



GSJ: Volume 7, Issue 8, August 2019, Online: ISSN 2320-9186
www.globalscientificjournal.com

THE ECONOMIC BURDEN OF *S.AUREUS* COLONIZATION AMONG DIABETIC PATIENTS WITH FOOT ULCERS (DPFUs): CASE OF VIHIGA COUNTY, KENYA

Dr. Kiganda Evans Ovamba (PhD)¹, Tuvei Susan Mamusavu²

1. Lecturer, Kaimosi Friends University College (KAFUCO), Kenya
2. Laboratory Technologist, School of Medicine, Maseno University, Kenya

*Corresponding author's email: eovamba@yahoo.com; stuvei@yahoo.com
P.O. Box 1926 - 40100, Kisumu, Kenya

Abstract

Background: *S. aureus* remains the predominant pathogen in diabetic foot ulcers which has been associated with increased mortality and hospital costs. However, economic burden of *S. aureus* colonization remains unknown since no study has been conducted on the subject matter. **Aim:** To investigate the economic burden of *S.aureus* colonization among DPFUs: case of Vihiga County, Kenya. **Method:** Pus samples from DPFUs were collected *S. aureus* screening. **Results:** 52.4% of DPFUs and colonized with *S. aureus* were poor earning less than Sh. 5,000 a month. Colonization with *S. aureus* had a negative economic effect on income earned by the diabetic patient with foot ulcer on a monthly basis. **Recommendations:** Enroll the diabetic patients with foot ulcers into transfer payments program and sensitize them on wound management practices to reduce their poverty profile and wound colonizations.

Keywords: *S.aureus*; Poverty Profile; Economic Burden

1.0 Introduction

Africa continues to experience an increase in the occurrence of diabetes alongside other non-communicable diseases (NCDs). In year 2010, over 12 million persons were projected to be living with diabetes in Africa, with a projection of about 24 million in the year 2030 (Hall *et al.* 2011). In spite of the common belief that NCDs trouble mostly high-income people, evidence reveals the contrary where according to the Ministry of Health reports, more than 50 % of hospital admissions and approximately 55 % deaths in Kenya are attributed to non-communicable diseases, diabetes amongst the prominent (El-busaidy *et al.*, 2014).

The diabetic foot remains a key impediment for diabetes care defined as a full thickness wound below the ankle in diabetics, regardless of the period (Iversen, 2009). The foot ulcers pervasiveness in diabetics has been projected to be approximately 25% which necessitates

continuous monitoring and frequent hospital visits that financially drain the patients (Mathangi *et al.*, 2013).

It has been widely thought that diabetic patients are prone to colonizations due to hyperglycemia induced immunodeficiency (Moazezi *et al.*, 2014). *S. aureus* has been identified as the main pathogen colonizing diabetic foot ulcers which has been connected with increasing death rates and hospital expenses (Oh & Tan, 2013). However, no study has been conducted to investigate the economic burden of *S.aureus* colonization which motivates a study to unravel the economic burden that the bacterium causes among the diabetics.

1.1 Objectives

To determine the;

- i. Poverty profile of DPFUs in Vihiga County, Kenya
- ii. Economic burden of *S.aureus* colonization on DPFUs in Vihiga County, Kenya

1.2 Research Questions

- i. What is the poverty profile of DPFUs in Vihiga County, Kenya?
- ii. What is economic burden of *S.aureus* colonization on DPFUs in Vihiga County, Kenya?

2.0 Literature Review

Danquah *et al.* (2010) conducted a study to single out risk factors among diabetics at Komfo-Anokye Teaching Hospital, Kumasi, Ghana using 1,466 patients. They established that the patients had a 46 % increased risk for Plasmodium falciparum colonization which exposing them to a high risk in contacting malaria that might impact negatively on their financial status.

