Modelling Outpatients Cost of Wound Dressing in Nigeria: A Prospective Study

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Research article

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Abstract

Background: Estimating the direct cost of wound dressing poses a challenge to patients, nurse managers, hospital administrators, health maintenance organisations and other policy makers. This study therefore model the weekly cost of wound dressing in South West Nigeria

Methods: A descriptive cross sectional research design was utilized to assess the cost of wound dressing among outpatients' clinics attendees. An inventory of direct cost of wound dressing per week consisting of cost of materials, lotion and consumables were recorded. The data collection was for period of three months in three selected Teaching Hospitals South West Nigeria. Then modelling weekly cost of wound types was done by regression analysis. The effect of various independent variables such as age, occupation, family size, monthly income, aetiology, diagnosis, wound type, comorbidities, frequency of wound dressing and health insurance coverage on cost of wound dressing per week was considered. Ethical approval was obtained from each of the hospital and Covid-19 precautions were observed.1 USD equalled ₦570

Results: The estimated cost of wound dressing per week with no contribution from other variables was found to be ₦36,922- Open wound, ₦6011-Leg ulcer, ₦3768- Cancer wound, ₦2785- Diabetic Foot Ulcer, ₦610-Surgical wound. Only frequency of wound dressing was found to contribute to weekly cost of leg ulcers (P value= 0.003)

Conclusions: The estimated cost of various type of wound provides yardstick for determining the weekly cost of wound dressing in Nigeria. Also, frequency of wound dressing is a major determinant of the outpatient cost of dressing. Therefore, it is imperative for nurses to render high quality wound care to match up with the huge financial commitment from patients and families

Introduction

Wound dressing is an integral part of wound care protocol and it is known to consume huge healthcare resources [1, 2]. The geometric rise in the cost of wound care has received the attention of many wound care researchers [1, 3–6]. However, the gap in most studies is how to determine the cost implications for successful wound dressing. Critically, wound dressing cost allocation poses challenge in terms of wound aetiology, diagnosis, wound type, choice of dressing materials and frequency of wound dressing [2]

One suggestion is to compute the cost of wound dressing in relation to each wound type. Studies which model the weekly cost expectation of wound dressing are sparse. Healthcare policy formulation, care protocol and service charges are undermined due to inappropriate wound dressing accounting system. Often, cost of wound dressing are subsumed into surgical procedural bill[1, 2, 7], therefore, a nursing care friendly accounting system is require to estimate the cost required for successful wound dressing[7, 8]

According to Ogundeji et al [1], the cost of continual wound dressing alone constitutes fifty percent of the wound care cost. Furthermore, it is worth noting that, in most part of Africa, a prospective guideline for

wound dressing coverage and costing is lacking [1, 2, 7, 8]. It follows that wound dressing assessment and pricing is arbitrary. This significantly causes a hitch for health maintenance organisations, hospital administrators, nurse managers and other policy makers in the cohort. The authors are also concern with inordinate computation of wound dressing billing by hospital administrators and health personnel. Patients are likely to pay less or more.

From experience, cost of wound dressing is allocated as board and room rate irrespective of wound aetiology, diagnosis and type. A recent field report on wound dressing among outpatients' attendees in some Teaching Hospitals in Nigeria revealed that cost of wound dressing is a fixed price with great variations among the hospitals [8]. Furthermore, extant studies underlined that cost determination without consideration for patients' characteristics assumed that all patients use the same nursing resources [7–10]. Dyke, Wantland, Lipsitz & Saba [11] and Rutherford [10] posited that nursing care will become an important hospital generating unit if nurses can articulate a scientific costing model for various nursing skills.

