

## **Prevalence and healthcare costs associated with the management of diabetic foot ulcer in patients attending Ahmadu Bello University Teaching Hospital, Nigeria**

**<sup>1</sup>Umar Mukhtar Danmusa, <sup>2</sup>Iorliam Terhile, <sup>3</sup>Idris Abdullahi Nasir, <sup>4</sup>Auwal Alkasim Ahmad, <sup>5</sup>Habiba Yahaya Muhammad**

<sup>1</sup>Faculty of pharmaceutical Sciences, Usmanu Danfodiyo University, Sokoto, Sokoto State, Nigeria;

<sup>2</sup>Department of Pharmaceutical Services Ahmadu Bello University Teaching Hospital, Shika 06, Kaduna State, Nigeria;

<sup>3</sup>Department of Medical Laboratory Services, University of Abuja Teaching Hospital, PMB 228 Gwagwalada, FCT Abuja, Nigeria;

<sup>4</sup>Faculty of Pharmacy, Ahmadu Bello University, Zaria, PMB 05, Zaria, Kaduna State, Nigeria;

<sup>5</sup>Department of Chemical Pathology, Aminu Kano Teaching Hospital, PMB 3452 Zaria road, Kano state, Nigeria.

### **Abstract**

**Introduction:** Diabetic foot ulcers (DFU) are non-traumatic lesions of the skin on feet of diabetic patients. DFU require appropriate investigations, dietary placement and clinical management. These constitute huge healthcare costs in DFU care.

**Objective:** This study sought to determine the prevalence of DFU in relation to clinical, sociodemographic variables and healthcare costs expended.

**Methods:** This was a retrospective study. Hence, medical records and healthcare costs of 1573 DFU-diagnosed patients who visited the diabetic clinic and medical wards of Ahmadu Bello University Teaching Hospital, Nigeria were reviewed and analyzed for relevant data.

**Results:** The prevalence of DFU in patients with diabetic mellitus (DM) was 6.0% with more cases in men (67.2%) than women (32.8%). The prevalence of DFU in relation to type of DM was 6.5% and 0% for DM type-II and DM type-I respectively. The distribution of DFU in relation to clinical stages was 40%, 25.7%, 17.1% and 11.4% for stages-IV, III, II and I. Patients in the age group 51-60 years had the highest frequency of DFU (28.6%), but there was no DFU in those 10-20 years and > 80 years. It required an average of 1808 US\$ to successfully treat patients with DFU stage IV, while 1104 US\$ and 556 US\$ was required to treat DFU stage III and II respectively. Cost of procuring drugs covered the highest burden of total healthcare cost in managing DFU (35%-46%).

**Conclusion:** The prevalence of DFU in DM patients attending ABUTH was high. Healthcare costs associated with DFU especially cost of drugs procurement contributed the highest financial burden in managing DFU.

**Keywords:** Diabetic mellitus, Diabetic foot ulcer, Financial costs, Chemotherapy, Nigeria.

### **Corresponding author:**

**Idris Abdullahi Nasir**

Department of Medical Laboratory Services, University of Abuja Teaching Hospital

PMB 228 Gwagwalada, FCT Abuja, Nigeria

Phone Number: +2348030522324

Email: [eedris888@yahoo.com](mailto:eedris888@yahoo.com)

## Introduction

Diabetes mellitus (DM) is a common hormonal and glucose metabolic disorder with major systemic consequences arising from severe damage to numerous end organs. <sup>(1)</sup> DM has a worldwide distribution and the prevalence increases at a very alarming rate. <sup>(2)</sup> In 1992, Zimmet first coined the term "epidemic of diabetes," noting that DM constitute an alarming rate of both economic burden and human suffering. <sup>(3)</sup>

The global prevalence of diabetes mellitus has been projected to nearly double from a baseline of 2.8% in 2000 to 4.4% by 2030, affecting over 350 million individuals. Lower extremity morbidity constitutes a major complication of DM on affected individuals and the healthcare system. <sup>(4)</sup> As the incidence of DM is dramatically rising dramatically, so are the risks of developing diabetic foot disease. <sup>(5)</sup> The lifetime risk persons with diabetes developing diabetes foot ulcers was reported to be as high as 25%. <sup>(6)</sup> In Nigeria, estimates of 10% people with diabetes suffer lower limb complications and the incidence is on the rise. <sup>(7)</sup> Presently, DFU account for the majority of non-traumatic amputations performed in most Nigerian tertiary hospitals.

