaluation of diabetes-related complications (i.e., diabetic foot). Prior foot problem in the study was defined as reduced sensation, previous ulcer or amputation of part or whole limb, whereas the current foot problem is defined as pain, numbness, ulcer, slipping

Table 1: Prevalence of foot problems in the population screened during the study

<i>Current problem</i>	<i>Men (%)</i>	<i>Women (%)</i>	<i>Duration of diabetes</i>
A			
Ulcer, sore, or blister in feet	8.7	-	<1year
Blood or discharge noted in socks	13	-	
Callus in feet	4.3	-	
Pain or cramps in feet, calves, thighs or buttocks on walk	21.7	22.2	
Numbness or tingling sensation in feet	17.4	22.2	
Slipping of chappals/slippers	8.7	-	
B			
Ulcer, sore, or blister in feet	2.9	5.9	1-5 years
Blood or discharge noted in socks	-	-	
Callus in feet	5.7	-	
Pain or cramps in feet, calves, thighs or buttocks on walk	20	23.5	
Numbness or tingling sensation in feet	25.7	29.4	
Slipping of chappals/slippers	5.7	-	
C			
Ulcer, sore, or blister in feet	9.2	5	6-10 years
Blood or discharge noted in socks	3.1	-	
Callus in feet	10.8	25	
Pain or cramps in feet, calves, thighs or buttocks on walk	18.5	35	
Numbness or tingling sensation in feet	23.1	35	
Slipping of chappals/slippers	13.8	10	
D			
Ulcer, sore, or blister in feet	7.5	3.6	11-15 Years
Blood or discharge noted in socks	1.9	3.6	
Callus in feet	17	10.7	
Pain or cramps in feet, calves, thighs or buttocks on walk	28.3	32.1	
Numbness or tingling sensation in feet	30.2	32.1	
Slipping of chappals/slippers	7.5	7.1	
E			
Ulcer, sore, or blister in feet	5.9	8.3	16-20 years
Blood or discharge noted in socks	5.9	8.3	
Callus in feet	35.3	16.7	
Pain or cramps in feet, calves, thighs or buttocks on walk	52.9	41.7	
Numbness or tingling sensation in feet	47.1	41.7	
Slipping of chappals/slippers	47.1	-	
F			
Ulcer, sore, or blister in feet	10.3	6.7	>20 years
Blood or discharge noted in socks	3.4	-	
Callus in feet	34.5	13.3	
Pain or cramps in feet, calves, thighs or buttocks on walk	37.9	26.7	
Numbness or tingling sensation in feet	44.8	26.7	
Slipping of chappals/slippers	31	6.7	

of chappals, blood discharges or extreme sensitivity due to diabetes. During the study, we found discrepancies between male and female population for their management of diabetes [Table 2]. Population in the study

also reported of pain, ulcers, blister and callus formation in the feet [Table 1]. Urban population had a follow up 16.8% with physician and 6.4% with a physiotherapist for diabetes and foot related problems in diabetes where as in rural

Table 2: Baseline characteristics of management of diabetes in the population screened during the study

<i>Duration of diabetes</i>	<i>Prescription for men population (%)</i>	<i>Prescription for women population (%)</i>
<1 years	Lifestyle modifications only – 43.5	Lifestyle modifications only – 22
	OHA only – 47.8	OHA only – 67
	Insulin only – 4.3	Insulin only – 11.1
	OHA and Insulin – 4.3	OHA and Insulin–
1-5 years	Lifestyle modifications only – 8.6	Lifestyle modifications only – 11.8
	OHA only – 82.9	OHA only – 88.2
	Insulin only – 5.7	Insulin only–
	OHA and Insulin-2.9	OHA and Insulin–
5-10 years	Lifestyle modifications only – 1.5	Lifestyle modifications only–
	OHA only – 86.2	OHA only – 85
	Insulin only – 5.7	Insulin only – 10
	OHA and Insulin – 2.9	OHA and Insulin – 5
10-15 years	Lifestyle modifications only – 3.8	Lifestyle modifications only–
	OHA only – 86.2	OHA only – 82.1
	Insulin only – 9.4	Insulin only – 14.3
	OHA and Insulin – 9.4	OHA and Insulin – 3.6
15- 20 years	Lifestyle modifications only–	Lifestyle modifications only – 8.3
	OHA only – 70.6	OHA only – 66.7
	Insulin only – 5.9	Insulin only – 8.3
	Tablet and Insulin – 23.5	Tablet and Insulin – 16.7
>20 years	Lifestyle modifications only–	Lifestyle modifications only – 6.7
	OHA only – 62.1	OHA only – 86.7
	Insulin only – 10	Insulin only –
	OHA and Insulin – 27.6	OHA and Insulin – 6.7

