Direct medical expenditure of snakebite victims in Ghana

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# Abstract

# Introduction

Worldwide, snakebite victims are often the vulnerable poor rural folks1,2. Inequitable distribution of healthcare facilities and the lack of appropriate care exacerbates the plight of snakebite victims. An 125,000 to 500,000 cases of snakebites occur annualy in Africa even though most of them as thought to be undocumented3. An estimated 95,000 deaths occur annually globally from snakebites with only about 300,000 survivors4. The survivors are often left with permanent disabilities or disfigurement, and are often left stigmatized and destitute5. Life-threatening effects of snakebite envenoming include shock, spontaneous systemic bleeding, paralysis involving respiratory and skeletal muscles and can also lead to acute renal failure6. Amputations, disfigurement, mutilations, and tissue necrosis are common complications of snakebite envenoming.7,8 The high morbidity and mortality associated with the bites result in high socioeconomic consequences6.

Victims of snakebites require a range of services. The services may range from antivenom administration plus supplementary medical interventions such as cardio-respiratory and/or fluid resuscitation; airway intubation; mechanical ventilation; hemodialysis; wound debridement and reconstructive surgery; physiotherapy; and other rehabilitation services6. Unfortunately, these services are not usually available in primary care health settings (Community-based Health Services and Planning) in rural Ghana where a lot of the cases occur. In situations where they are available, they are not cheap. Snakebite victims therefore often start by going to traditional healers or use ineffective or unproven methods before seeking hospital care, resulting in delays in the administration of antivenoms which results in complications and possible mortality9,10.

The socioeconomic impact of snakebite is under-appreciated around the world, even though the impact transcends individuals and families into communities and the health system11. It is estimated the burden to some families to be as much as their 12-year salary.12 The average cost for an effective treatment, based on recommended doses to be USD 124 in Sub-Saharan Africa,13 4 times the minimum monthly wage in Ghana then**Africapay.org?**. In The Sri Lanka, 79% of snakebite victims suffered an economic loss following a snakebite with a median Out of Pocket Payments(OOP) of USD 11 and a median estimated loss of income of USD 28.57 and USD 33.21 for those in employment or self-employment, respectively2. The total estimated OOP in the country was USD 1,981,6992. Additionally, family members also lost income to help care for patients. In India, 53.5% of snakebite victims spent 1 to 6 months or more at home after the bite, 43.5% of the victims had to sell an asset due to snakebites, with the majority having to sell their farm crops. Four of the victims had to forfeit their education because of the bite, an unfortunate incident that must not happen. The annual estimated total number of DALYs was 11,101 to 15,076 per year for envenoming following snakebite12.

The health system cost for The Sri Lanka was estimated to be USD 10,260,652 annually2. Using the conservative estimate from,13 then multiplying by the average yearly incidence in Ghana (9600), as said by Dr. Amuasi John; Executive Director of the African Research Network for Neglected Tropical Diseases (ARNTD) medicine in Ghana after his preliminary analysis from the District Health Information System (DHIMS) Databases, reported by in Daily Graphic Online,14 it can be estimated that the government of Ghana spend an average of USD 1,190,400 on antivenoms since they are free in Ghana.

To the best of our knowledge, no studies exist in sub-Saharan Africa which reports the financial cost experienced by snakebite victims. The study, therefore, reports the direct financial cost experienced by snakebite victims in rural Ghana.

# Methods

## Ethical statement

This study has ethical approval from the Ghana Health Service. The reference number for it is GHS-ERC010/03/20. It is part of the Snakebite Incidence Treatment and Effect in Ghana (SnakebITE) project being run by the author[]. Permission was also sought from the administration of the hospital to extract records from their electronic health records (EHR). The financial cost of snakebite victims Data were extracted from the electronic health records database of the hospital. The hospital has used the system since 2015. Author[] can script in Transactional-Structured Query Language (T-SQL) and used his knowledge to extract the records from the database. A total of 1436 were retrieved from the database.