DFU is common, disabling and frequently leads to amputation of the leg. Mortality is high and healed ulcers often recur. DFU has a complex pathogenesis, variable clinical presentation, thus the management requires early expert investigations. Interventions should be directed at containing secondary infections, peripheral ischemia and abnormal pressure loading caused by peripheral neuropathy and limited joint mobility. Despite treatment, ulcers readily become chronic wounds. Diabetic foot ulcers have been neglected in health-care research and planning, and clinical practice is based more on opinions than scientific facts. Furthermore, the pathological processes associated with DFU are poorly understood, inadequately taught and communicated between the many clinical specialties involved. <sup>(8)</sup>

It was indicated that a 1% mean reduction in HbA1c was associated with a 25% reduction in microvascular complications, including neuropathy. Investigations have found that poor glucose control accelerated the manifestation of Peripheral Arterial Disease (PAD). It has been shown that for every 1%

increase in HbA1c, there is an increase of 25%-28% in the relative risk of PAD, which is a primary cause of DFU. However, to date, no Randomized Controlled Trial (RCT) has been performed to determine whether improved glucose control benefits patients after foot ulcer has developed. <sup>(9)</sup>

There are different kinds of debridement including surgical, enzymatic, autolytic, mechanical, and biological. Among these methods, surgical debridement has been shown to be more effective in DFU healing. Surgical or sharp debridement involves cutting away dead and infected tissues followed by daily application of saline moistened cotton gauze. The main purpose of this type of debridement is to turn a chronic ulcer into an acute one. <sup>(10, 11)</sup> Surgical debridement should be repeated as often as needed if new necrotic tissue continues to form. It has been reported that regular (weekly) sharp debridement is associated with the rapid healing of ulcers than less frequent debridement. In a retrospective cohort study, Wilcox *et al* indicated that frequent debridement healed more wounds in a shorter time ( $p < 0.001$ ). In fact, the more frequent the debridement, the better the healing outcome. <sup>(12)</sup>

Although accurate prevalence figures of DFU are difficult to obtain, the results of cross-sectional community surveys in the UK showed that 5.3% (type 2) and 7.4% (both type 1 and 2) of people with diabetes had a history of active or previous foot ulcer. <sup>(13, 14)</sup> The lifetime risk for any diabetic patient is up to 15%. <sup>(15)</sup> Ramsey *et al* noted a cumulative 3-year incidence of 5.8% in diabetic patients in the USA, but this value was based on hospital discharge data; community surveys have produced slightly higher figures. <sup>(16)</sup>

There is no widely accepted method for classifying or even describing foot ulcers. Non-specialists commonly refer to all ulcers as diabetic foot. Two international working parties are trying to define a system of describing individual ulcers to improve communication and develop a classification for audit and research. <sup>(17)</sup> Without classification, selection of comparable populations for urgently needed multicenter trials will be impossible. There are 2 well-established systems, the Wagner and the University of Texas classifications. Although both systems provide descriptions of ulcers, each has its merits and drawbacks. The

Wagner system uses 6 wound grades (scored 0 to 5) to assess ulcer depth. <sup>(18)</sup> However, the system is limited in its ability to identify and describe vascular disease as an independent risk factor. In addition, superficial wounds that are infected or dysvascular are not able to be classified by this system. <sup>(19)</sup>

In addition to causing suffering and morbidity, foot lesions in diabetic patients have substantial economic consequences. <sup>(20)</sup> Diabetic foot complications result in huge costs for both society and the individual patients. The economic burden of DFUs and the complications arising from them are enormous. The cost to treat a DFU over a 2-year period was 27,987 US\$ in 1995 and, based on the medical component of the US Consumer Price Index, rose to 46,841 US\$ in 2009. <sup>(21, 22)</sup> These high costs have been linked to frequent outpatient appointments, in-patient days, laboratory tests, drugs/medications, hospital stays, and secondary complications of osteomyelitis and amputation. <sup>(21, 23)</sup> Direct costs for a lower-extremity amputation range from 22,700 US\$ to 51,300 US\$. <sup>(24)</sup>