Moreover, wound dressing requires much of nursing intensity and it is a major cost drive among surgical patients [1, 2, 12]. Following plethora of evidences surrounding the frequency and cost of wound dressing in Nigeria, the authors model the weekly cost of wound dressing among outpatients using a regression model. This is imperative to provide data for the basis of designing a wound dressing tariff in Nigeria Teaching Hospitals. The outcome will also foster policy making and operational guidelines on wound dressing in Nigeria and West Africa sub-Region

Material And Methods

Study design and settings

A descriptive cross sectional research design was followed to assess the cost of wound dressing among patients visiting the medical and surgical outpatients' clinics of the three selected tertiary hospitals in South West Nigeria. This was followed by regression model analysis to model the weekly cost of different type of wounds. The unit cost of varied type of wound was computed with consideration for dependent and independent variables. The influence of independent variables such as age, occupations, family size, monthly income, wound aetiology, diagnosis, wound type, comorbidities, frequency of wound dressing and enrolment into health insurance scheme on the cost of wound dressing per week (dependent variable) was considered. Furthermore, a mathematical model was included in the analysis for predicting the future cost of wound dressing in Nigeria.

The patients were asked to give an inventory of direct cost of wound dressing per week detailing the cost of dressing materials, lotion used and consumables excluding the professional charge. The cost estimation was recorded in Nigeria currency (Naira=₦), 1 USD equalled ₦570. The data was collected every week for a period of three months in three Nigerian Teaching Hospitals. The inclusion criteria were adult patients with wounds who are regular Outpatient' clinics visitors for a period not less than four

weeks. The drafted research proposal was reviewed and approved by the University of South Africa College of Human Science Ethical Committee with reference number 2020-CHS-90163346.

Ethical Clearance was also obtained from the Institutional Review Board (IRB) of the selected hospitals which include the National Orthopaedic Hospital Igbobi Lagos (OH/90/C/IX), the University College Hospital Ibadan (NHREC/05/01/2008a- 21/0047) and the Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife (ERC/2021/04/07). Also, verbal and written consent was received from each participant while ethical principles of anonymity, voluntariness and confidentiality were upheld. Furthermore, data collection was conducted during covid-19 pandemic, therefore, safety precautions as regards hand washing, physical distancing and face masking were strictly observed

Results And Discussion Of Findings:

Parameter estimates of cost of wound dressing

Table 1
Parameter estimates for cost of wound dressing per week (Open Wound)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	36921.878	52086.997		.709	.552
Occupation	-7670.526	5232.554	-.747	-1.466	.280
Family size	-1065.492	16232.721	-.051	-.066	.954
Monthly income	4317.082	13257.557	.246	.326	.776
Age	4967.273	5646.361	.737	.880	.472
Diagnosis	-4767.154	5114.874	-.912	-.932	.450
Comorbidities	-1584.307	19967.985	-.090	-.079	.944
Frequency of wound dressing per week	3373.723	14045.147	.213	.240	.833

Table 1 above shows the regression analysis result of the cost of dressing per week for an open wound per outpatient care episode. The variables such as occupation, family size, monthly income, age, diagnosis, comorbidities and frequency of wound dressing per week produced

-7670.526, -1065.492, 4317.082, 4967.273, -4767.154, -1584.307, 6100.242 and 3373.723 respectively. None is a significant variable with p-values greater than 0.05. This implies that none of these variables contribute most to the cost of an open wound per week. The mathematical model for the result above is written as follows:

*Cost of dressing per week for an open wound = 36921.878 -7670.526*occupation -1065.492* family size+ 4317.082* monthly income + 4967.273*Age - 4767.154* diagnosis -1584.307*comorbidities + 3373.723* frequency of wound dressing per week*

The estimated cost of an open wound dressing per week was ₦36921.88 with no contribution from other variables that affect the cost of wound dressing. Again, most variables that influence the cost of wound dressing do not practically affect the estimated cost of dressing per week for an open wound. The unit cost of an open wound applied to all irrespective of the age, diagnosis or comorbidities.

Table 2
Parameter estimates for cost of wound dressing per week (Surgical Wound)

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	609.488	3748.735		.163	.872
Occupation	1890.730	702.299	.389	2.692	.012
Family size	-1010.618	1509.371	-.099	-.670	.508
Monthly income	-784.333	700.106	-.148	-1.120	.272
Age	-148.512	521.801	-.039	-.285	.778
Diagnosis	-434.405	239.352	-.248	-1.815	.080
Comorbidities	1274.576	870.119	.195	1.465	.154
Frequency of wound dressing per week	1899.846	627.926	.433	3.026	.005