Statistical analysis was done with R (4.1.0). Frequencies and percentages were recorded for the count variables. The median cost with interquartile range was reported for the cost of care. A regression model was fitted to estimate the predictors of cost at the hospital

# Results and analysis

Table : Demographic characteristics of snakebite victims extracted from EHR

| Characteristic | N = 1,4361 |
| --- | --- |
| Age | 24 (16, 36) |
| Gender |  |
| Female | 497 (35%) |
| Male | 939 (65%) |
| NHIS | 791 (55%) |
| Occupation |  |
| Farmer | 628 (44%) |
| Student | 275 (19%) |
| Others | 112 (7.8%) |
| Unknown | 421 (29%) |
| 1Median (IQR); n (%) | |

We report cases of snakebites reported at public hospital from 2016 to 2019 (Table ). A total of 1436 were retrieved from the EHR. Most of the snakebite victims were males 939 (65%). The median age of the victims was 24 (16, 36) The primary occupation indicated in the EHR of the victims was farming accounting for 628 (44%) of all the victims. A total of 275 (19%) were students. For 421 (29%) of the victims, their primary occupation was not indicated in the EHR.

## Direct cost of snakebite treatment

Table : Summary of payments by snakebite victims

|  | Total | Summary |
| --- | --- | --- |
| Characteristic | N = 1,4361 | N = 1,4362 |
| Investigations | 36,308(199) | 18 (8, 36) |
| Consultation | 20,111.5(77.5) | 17.0 (7.0, 20.0) |
| Drugs | 200,020(1,952) | 21 (7, 93) |
| Admission | 58,225(500) | 50 (0, 75) |
| Procedures | 15,276(771) | 0 (0, 0) |
| Services | 45,711(1,362) | 0 (0, 19) |
| Total Payment | 375,652(2,225) | 139 (65, 334) |
| 1sum(Maximum) | | |
| 2Median (IQR) | | |

Total direct expenditure on healthcare by snakebite victims was Sum(max) = 375,652(2,225), Median(IQR) =[139 (65, 334)] from 2016 to 2019 (Table ). An amount of Sum(max) = 200,020(1,952), Median(IQR) =[21 (7, 93)] had been spent by patients on drugs alone representing 53.2% of total direct expenditure during the period between 2016 and 2019. The next highest direct cost to patients was admission cost Sum(max) = 58,225(500), Median(IQR) =[50 (0, 75)] accounting for 15.5% of all expenditure.

### Expenditure by health insurance status

Table : Table 3: Direct expenditure on healthcare following snakebites

| Characteristic | No, N = 6451 | Yes, N = 7911 | p-value2 |
| --- | --- | --- | --- |
| Investigations | 5,209 | 4,867 | <0.001 |
| Unknown | 136 | 172 |  |
| Consultation | 19,914 | 16,395 | <0.001 |
| Drugs | 11,868.5 | 8,243.0 | <0.001 |
| Admission | 32,224 | 167,796 | >0.9 |
| Procedures | 39,255 | 18,970 | <0.001 |
| Services | 8,918 | 6,358 | 0.006 |
| Total Payment | 1,409 | 44,302 | <0.001 |
| 1sum | | | |
| 2Wilcoxon rank sum test | | | |