Boulton *et al* <sup>(24)</sup> provided the substantial economic burden diabetic foot ulcers place on afflicted patients and the health care system, although they recognized that most estimates fail to account for preventive care, loss of productivity, and rehabilitation. They further proposed that if these aspects were included to the current estimates as much as 20% of diabetes-related costs could be associated with diabetic foot ulcers. The excess costs are primarily attributable to more frequent hospitalization, use of antibiotics, and need for amputations and other surgical procedures. <sup>(25)</sup>

The direct economic costs of the diabetic foot in Nigeria are substantial. The average cost of successfully treating foot ulceration a decade ago in Nigeria was estimated 1280 US\$ <sup>(7)</sup> while the mean cost for successfully treating a patient with DFU was 1003 US\$. The total costs incurred ranged from 113 US\$ to 1544 US\$. DFU-related medications usually account for the majority of the total costs

incurred by patients. <sup>(23, 26)</sup> More so, medication costs considerably vary based on foot ulcer grade. <sup>(26)</sup>

It is pertinent to provide an update on the healthcare-related financial burden involved in the management of DFU in Nigeria. This study set to determine the prevalence of DFU, associated risk factors in DM patients and healthcare cost expended in the diagnosis and management of DFU in Ahmadu Bello University Teaching Hospital, Nigeria.

## Methodology

### Study Area:

This retrospective study was carried out at the Ahmadu Bello University Teaching Hospital (ABUTH). ABUTH is a tertiary health institution located in Shika-Zaria, Kaduna State, Nigeria. It is the largest hospital that serves all the 19 Northern States of Nigeria and some neighboring countries. Zaria city has a population of 975,153 (Nigerian National Population Commission, 2006).

### Analysis of DFU Prevalence:

Medical records of all patients who visited the diabetic clinic and those admitted at the medical wards of ABUTH Zaria diagnosed with DFU over the period of six (6) months (i.e. January -June 2014) were reviewed and variables considered included gender, age, clinical presentation and types of DM.

### Analysis of Healthcare costs:

Medical records and ledger of patients with DFU whom were successfully treated during the study period were reviewed and relevant financial information obtained. These included costs of laboratory /radiology investigations, consumables and procedures, medications, surgery, hospital accommodation, foot care/dressing and feeding. While information about the duration of hospital stay was obtained from the nurses' admission and discharge record. Costs of miscellaneous services were also included.

**Wagner Classification System for Diabetic Foot Ulcer**

<b>GRADE</b>	<b>LESION</b>
0	Intact skin
1	Superficial ulcer
2	Deeper ulcer (tendon and bone involvement)
3	Deep ulcer + infection
4	Ulcer with gangrene of 1-2 toes
5	Ulcer with extensive gangrene the whole foot

**Ethical Clearance:**

This protocol of this study was approved by the ethical research committee of Ahmadu Bello University of Teaching. All data were analyzed anonymously throughout the study.

**Statistical analysis:**

Data was systematically analyzed as appropriate using statistical package for social sciences (SPSS) software version 20 (California Inc., USA). A two sided  $p < 0.05$  at 95% confidence interval (CI) was considered statistically significant for t-test to determine the statistical association between the variables.

**Results****Table 1.1: Gender distribution of diabetic foot ulcer**

Month	Sex	Total DM patients	Total DFU	Relative frequency of DFU %	<i>P-value</i>
JANUARY	M	128	2	1.6	<b>0.011*</b>
	F	192	3	1.6	
FEBRUARY	M	115	5	4.3	
	F	189	6	3.2	
MARCH	M	118	9	7.6	
	F	172	8	4.7	
APRIL	M	145	10	6.9	
	F	210	8	3.8	
MAY	M	110	14	12.7	
	F	142	7	4.9	
JUNE	M	27	15	55.5	
	F	25	7	28.0	
TOTAL	M	643	55	8.6	
	F	930	39	4.2	
		1573	94	6.0	