Gracia and Dunavan (2005) examined tetanus epidemiology from 1972-2001 in the United States (US) and found that the incidence of tetanus for diabetics was 0.7/million as compared to 0.2/million for non-diabetics. Overall, diabetics are 3.2 times more likely to contract tetanus than non-diabetics. Similarly, a review on the scale of infectious challenges amongst diabetics in the US by Peter and Chin- Hong (2006) revealed that the most common risks were bacterial foot colonization. This was attributed to the peripheral neuropathy present in nearly half of patients with long-standing diabetes due to undetected injuries which usually causes severe consequences that include osteomyelitis and amputations if not controlled.

Saleem and Daniel (2011) evaluated the frequency of Urinary Tract infections (UTIs) amongst diabetics for a period of four years involving 1000 diabetic and non-diabetic urine specimens. Following standard laboratory protocols, they established 56.4% of patients from low socioeconomic class had UTIs in relation to 43.6% from the higher status. This indicated an alarming risk from those in the lower socioeconomic class.

Simkhada (2013) in his designed prevalence analysis of culture positive Urinary Tract infections in diabetic patients in Nepal using 100 diabetic patients established a 21% risk bacterial colonization. Bacterium colonization was highly prevalent in females as compared to males and those with prolonged duration with diabetes.

Thomsen (2004) in his study on Diabetes and Community-acquired Bacteremia: Risk and Prognosis in North Jutland County, Denmark. A total of 225 (17.1 %) diabetics had bacterium that was greatest in adults under 65 years and the risk appeared to be greater in diabetic females as opposed to males.

By investigating pervasiveness of wound colonization by Staphylococcus in 125 hospitalized patients from extremely poor Brazilian population, Almeida *et al.* (2014) found that 20% had *S. aureus* which was a high proportion. This implied prolonged healing and increased medication costs.

Based on the reviews done, it is evident that various studies on common bacterial colonization among diabetics have been conducted world over. However, the knowledge gap in these reviews is that, there are few studies on *S. aureus* colonization among diabetics and no studies on the economic burden of *S. aureus* colonization. Further, there is no documented study that has been conducted in Kenya with regard to financial strain that *S. aureus* colonization afflicts to diabetics with foot ulcers.

3.0 Methods and Materials

3.1 Study Design

A cross sectional design involving 80 diabetic patients at Vihiga County Referral Hospital, Vihiga County, Kenya for two and half months was employed. Given that the number of participants was too small, the study sample size comprised of all the 80 participants.

3.2 Data Collection and Analysis

Questionnaires were used to gather information on socio-demographic features of the participants and a laboratory form to investigate *S. aureus* colonization. Descriptive statistics were used to analyze the poverty profile and determinants of *S. aureus* colonization. Regression analysis determined the economic burden that *S. aureus* colonization had on DPFUs in Vihiga County, Kenya. Analysis was by use of SPSS version 20.

3.3 Laboratory Techniques

Pus discharge samples were obtained for *S. aureus* screening. Gram staining was conducted to determine the organism present with samples inoculated on Blood Agar (BA) plates incubated at 37°C for a day to 2 days. Secluded colonies were further investigated for the production of free coagulase enzymes based on the tube coagulase test as per the standard methods with *Staphylococcus aureus* ATCC 25923 acting as a control strain.

4.0 Findings

4.1 Demographics

4.1.1 Age

Table 4.1 results indicated that 12.5%, 21.3%, 23.8% and 42.5% of diabetic patients with foot ulcers were aged between 18-20 years, 30-44 years, 45-60 years and over 60 years respectively.

Table 4.1: Age

Years	Frequency	Percent (%)
18-20	10	12.5
30-44	17	21.3
45-60	19	23.8
over 60	34	42.5
Total	80	100.0

4.1.2 Gender

Table 4.2 results indicated that 50% and 50 % of diabetic patients with foot ulcers were male and female respectively.

Table 4.2: Gender

Gender	Frequency	Percent (%)
Male	40	50.0
Female	40	50.0
Total	80	100.0

4.1.3 Education

Table 4.3 results indicated that 2.5%, 65%, 22.5% and 10 % of diabetic patients with foot ulcers had no education at all, attained primary level education, secondary education and college education respectively. This implied that majority of diabetic patients with foot ulcers are primary school dropouts.