Table 2 above shows the regression analysis result of the cost of dressing per week for surgical wound care. The variables such as occupation, family size, monthly income, age, diagnosis, comorbidities and frequency of wound dressing per week produced 1890.730, -1010.618, -784.333, -148.512, -434.405, 1274.576 and 1899.846 respectively. None is a significant variable with p-values greater than 0.05. This implies that none contribute most to the cost of surgical wound dressing per week. The mathematical model for the result above is written as follows:

*Cost of dressing per care episode for a Surgical Wound = 609.488 + 1890.730*occupation*

-1010.618 family size -784.333* monthly income -148.512*Age -434.405* diagnosis +1274.576 * comorbidities +1899.846* frequency of wound dressing per week*

From regression modelling, the cost of wound dressing per week on an outpatient basis was estimated at ₦609.49 with no contribution from other variables such as age, occupation, family size, comorbidities,

frequency of wound dressing and health insurance scheme. Findings show that none of these wound related variables contribute to the cost of surgical wound dressing per week.

Table 3
Parameter estimates for cost of wound dressing per week (Leg Ulcer)

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	6010.831	5195.420		1.157	.254
Occupation	-527.772	734.055	-.104	-.719	.476
Family size	-1476.588	1634.041	-.126	-.904	.371
Monthly income	-2429.859	2045.162	-.172	-1.188	.241
Age	352.770	724.281	.068	.487	.629
Diagnosis	402.822	450.593	.122	.894	.376
Comorbidities	1920.166	1016.281	.259	1.889	.065
Frequency of wound dressing per week	2614.514	836.899	.422	3.124	.003

Table 3 above shows the regression analysis result of the cost of dressing per week for a leg ulcer. The variables such as occupation, family size, monthly income, age, diagnosis, comorbidities and frequency of wound dressing per week produced -527.772, -1476.588, -2429.859, 352.770, 402.822, 1920.166 and 2614.514 respectively. Frequency of wound dressing per week is the significant variable with p-values less than 0.05. This implies that this variable contribute most to the cost of leg ulcer care per episode. The mathematical model for the result above is written as follows:

Cost of dressing per week for a Leg Ulcer = 6010.831 - 527.772 occupation - 1476.588* family size -2429.859* monthly income + 352.770* Age + 402.822* diagnosis + 1920.166* comorbidities +2614.514* frequency of wound dressing per week*

The estimated cost of wound dressing per week for a leg ulcer was ₦6010.83 with no contribution from other variables. This cost can increase or reduce depending on the interaction with other variables that can affect the cost of wound dressing. Regression analysis shows that frequency of wound dressing had a positive relationship with cost of wound dressing for a leg ulcer and will increase the unit cost by ₦2614.51 per week. This finding is consistent with a study by Gray, Rhodes, Atkinson, Rothwell, Wilson, and Dumville [13] which associated high cost of wound dressing to repeated dressing changes.

Moreover, our estimate corroborates similar findings by Lotz [14] and Brain, Tulleners, Lee, Cheng, Graves, Pacella [15] that choice of wound dressing materials and the procurement cost are factors modulating the frequency and cost of wound dressing per week. Patients can make choice of traditional or modern

dressing materials. Typically, modern dressing materials are advocated to improve wound care and rate of recovery but with increased cost of procurement. This is also influenced by the exchange rate as modern dressing materials are imported from high income countries to Africa.

Again, the regression analysis also support the perspective by Builders & Oseni-Momodu[16] and Odhiambo, Omondi & Magak[17] that frequency of wound dressing means increase use of dressing materials per week with the associated cost. This finding particularly has implication for nurses' quality wound assessment and care. Interestingly, wound care nurses are conspicuously lacking across care settings in Nigeria. To the best of researchers' knowledge, there is no certification and licensure wound care training programme for nurses in Nigeria. This development was also reported by Ogundeji et al [1] and Ilesanmi & Ogundeji [2]. Currently in Nigeria and in most part of sub-Sahara Africa, wound dressing is left at the jurisdiction of all categories of nurses

Table 4
Parameter estimates for cost of wound dressing per week (Diabetic Foot Ulcer)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2785.000	8317.375		.335	.794
Occupation	-1442.500	2401.019	-.339	-.601	.656
Monthly income	-3265.000	3143.672	-.768	-1.039	.488
Frequency of wound dressing per week	3507.500	2401.019	1.065	1.461	.382