\*  $p < 0.05$  is statistically significant

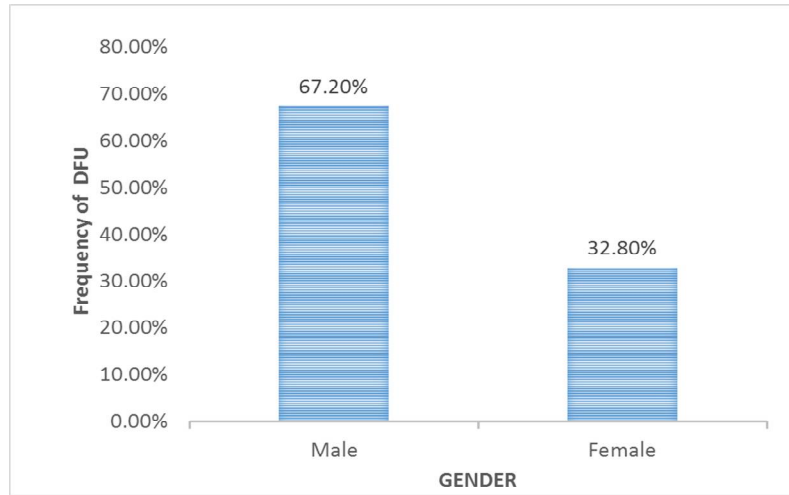


Figure 1. Distribution frequency of diabetic foot ulcer in relation to gender

Table 1.2: Prevalence of diabetic foot ulcer in relation to type of diabetes

Type of DM	No. of patient with DM	No. Of patient with DFU	% with DFU
Type 1	119	0	0
Type 2	1454	94	6.5

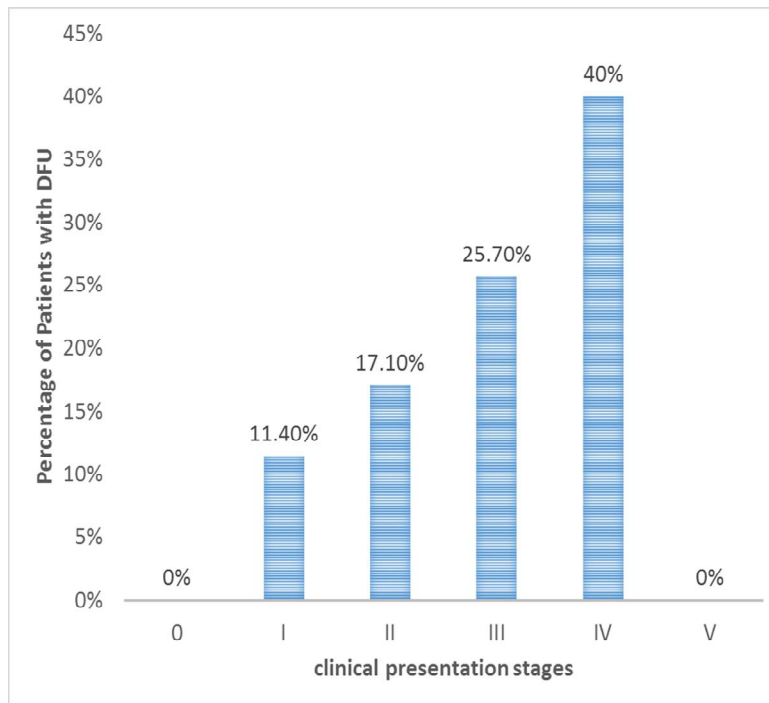
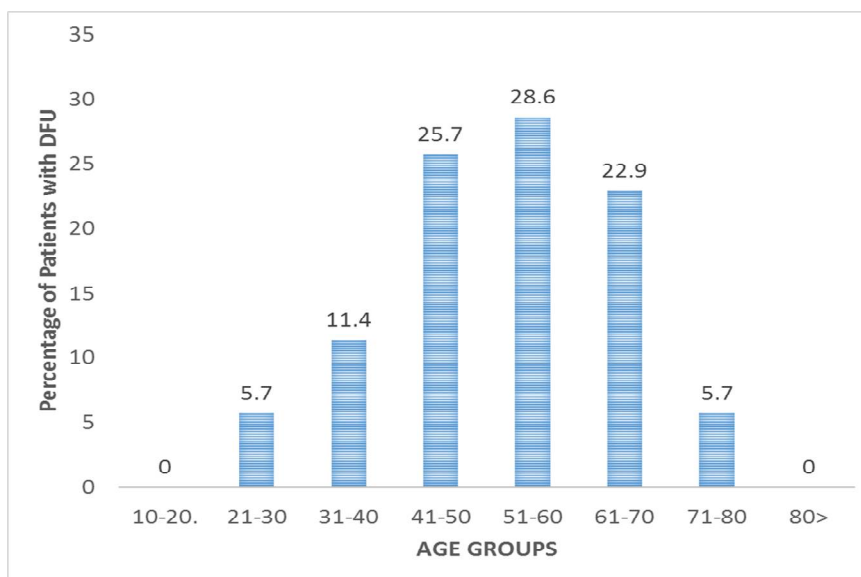