OHA=Oral hypoglycemic agents

India, population had a follow-up of 17.5% with physician and 2% with a physiotherapist for management of diabetes and diabetic foot related problems.

71.4% of urban population and 76% of rural population inspected their feet daily for any blister, sore or related foot problems. 81% of people in urban and 83.5% in the rural area were aware of the immediate management for foot ulcers.

Foot care education

Foot care education involves all the aspect of preventative and corrective care of the foot and ankle after the diagnosis of diabetes. 56.4% of the population in urban area and 46.6% of the population in the rural area had been educated

regarding foot care in diabetes. In the study, among the participants screened 42% of urban and 21% of rural population had knowledge regarding foot care through pamphlets and hand outs. 59% of people in urban area and 58% in the rural area applied some sort of lotion and oils to prevent skin from becoming dry. 45% of population with diabetes in urban area preferred to wear footwear outside, 54% preferred inside the house and 54% wore footwear all the time. In rural India 6% of people felt footwear were not applicable for them, 33% wore footwear's outside the house premises, and 60.2% people wore foot wears all the time of day irrespective they were inside or outside the house.

However, only 30.5% of population in urban areas and 9.7% of population in the rural areas

knew about the importance of shoe selection in diabetes.

Daily foot care and adherence to footwear in day to day life had a significant positive correlation of $P = 0.03$ and $P = 0.01$ with occupation respectively ($P \leq 0.05$). For awareness regarding knowledge regarding the appropriate foot wears, had a correlation of $P = 0.02$ with occupation, $P = 0.00$ with income and $P = 0.00$ with education ($P \leq 0.01$).

Programs on diabetes management in India

There are various international initiatives World diabetic foundation (WDF) on diabetes and its related complication management in India. In our study, we found a poor awareness among Indian masses regarding any initiatives on management of diabetic foot by national or international bodies. Urban population had an awareness of 13% compared to 11% of rural population about the initiatives of WDF. For management of diabetes and its complication only 8.6%

people in urban area compared to 4% in rural areas adhered to the foot care programmes by WDF in their day to day life.

Socioeconomic status of the population

Socioeconomic status was evaluated as a combination of factors, including income, level of education and occupation. It is also a way to look as to how an individual or a family fit into society using economic and social measures. Among variety of occupations, semiskilled workers suffered from the highest percentage of ulcers [Figure 2]. Whereas 13.3% of person with no income group reported higher percentage of ulcers compared to other earning groups (4.8% in <Rs. 10,000, 6.5% in Rs. 10,000-20,000 and 8% in more than Rs. 20,000 income per month). Population screened in the study with current foot or leg problems for blood or pus discharge in socks or footwear's had a significant negative correlation of $P = 0.03$ and $P = 0.02$ with family income and educational status respectively. Population suffering from discomfort in the leg on walking had a negative correlation of $P = 0.04$ and $P = 0.03$ with the family income