Table 2: Expenditure on snakebite victims at BMC. C% = column percentage, R% = row percentage For the period under review, a total of GHS 206,636.86 was expended on the treatment of snakebite victims. Expenditure on drugs constituted the largest, 56.49% (GHS116,728.18) of the total expenditure. The cost of services, including consultation and admission charges, was 25.57% (GHS 52,833.11) of the total expenditure. Finally, 17.94% (GHC 37,075.57) was spent on investigative/diagnostic procedures like blood clotting and full blood counts and X-rays. 56.46% (65,900.00) of the expenditure on drugs was through OOP, compared to 43.54%(GHS 50,828) that were NHIS claims. 90.49% (GHS 47808) of the total expenditure on services including consultation fees were paid for through OOP. Given there was the same number of victims with NHIS as those with not, it begs the question of how that arises. Discussions NHIS claims The total NHIS claims due to snakebites from 2016 to 2019 was GHS 74,107.46 accounting for 35.86% of all expenditure. 68.59% (GHS 50,828.00) of the NHIS claims was on drugs. The rests were services 6.78% (GHS 5, 025.00) and investigations 24.63% (GHS 18, 254.00). Out of pocket expenditure Total OOP by snakebite victims from 2016 to 2019 at the hospital was 64.14% (GHS 132,529.40) of the total expenditure as indicated in table 2. Drugs accounted for 49.73% (GHS 65,900.33) of the total OOP. Total payments due to services were 36.1% (GHS 47,807.00) and 14.2% (GHS 18,821) was paid for by clients for investigations. OOP by NHIS clients NHIS clients were not spared OOP expenditure. Total OOP by NHIS clients was 45,686.28 of which 90.54% was spent on drugs, the remaining being spent on investigations. Total expenditure Adding the OOP by NHIS clients to the total payments including claims bring the total expenditure to GHC 252,323.28.   Patient-level payments OOP by NHIS clients NHIS Drugs Investigations Services Cash & Carry 24.2(65.57) 21(30) 70(75) NHIS 18.65(106.58) 12.84(44.96) 7(5) Table 3: summary statistics of patient payments The median(IQR) NHIS potential reimbursement for drugs for the period was GHS 18.65(106.58). The median(IQR) OOP wasGHS 24.2(65.57), about 6 points higher for NHIS clients. The median cost of investigations was 12.84(44.96) which was about twice as low for OOP clients (Median(IQR) = 21(30). Payments for services was very different between the two groups. OOP clients paid 10 times more for services than NHIS clients. We have demonstrated that the cost of care for snakebite victims in a rural setting in Sub-Saharan Africa, the first of its kind in Sub-Saharan Africa to the best of our knowledge. Most victims of snakebites are males farmers and potentially low-income earners. The victims are mostly between the ages of 10 to 50 years. NHIS coverage is extrapolated to be low in the district given only 50% of the patients had medical insurance at the time they reported to the hospital with a case of snakebite. A total of GHS 206,636.86 was spent on snakebite victims from 2016 to 2019. The median cost for OOP clients was 137(152) compared to 20.4(64.1) for NHIS clients. The majority of the victims were Muslims, accounting for 63.05% (n=691) of all cases. This is not surprising as the majority of the population are Muslims. Hard to miss is the difference in median(IQR) payments for investigations and services for NHIS and OOP clients, 21(30) vs 12.84(44.96), and 70(75) vs 7(5), respectively. Could it be there is a systemic over-prescription of services and investigations for OOP clients or there is an under prescription for NHIS clients? It is our position that the differences of 2 and 10 times for investigations and services respectively deserve a study on its own. Recommendations It is important NHIS is expanded to cover poor people in rural areas through social schemes included subsidies. Additional research needs to be conducted to establish the full economic cost to clients following an episode of snakebite.

## Tables

### Table 1

Table : caption 1

| mpg | cyl | disp | hp | drat | wt | qsec | vs | am | gear | carb |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 21.0 | 6 | 160 | 110 | 3.90 | 2.620 | 16.46 | 0 | 1 | 4 | 4 |
| 21.0 | 6 | 160 | 110 | 3.90 | 2.875 | 17.02 | 0 | 1 | 4 | 4 |
| 22.8 | 4 | 108 | 93 | 3.85 | 2.320 | 18.61 | 1 | 1 | 4 | 1 |
| 21.4 | 6 | 258 | 110 | 3.08 | 3.215 | 19.44 | 1 | 0 | 3 | 1 |
| 18.7 | 8 | 360 | 175 | 3.15 | 3.440 | 17.02 | 0 | 0 | 3 | 2 |
| 18.1 | 6 | 225 | 105 | 2.76 | 3.460 | 20.22 | 1 | 0 | 3 | 1 |

### Table 2

Table : iris

| Sepal.Length | Sepal.Width | Petal.Length | Petal.Width | Species |
| --- | --- | --- | --- | --- |
| 5.1 | 3.5 | 1.4 | 0.2 | setosa |
| 4.9 | 3.0 | 1.4 | 0.2 | setosa |
| 4.7 | 3.2 | 1.3 | 0.2 | setosa |
| 4.6 | 3.1 | 1.5 | 0.2 | setosa |
| 5.0 | 3.6 | 1.4 | 0.2 | setosa |
| 5.4 | 3.9 | 1.7 | 0.4 | setosa |

### Table 3

Table : cars

| speed | dist |
| --- | --- |
| 4 | 2 |
| 4 | 10 |
| 7 | 4 |
| 7 | 22 |
| 8 | 16 |
| 9 | 10 |

## figures

### A boxplot



Figure : A boxplot

### A barplot



Figure : What a barplot

## Lists

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   2. Urna sed dui, ornare, eu turpis mus pellentesque amet amet bibendum.
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* In porttitor id lorem eu efficitur, nisl dis!

see figure

and table !

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