Figure 2: Frequency distribution of diabetic foot ulcer in relation to clinical presentation stage

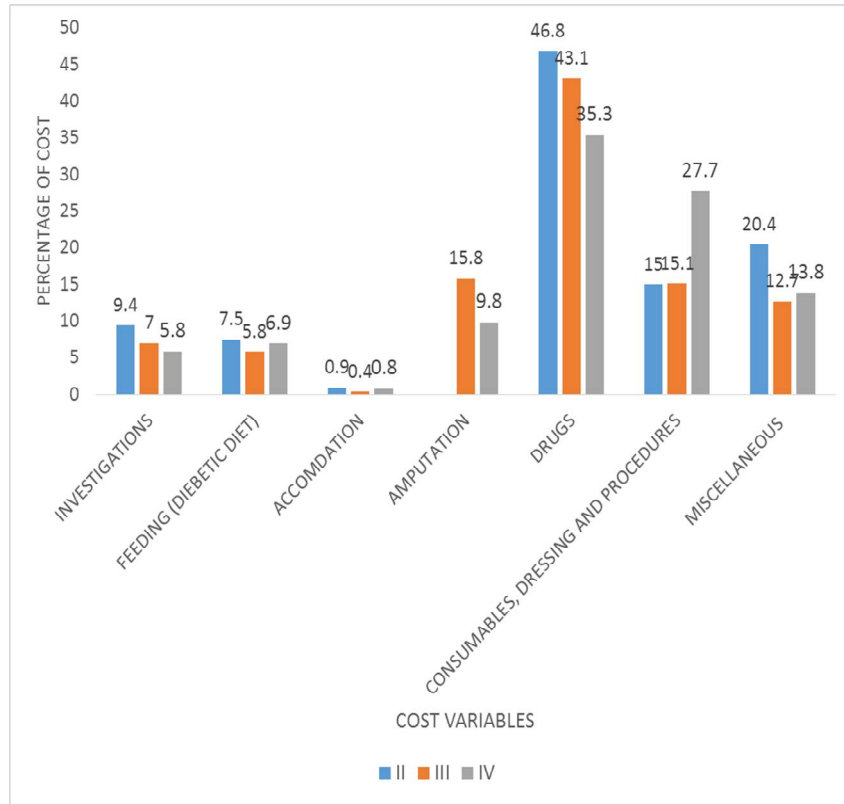


**Figure 3: Prevalence of diabetic foot ulcer in relation to patients' age**

**Table 1.3 Average cost expended (US\$) in managing various stages of diabetic foot ulcer**

Cost variables	Stages		
	II	III	IV
Investigations	52	77.7	105
Feeding (diabetic diet)	41.7	63.7	125
Accommodation	5	4.3	15
Amputation	-	175	175
Drugs	260.4	476.4	637.9
Consumables, dressing and procedures	83.3	166.7	500
Miscellaneous	113.3	140.6	250
Total	556	1104	1808

Note: Currency conversion rate at 30<sup>th</sup> June, 2014 was 1 US\$ to 180 Nigerian Naira



**Figure 4: Percentage cost of each variable determinants in managing diabetic foot ulcer**

**Discussion**

This study shows the prevalence of diabetic foot ulcer among diabetic patients attending ABUTH Shika to be 6.0%. Previous studies in different settings reported the prevalence of diabetic foot ulcer between 4.6% - 11.9% among diabetic patients. (8, 27, 28) Higher prevalence was reported in Ethiopia and India. (29, 30) The difference may be due to variation in sample size, racial difference, differences in year of studies and sociocultural variation of study participants.