Table 4 above shows the regression analysis result of the cost of Diabetic Foot Ulcer wound care per week. The variables such as occupation, monthly income and frequency of wound dressing per week produced -1442.500, -3265.000 and 3507.500 respectively. None of the variables is the significant variable with p-values less greater 0.05. This implies that none of these variables contribute most to the cost of a Diabetic Foot Ulcer per week. The mathematical model for the result above is written as follows:

Cost of dressing per week for a Diabetic Foot Ulcer = 2785.000 - 1442.500 occupation*

- 3265.000 * monthly income + 3507.500* frequency of wound dressing per week

The cost of wound dressing for a diabetic foot ulcer per week was estimated at ₦2785.00 with no contribution from other variables. Most identified variables such as age, occupation, family size, comorbidities are not variables that contribute to the cost of wound dressing for a diabetic foot ulcer per week.

Table 5
Parameter estimates for cost of wound dressing per week (Cancer Wound)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-3768.135	7056.135		-.534	.608
Occupation	-2738.460	1532.075	-.237	-1.787	.112
Family size	1428.391	2271.517	.100	.629	.547
Monthly income	-310.757	987.121	-.051	-.315	.761
Age	-128.534	797.849	-.025	-.161	.876
Diagnosis	-313.285	314.402	-.133	-.996	.348
Comorbidities	345.799	835.369	.053	.414	.690
Frequency of wound dressing per week	6621.926	1248.143	.841	5.305	.001

Table 5 above shows the regression analysis result of the cost of a cancer wound care per week. The variables such as occupation, family size, monthly income, age, diagnosis, comorbidities and frequency of wound dressing per week produced -2738.460, 1428.391, -310.757, -128.534, -313.285, 345.799 and 6621.926 respectively. None of the variables is a significant variable with p-values greater than 0.05. This implies that none of these variables contribute most to the cost of cancer wound care per week. The mathematical model for the result above is written as follows:

Cost of dressing per week for a Cancer wound = -3768.135 -2738.460 occupation +1428.391* family size -310.757* monthly income -128.534*Age -313.285* diagnosis 345.799*comorbidities + 6621.926* frequency of wound dressing per week*

The estimated cost of wound dressing for a cancer wound per week was estimated at ₦3768.135 with no contribution from other variables. Regression analysis shows that variables such as age, occupation, family size, comorbidities, frequency of wound dressing and health insurance coverage have no relationship to the cost of dressing for a cancer wound.

Conclusion

The primary source of data from patients attending Outpatients clinics of typical Teaching Hospital South West Nigeria was computed to estimate the cost of weekly wound dressing using regression model analysis. Modelling the cost of wound dressing in imperative to provide data necessary for the design of healthcare tariff for costing wound dressing in Nigeria and West Africa sub region. The influence of independent variables such as age, aetiology, diagnosis, comorbidities as well as occupation, family size

and income, frequency of wound dressing and health insurance coverage were determined against the cost of wound dressing per week. Current evidence suggests that frequency of wound dressing is the only variable that contributed to the cost of wound dressing per week.

Declarations

Ethical Approval and Consent to participate

Ethical Clearance was granted by the Institutional Review Board (IRB) of the selected hospitals which include the National Orthopaedic Hospital Igbobi Lagos (OH/90/C/IX), the University College Hospital Ibadan (NHREC/05/01/2008a- 21/0047) and the Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife (ERC/2021/04/07) all in Nigeria. Verbal and written consent was received from each participant while ethical principles of anonymity, voluntariness and confidentiality were upheld.

Consent for publication

Not applicable

Availability of data and materials

Data was collected from medical and surgical outpatients, analyzed by statistical package for Social Sciences (SPSS). Modelling cost of various wound type was done by regression analysis

Competing interests

There are no competing interests

Funding

There is no funding for this study

Authors' contributions

KD and PR conceived the study. KD and GB source for study materials. KD analysed data and wrote the first draft of the manuscript.PR and GB review the manuscript for intellectual content and suitability for publication. The final version of the manuscript was read and approved by all authors

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