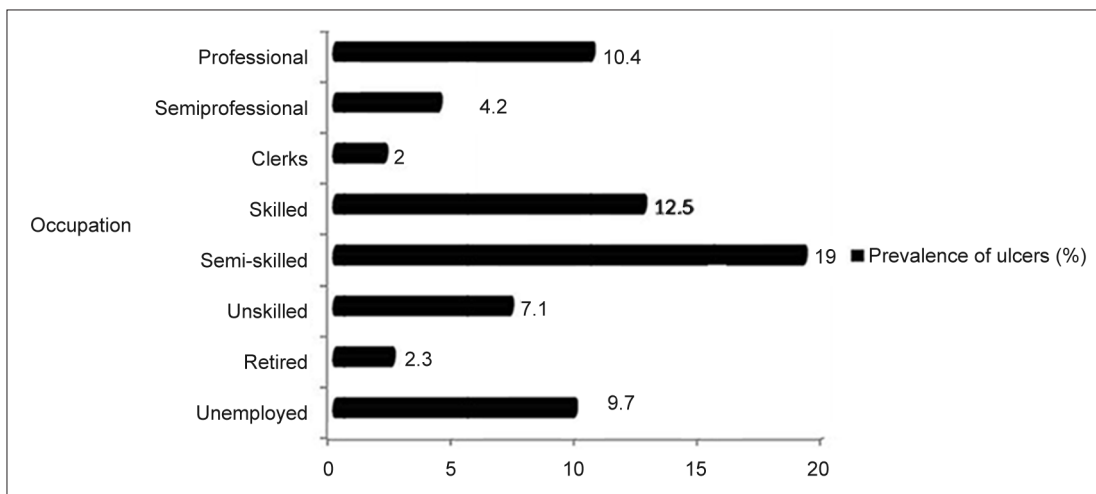


Figure 2: Prevalence of diabetic foot ulcers in Indian population

respectively (correlations were considered significant if $P \leq 0.05$).

DISCUSSION

In the study, we found with increased duration of diabetes, there was a simultaneous increase in the prevalence of foot ulcers [Table 1]. We evaluated the population with diabetes for their problems in feet and awareness of foot care. Within a year of onset of diabetes, almost 8.7% of the study-population suffered from foot ulcers [Table 1]. Men (10.3%) were more prone for foot-ulcers with duration of diabetes greater than 20 years and women (8.3%) were more prone for ulcers between 16 and 20 years from the onset of diabetes [Figure 3a-c]. Hence, it implies that, overall with the increase in duration of diabetes there did not appear to be a linear increase in the individual's education and usual care of feet in diabetes.

Prevalence of diabetes and its complications has been increasing steadily, along with the increase in age and obesity over the past decade.^[1,2] Diabetic foot has a devastating outcome like pain, ulceration, chronic infections and amputation, which significantly reduces an individual's functional independence.^[4] Many foot problems are preventable with appropriate management strategies and, therefore, there is a need for standardized care and access to foot care specialist services across the country. For the monitoring of diabetes, in the country there are guidelines focusing on the cost-effective measures to ensure good control of diabetes and its associated risk factors to protect the patient from developing complications.^[7] Though there is a physician centered approach to the population (glycemic