In consistence with our findings, the presence of diabetic foot ulcer (mostly in males) progresses with age and most frequent in elderly subjects as reported by several researchers. (7, 30, 31) The variation of diabetic foot ulcer in relation to sex and age might be a reflection of variation in societal role between males and females in Northern Nigeria, typically in the study area, males spend most of their time outdoors doing hard jobs that could exposed them to more risks of

amputation than women. Numerous studies have provided support that men have a higher risk of amputation than women. This difference has been observed in amputations related to trauma as well as diabetes. Among diabetic patients, the risk of amputation appears to be twice more in men than women. (31) As of 1999, an age-adjusted incidence was found to be 4.1 per 1,000 for females and 9.2 per 1,000 in males. Six years later, in 2005, the age-adjusted rates were 2.6 per 1,000 and 5.6 per 1,000, respectively. (32)

The prevalence of diabetic foot ulcer in relation to the type of diabetes mellitus was shown by previous studies to be higher with type II diabetes mellitus. (8, 29, 33) This study shows that all the patients with diabetic foot ulcer in the study area was as result of type II diabetes mellitus.

This present study showed the prevalence of diabetic foot ulcer in relation to age to be highest in the age group 51-60 years (28.6%), followed by 41-50 years (25.7%) and 61-70

years (22.9%) while none was recorded in the age groups 10-20 years and > 80 years. This might be because all the DFU patients were as a result of diabetes mellitus type II (DM II), which occurs mostly in people between the age range of 45-65 years. <sup>(34, 35)</sup>

Some studies showed that age was statistically significant in diabetic foot ulcers in patients with long-term diabetes even after glycemic control. <sup>(8, 34, 35)</sup> Ekere *et al* showed that foot ulcers have been reported to occur after a mean interval of 13 years from the diagnosis of diabetes in Nigerian population. <sup>(35)</sup> Other studies also found that the frequency of having diabetic foot ulcer increased by 8 fold higher in those who were diabetic for more than 10 years. <sup>(29, 36, 37)</sup> The possible explanation might be due to the fact that diabetic patients were presumed to be at more risk due of developing long term diabetic-related complications such as peripheral vascular disease, neuropathy, nephropathy and retinopathy which could predispose to the occurrence of foot ulcer. In summary the age range (51-60) years are more at risk of developing foot ulcer than any other age groups. <sup>(37)</sup>

The total cost required to successfully treat diabetic foot ulcer among diabetic patients attending ABUTH Shika was calculated based on the stages of presentation, and the average cost of each variable. From our study, the average cost of treating patients with stage II diabetic foot ulcer successfully is 556 US\$ and 1104 US\$ would be required to successfully treat those at stage III, while patients with stage IV diabetic foot ulcer will require an average of 1808 US\$ to be successfully treated. The differences in the cost of treating the three stages might be as a result of the difference in clinical commodities presented by patients, because the more the severity of the condition the more time it takes in treatment and hence the more expenses incurred.

Previous studies in Nigeria did not classify the cost of treatment in relation to stages of presentation rather showed the mean and range of cost incurred to successfully treat diabetic foot ulcer regardless of the stage. Ogbera *et al* <sup>(7)</sup> showed that the mean cost for successfully treating a patient with diabetic foot ulcer in Nigeria was 1003 US\$ and the total cost incurred range from 113 US\$ to 1544 US\$. These values are quite lower than those from

our findings. The possible explanation might be the reflection of inflation, monetary value variations, time of the study and differences in study area.

Previous studies showed that the cost of drugs procurement accounted for the majority of the total cost incurred during DFU management. <sup>(37, 38, 39, 40)</sup> Our study is consistent with their findings because the cost of drugs procurement accounted for the largest burden incurred in DFU patients in all the three stages (35% - 46% of total cost), followed by cost of foot dressing, surgical consumables and procedures.

### Conclusion

The prevalence of DFU in DM patients attending ABUTH Shika was 6.0% with more cases in men than women. Age, sex and type of DM were found to be significant risk factors of DFU. Health care costs associated with DFU significantly contributed to the high financial burden in the management of various stages of DFU and cost of drugs covered the highest percentage of the total cost incurred in the management of DFU. To prevent or minimize the risk of developing diabetic foot ulcer, health educators should emphasize on the benefit of weight reduction, blood pressure monitoring and other known predisposing factors.