Table 4.3: Education

Level	Frequency	Percent (%)
None	2	2.5
Primary	52	65.0
Secondary	18	22.5
college/university	8	10.0
Total	80	100.0

4.1.4 Income

Table 4.4 results indicated that 62.5% and 37.5 % of diabetic patients with foot ulcers earn less than Sh. 5000 and between Sh. 5000 – Sh.25, 000 respectively. This implied that majority of diabetic patients with foot ulcers are poor and may be wallowing in abject poverty by living on less than \$1.25 a day as defined by World Bank.

Table 4.4: How much do you earn per month

Kenya Shillings	Frequency	Percent (%)
less than 5000	50	62.5
5000- 25000	30	37.5
Total	80	100.0

4.1.5 *S. aureus* Colonization

Results in Table 4.5 showed that approximately 53% of DPFUs in Vihiga County Kenya were colonized with *S.aureus*.

Table 4.5: *S.aureaus* Colonization

<i>S.aureaus</i> Colonization	Frequency	Percent (%)
Yes	42	52.5
No	6	7.5
no any bacterial colonization	32	40.0
Total	80	100.0

4.2 Poverty Profile

The first objective was to determine the poverty profile of diabetic patients with foot ulcers and infected with *S.aureus* in Vihiga County, Kenya by analyzing the income earned by the participant on a monthly basis. Table 4.6 results indicated that 22 out 42 (52.4%) diabetic patients with foot ulcers and infected with *S.aureus* in Vihiga County, Kenya earn less than Sh. 5000 while 20 out 42 (48 %) earn between Sh. 5000 – Sh.25, 000. This implied that majority of DPFUs and colonized with *S.aureus* are poor and may be living on less than \$1.25 on a daily basis.

Table 4.6: How much do you earn per month

		less than 5000	5000- 25000	Total
Infected with <i>S.aureaus</i>	Yes	22 (52.4%)	20 (47.6%)	42 (100%)
	No	6 (100.0%)	0 (0.0%)	6 (0.0%)
	no any bacterial colonization	22 (68.8%)	10 (31.2%)	32 (100.0%)
Total		50 (62.5%)	30 (37.5%)	80 (100.0%)

4.3 Economic Burden of *S.aureus* Colonization

The study established the economic burden of *S.aureus* colonization by examining its effect on income earned by the diabetic patients with foot ulcers. Age and education level were included in the model as intervening variables. Table 4.6 results indicated *S.aureus* colonization, age and education level explained 43.2% of the variation in monthly earnings of diabetic patients with foot ulcers. The model was also significant as denoted in the ANOVA Table 4.7 results. Finds as in Table 4.8 indicated that colonization with *S.aureus* and education level significantly influenced the income earned by the diabetic patient with foot ulcers.

Based on the second objective of determining the economic burden of *S.aureus* colonization on DPFUs in Vihiga County, Kenya, it was established that a percentage increase in colonization by *S.aureus* causes 0.12% decline in monthly income of a diabetic patient with foot ulcers.

Table 4.6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.657 ^a	.432	.410	.37425

a. Predictors: (Constant), what is your education level, Infected with *S.aureaus*, Age in years

Table 4.7: ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	8.105	3	2.702	19.288	.000 ^b
Residual	10.645	76	.140		
Total	18.750	79			

a. Dependent Variable: how much do you earn per month

b. Predictors: (Constant), what is your education level, Infected with *S.aureaus*, Age in years

Table 4.8: Regression Analysis

Model	Coefficients		T	Sig.
	Beta	Std. Error		
(Constant)	.631	.301	2.095	.040
Age in years	-.028	.055	-.502	.617
Infected with <i>S.aureus</i>	-.120*	.052	-2.308	.037
what is your education level	.438*	.060	7.316	.000

a. Dependent Variable: how much do you earn per month

5.0 Conclusions

The study concluded that;

- i. Most of DPFUs and infected with *S.aureus* in Vihiga County, Kenya are poor and may be living on less than \$ 1.25 daily.
- ii. *S.aureus* colonization has a negative effect on the monthly earnings of DPFUs.