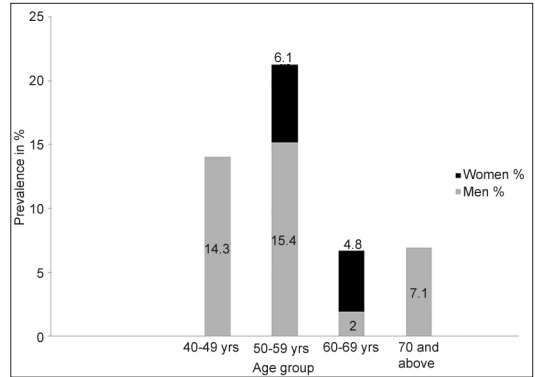


Figure 3a: Prevalence of foot ulcers in urban India

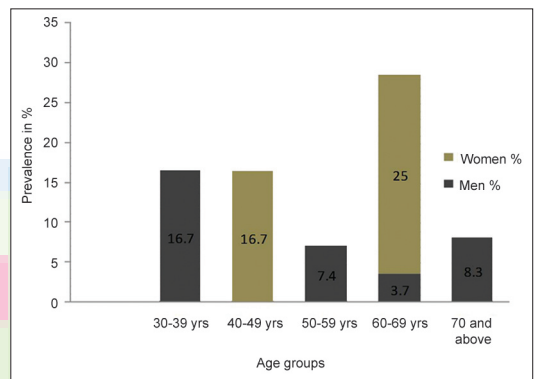


Figure 3b: Prevalence of foot ulcers in rural India

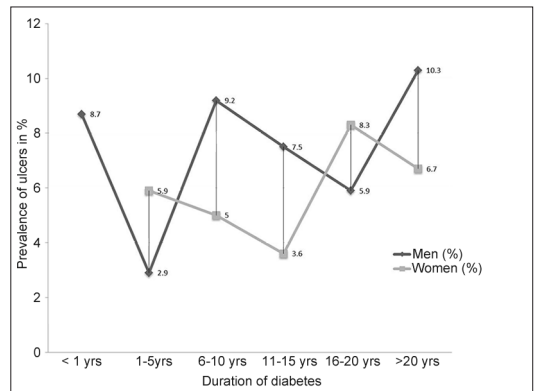


Figure 3c: Prevalence of diabetic foot ulcers in men and women in India

control, biomarkers in diabetes, blood-lipid profile) but there are no guidelines addressing

the perspectives of the population in diabetes to achieve a better quality of life. From this study, we observed a clear lack of national policies and strategies focusing on prevention and management of diabetic foot complications. Emphasis on such primary policies would result in an improved quality of life among Indian masses.

The authors in the present study feel that there is a need for yardsticks, which ensures that our medical policies focus on primary and secondary preventive measures at the community level. The strategies should not only focus on diabetic population but also on high-risk groups at the verge of developing diabetes. In an analysis of preventive measures by Narayan *et al.* on global prevention and control of type two diabetes, had stated to implement effective preventive measures on a single stage for the management of diabetes and its complications.^[6] Our focused national policies that are developed in the interest of population with diabetes should have a cumulative effect at the national level to support people with diabetes and also provide them the armamentarium for the control of diabetes, and its complications. The authors have further outlined for development of “cluster visits” with a multi-disciplinary team of health-care providers, for people with diabetes.^[6] Moreover, it is also important that individuals with diabetes who are at risk of developing complications should be encouraged to undertake a basic foot care regimen to reduce their likelihood of developing complications.^[6] These focused policies will not only lead to risk reduction for foot ulceration or reduced functional independence associated with diabetes and other non-communicable disease, but will also bring down the prevalence

of diabetes and its complications in India, which set to rise to 69.9 million in 2025.^[3]

Physical activity and dietary changes will play the cornerstone in the prevention and progression of diabetes and its complications. AHEAD (Action for Health in Diabetes) a united states based trial identified that intensive lifestyle modifications can modulate complications in diabetes.^[9] A good glycemic control through intensive lifestyle modification can delay or alter the natural progression of DPN, thereby reducing the chances of developing foot ulcers.^[10] There is a need for a trial of good methodological quality addressing the quality of life, self-care management in diabetes and foot complications in India as in the present study we found there were 8.7% of the study population had already developed foot ulcers in their first year of diabetes [Figure 3].

A diabetic foot ulcer not only causes immense psychological stress on the person but also causes decline or loss of mobility, body function and a greater dependence on family members. The expense estimated for diabetes-related amputation is between, A 3 years follow up study analyzed long-term expenses for the management of diabetic foot ulcers to be \$26,700 (U.S. dollars) for healing in critical ischemia and \$16,100 for healing without critical ischemia. For individuals requiring minor amputation the corresponding costs were \$43,100 and \$63,100 for individuals requiring major amputation, while the psychological distress in such conditions are usually immeasurable ^[11]. A study done by Viswanathan *et al.* in India found that strategies such as intensive management of diabetes and foot care education can have overwhelming

results in people with diabetes.^[12] Similar findings were reported by Barth *et al.* in a study where population adhering to foot care advices reported lesser number of foot problems.^[13] Hence from these studies we can estimate the effectiveness of conservative management on foot related problems in diabetes.