### Conflict of interest

Authors declare that there are no conflicts of interested associated with this manuscript.

### References:

1. Du Y, Heidemann C, oßwald AG, Schmich P. Prevalence and comorbidity of diabetes mellitus among non-institutionalized older adults in Germany-results of the national telephone health interview survey 'German Health Update (GEDA)' 2009. BMC Public Health, 2013; 13:166.
2. Pinidiyapathirage MJ, Kasturiratne A, Ranawaka UK, Gunasekara D, Wijekoon N, Medagoda K. The burden of diabetes mellitus and impaired fasting glucose in an urban population of Sri Lanka. Diabetic Med, 2013; 30:326-332.
3. Zimmet PZ. Kelly West Lecture 1991. Challenges in diabetes epidemiology-from West to the rest. Diabetes Care, 1992; 15:232-52.
4. Cook JJ, Simonson DC, In. Epidemiology and health care cost of diabetic foot problems. Veves A. (eds.). The Diabetic



- Foot: Medical and Surgical Management, Contemporary Diabetes. 2012. DOI 10.1007/978-1-61779-791-0-2
5. Tesfaye S, Stevens LK, Stephenson JM, et al. Prevalence of diabetic peripheral neuropathy and its relation to glycaemic control and potential risk factors: the EURODIAB IDDM complications study. *Diabetologia*, 1996; 39:1377-84.
  6. Singh N, Armstrong DG, Lipsky BA. Preventing foot ulcers in patients with diabetes. *JAMA*, 2005; 293:217-28.
  7. Ogbera AO, Fasanmade O, Ohwovoriole AE, Adediran O. An assessment of the disease burden of foot ulcers in patients with diabetes mellitus attending a teaching hospital in Lagos, Nigeria. *Int J Low Extrem Wounds*, 2006; 5:244-249.
  8. Jeffcoate WJ, Harding KG. Diabetic foot ulcers. *The Lancet*, 2003; 1-7. <http://image.thelancet.com/extras/02art6190web.pdf>
  9. American Diabetes Association. Standards of medical care in diabetes-2006. *Diabetes Care*, 2006; 29:S4-42.
  10. Lebrun E, Tomic-Canic M, Kirsner RS. The role of surgical debridement in healing of diabetic foot ulcers. *Wound Repair Regen*, 2010; 18:433-438.
  11. Cardinal M, Eisenbud DE, Armstrong DG, Zelen C, Driver V, Attinger C, Phillips T, Harding K. Serial surgical debridement: a retrospective study on clinical outcomes in chronic lower extremity wounds. *Wound Repair Regen*, 2009; 17:306-311.
  12. Wilcox JR, Carter MJ, Covington S. Frequency of debridements and time to heal: a retrospective cohort study of 312 744 wounds. *JAMA Dermatol*, 2013; 149:1050-1058.
  13. Kumar S, Ashe HA, Parnell LN. The prevalence of foot ulceration and its correlates in type 2 diabetic patients: a population based study. *Diabet Med*, 1994; 11:480-84.
  14. Walters DP, Gatling W, Mullee MA. The distribution and severity of diabetic foot disease: a community study with comparison to non-diabetic group. *Diabet Med*, 1992; 9:354-58.
  15. Reiber GE, Lipsky BA, Gibbons GW. The burden of diabetic foot ulcers. *Am J Surg*, 1998; 176:5S-10S.
  16. Ramsey SD, Newton K, Blough D, et al. Incidence, outcomes, and cost of foot ulcers in patients with diabetes. *Diab Care*, 1999; 22:382-87.
  17. Macfarlane RM, Jeffcoate WJ. Factors contributing to the presentation of diabetic foot ulcers. *Diabet Med*, 1997; 14:867-70.
  18. Wagner FW. The dysvascular foot: a system for diagnosis and treatment. *Foot Ankle*, 1981; 2:64-122.
  19. Oyibo SO, Jude EB, Tarawneh I. The effects of ulcer size, patient's age, gender and type and duration of diabetes on the outcome of diabetic foot ulcers. *Diabet Med*, 2001; 18:133-38.
  20. American Diabetes Association. Consensus Development Conference on Diabetic Foot Wound Care. *Diab Care*, 1999; 22:1354-60.
  21. Ramsey SD, Newton K, Blough D. Incidence, outcomes, and cost of foot ulcers in patients with diabetes. *Diabetes Care*, 1999; 22:382-387.
  22. Bureau of Labor Statistics, Consumer Price Index, Archived Consumer Price Index Detailed Report Information, 2009 CPI Index Detailed Report Tables, December 2009. Accessed March 3, 2010. [http://www.bls.gov/cpi/cpi\\_dr.htm](http://www.bls.gov/cpi/cpi_dr.htm)
  23. Ogbera AO, Adedokun A, Fasanmade OA, Ohwovoriole AE, Ajani M. The Foot at Risk in Nigerians with Diabetes Mellitus: The Nigerian Scenario. *Int J Endocrinol Metab*, 2005; 4:165-73.
  24. Gordois A, Scuffham P, Shearer A. The health care costs of diabetic peripheral neuropathy in the US. *Diabetes Care*, 2003; 26:1790-1795.
  25. Boulton AJ, Vileikyte L, Ragnarson-Tennvall G, Apelqvist J. The global burden of diabetic foot disease. *Lancet*, 2005; 366:1719-24.
  26. Prompers L, Huijberts M, Schaper N, et al. Resource utilisation and costs associated with the treatment of diabetic foot ulcers. Prospective data from the Eurodiale Study. *Diabetologia*, 2008; 51:1826-34.
  27. Stock K, Vanderplas A, Tafesse E, Chang E. Costs of lower-extremity ulcers among patients with diabetes. *Diabetes Care*, 2004; 27:2129-34.
  28. Boulton AJM. The diabetic foot. *Med Int*, 1993; 271-274.