6.0 Recommendations

The study recommends that;

- i. County government of Vihiga in partnership with the national government of Kenya through the local administration to enroll the diabetic patients with foot ulcers in the transfer payments program since majority of them lie in the age bracket of over 60 years. This will enable them to be in a position to acquire some basic necessities hence reducing their poverty profile.
- ii. The DPFUs to be sensitized on the importance of wound management that may reduce bacterial colonizations given that majority have attained the basic primary education. This may cut down on the costs incurred for treating the infected wounds.

7.0 Declarations

7.1 Ethics approval and consent to participate

Approval to conduct the study was provided by Maseno University Ethical Review Committee and permission from Vihiga County Referral Hospital administration through the Chief Officer of Health in the County. Written informed assent was gotten from each participant before enrollment. Free education on diabetes was also provided to the participants with assurance on the confidentiality of their responses given and study results.

7.2 Acknowledgements

We are grateful to Vihiga County referral hospital administration for giving us an opportunity to conduct a study in the hospital.

References

- Almeida, G. C., Santos, M. D., Lima, N. G., Cidral, T. A., Melo, M. C., & Lima, K. C. (2014). Prevalence and factors associated with wound colonization by staphylococcus aureus in hospitalized patients in inland northeastern Brazil: A cross-sectional study. *BioMed Central Infectious Diseases* , 14, 1-8.
- Danquah, I., Bedu-Addo, G., & Mockenhaupt, F. P. (2010). Type 2 diabetes mellitus and increased risk for malaria colonization. *Journal of Emerging Infectious Diseases* , 16 (10), 1601-1604.
- El-busaidy, H., Dawood, M., Kasay, A., Mwamlole, C., Koraya, N., & Parpia, H. (2014). How serious is the impact of type II diabetes in rural Kenya? *The Open Diabetes Journal* , 7 (1), 1-4.
- Gracia, D., & Dunavan, C. P. (2005). Diabetics at an increased risk for tetanus colonization. *Migrant Clinicians Network Streamline* , 11 (4), 1-8.
- Hall, V., Thomsen, R. W., Henriksen, O., & Lohse, N. (2011). Diabetes in sub-saharan africa 1999-2011: Epidemiology and public health implicatio, a systematic review. *Biomed Central public Health* , 11 (564), 1-12.
- Iversen, M. M. (2009). *An epidemiologic study of diabetes-related foot ulcers (unpublished master's thesis)*. Norway: University of Bergen.
- Mathangi, T., Prabhakaran, P., Rayappan, F., & Tilton, F. (2013). Isolation, molecular characterization and antibiogram of bacteria isolated from diabetic foot ulcers. *International Journal of Current Research and Academic Review* , 1 (1), 17-25.
- Moazezi, Z., Hosseinian, A., Moazam, E. A., Eslami, M., Mosavi, E., Akhavan-Niaki, H., et al. (2014). Evaluation of immunological parameters in diabetic patients: Are these patients immunodeficient. *Iran Journal of Allergy and Asthma Immunol* , 3 (2), 110-119.
- Oh, M. L., & Tan, S. Y. (2013). Prevalence and risk factor analysis for meticillin resistant staphylococcus aureus colonization in an acute care hospital. *Antimicrobial Resistance and Colonization Control* , 2 (1), 54-59.
- Peter, V., & Chin-Hong, N. D. (2006). Colonizations in patients with diabetes mellitus: Importance of early recognition, treatment and prevention. *Johns Hopkins Advanced Studies in Medicine* , 6 (2), 71-81.
- Saleem, M., & Daniel, B. (2011). Prevalence of urinary tract colonization among patients with diabetes in Bangolere city. *International Journal of Emerging Sciences* , 1 (2), 133-142.
- Simkhada, R. (2013). Urinary tract Colonization and antibiotic sensitivity pattern among diabetics . *Nepal Medical College Journal* , 15 (1), 1-4.

Thomsen, R. W. (2004). *Diabetes mellitus and community- acquired bacteremia: Risk and prognosis (Unpublished doctoral thesis)*. Denmark: University of Aarhus.

© GSJ