Due to lack of the national task force on diabetic foot management, we haven't exploited our primary and secondary preventive measures to minimize complications of diabetes. In a study by Mohan *et al.* in 2007, the authors identified "Asian Indian phenotype" might be responsible for the increased insulin resistance, greater abdominal obesity. This theory might be an influential factor making Indians more prone for diabetes and its complications.^[2]

Through improving medical support system by national health bodies we found, urban, and rural population had been educated regarding foot care in diabetes but ironically, awareness regarding shoe selection in diabetes was low among Indian masses. This knowledge of wearing boots or protective footwear's are very less in rural India among farmers, who are frequently required to be in the in-field. Moreover, population in rural India sleeps outdoor, and due to loss of sensation in feet, the people in rural India are unaware of the bites by rodents. Hence, rural population being vulnerable for chronic ulcers, has higher chances of amputation of the limb, causing them a decline in functional, and vocational activities. A follow-up study by Viswanathan *et al.* in 2004, found that therapeutic foot wears were not only beneficial for high risk foot but also were capable of reducing chances of new ulcers.^[14]

By this study, we perceive a clear need for specialized professionals in the field of diabetic foot care. A study by Viswanathan *et al.* in 2006, stated a similar difference in foot care in rural and urban parts of Tamilnadu.^[15] Moreover, in a study in 2011 by Anjana *et al.*, the authors outlined an urgent need for a national wide survey on the prevalence of prediabetes, diabetes, and its complications.^[16]

A diabetic foot ulcer not only adds to emotional distress among the population, but also to the economic consequences of a family. Effective medical measures will not only impact a personal life of an individual, but will also help to alleviate stresses at home, work, and relationships. The psychosocial aspects of diabetic foot ulceration cannot be neglected; hence a primary and secondary care-based diabetes specialist is required to address the issue. Study had a few limitations, though we circulated questionnaires in various centers of the country, there were few non respondent centers in various states, hence the situation of current problems in those states could not be assessed. Moreover, the sampling method includes individuals that could be conveniently being identified at the various centers. So there is a probability that individuals in the centers may have more likelihood of getting the standard care for their diabetes management and may have a higher degree of awareness of their foot care issues in diabetes. In other words, the true degree of awareness at community level might be even worse than estimated. In future, study shall be pursued to lay emphasis on the utilization of our health-care resources for primary prevention measures in the diabetic feet.

CONCLUSION

In conclusion, there is a disparity in diabetic foot awareness and management in Indian diabetic population. Despite diabetes awareness among the Indian masses suffered from diabetic foot ulcers within their first year of onset of diabetes, and there seems to be a clear lack of implementation of foot care programmes in their daily life. This suggests more aggressive methods are required for patient education and foot care implementation in the rural and urban population of India as a preventive strategy.

ACKNOWLEDGEMENT

We would like to thank Dr. Manikandan, Senthil Kumaran, Ravi Reddy, Ranganathan, Kalyan Chakravarthy, Rajesh Navada, Veena S and Pragya Rai for their help and support during the study. We would also like to thanks various centers across India which participated in the survey.

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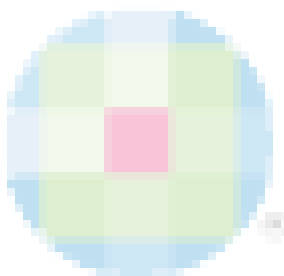
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How to cite this article: Dixit S, Maiya A, Khetrpal H, Agrawal B, Vidyasagar S, Umakanth S. A questionnaire based survey on awareness of diabetic foot care in Indian population with diabetes: A cross-sectional multicentre study. *Indian J Med Sci* 2011;65:411-23.

Source of Support: Nil. **Conflict of Interest:** None declared.



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