29. Unachukwu C, Babatunde S, Ihekweba AE. Diabetes, hand and/or foot ulcers: a cross-sectional hospital-based study in Port Harcourt, Nigeria. *Diabetes Res Clin Pract*, 2007; 75:148-152.
30. Shahi SK, Kumar A, Kumar S, Singh SK, Gupta SK, Singh TB. Prevalence of diabetic foot ulcer and associated risk factors in diabetic patients from North India. *The Journal of Diabetic Foot Complications*, 2012; 4:83-91.
31. Deribe B, Woldemichael K, Nemera G. Prevalence and factors influencing diabetic foot ulcer among diabetic patients attending Arbaminch Hospital, South Ethiopia. *J Diabetes Metab*, 2014; 2: 322.
32. Resnick HE, Carter EA, Sosenko JM. Incidence of lower-extremity amputation in American Indians: the Strong Heart Study. *Diabetes Care*, 2004; 27:1885-91.
33. Centers for Disease Control and Prevention (CDC). CDC WONDER Data. <http://wonder.cdc.gov/data2010>. Updated 2010. Accessed July 10, 2015.
34. Assal JP, Mehnert H, Tritschler HJ, Sidorenko A, Keen H; Hellmut Mehnert. Award Workshop Participants. On your feet! Workshop on the diabetic foot. *J Diabetes Complications*, 2002; 16:183-194.
35. Ekere AU, Yellowe BE, Dodivi-Manuel A. Pattern and management of diabetic foot disease in a developing country. *Niger J Med*, 2005; 14:272-275.
36. Khan H, Khan Z, Khan I, Jamal ud Din, Rehman S, Khan B. Factors contributing to the development of diabetic foot ulcers and role of health literacy. *RMJ*, 2011; 36:34-37.
37. Manda V, Sreedharan J, Muttappallymyalil J, Das R, Hisamatsu E. Foot ulcers and risk factors among diabetic patients visiting Surgery Department in a University Teaching Hospital in Ajman, UAE. *International Journal of Medicine and Public Health*, 2012; 2: 34-38.
38. Eregie A, Edo AE. Factors associated with Diabetic foot ulcers in Benin-City, Nigeria. *Niger Med J*, 2008; 49:9-11.
39. Ngwogu KO, Umez-Emeana EC, Ngwogu AC. The burden of diabetic foot ulcers in aba, Abia state, Nigeria. *Int J Basic, Appl Innov Res*, 2013; 2:118-124.
40. Ragnarson-Tennvall G, Apelqvist J. Health-economic consequences of diabetic foot lesions. *Clin Infect Dis*, 2004; 39:S132-S139.