Out of pocket expenditure by 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 exacerbate the plight of snakebite victims. An estimated 125,000 to 500,000 cases of snakebites occur annually in Africa even though most of them are thought to be undocumented3. About 95,000 deaths occur globally annually 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 envenoming7,8. The high morbidity and mortality associated with the bites result in high socioeconomic consequences6 for individuals and families.

Victims of snakebites require a range of services, from antivenom administration to 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 impacts transcend individuals and families into communities and the health systems11. It is estimated the burden to some families to be as much as their 12-year salary12. The average cost for an effective treatment, based on recommended doses to be USD 124 in Sub-Saharan Africa13, 4 times the minimum monthly wage in Ghana then**Africapay.org?**. In 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 Sri Lanka is estimated to be USD 10,260,652 annually2. Using the conservative estimate from13, then multiplying by the average yearly incidence in Ghana (9600)14, it can be estimated that the government of Ghana spends 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 report the OOP experienced by snakebite victims. The study, therefore, reports the direct OOP by snakebite victims in rural Ghana.

# Methods

## Ethics 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).

## Data extraction

The OOP by 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 extracted the records from the database. A total of 1391 were retrieved from the database.

Currency conversion was done with data from15. The average rate was taken from the website and used to compute the OOP for each year respectively.

## Data analysis

Statistical analysis was done with R (4.1.2). Frequencies and percentages were recorded for the count variables. The median cost with interquartile range was reported for the cost of care and length of stay. A regression model was fitted to estimate the predictors of cost and length of stay at the hospital.

# Results and analysis

We report cases of snakebites reported in a public hospital from 2016 to 2019 (Table ). A total of 1,391 records were retrieved from the EHR. The median (IQR) age of the victims was 20 (13, 33). Most [907 (65%)] of the snakebite victims were males, and a lot of the cases were reported in 2018 405 (29%) than other years. The primary occupation of most of the victims was farming 604 (43%), 256 (18%) were students, 63 (4.5%) engaged in other occupations. The primary occupation of 410 (29%) of the victims were not indicted in the EHR. A total of 892 (64%) were reported in the harmattan season and 519 (37%) was recorded during periods where there was rather little farming activity and mainly irrigation farming and hunting. Most of the victims [1,371 (99%)] were treated successfully at the hospital and were discharged. The median (IQR) length of stay of the victims at the hospital was 3.00 (2.00, 4.00).

**Table** : Demographic characteristics of snakebite victims extracted from EHR

| Characteristic | N = 1,3911 |
| --- | --- |
| Age | 20 (13, 33) |
| Gender |  |
| Female | 484 (35%) |
| Male | 907 (65%) |
| Year |  |
| 2016 | 311 (22%) |
| 2017 | 344 (25%) |
| 2018 | 405 (29%) |
| 2019 | 331 (24%) |
| Season |  |
| Dry | 892 (64%) |
| Rainy | 499 (36%) |
| NHIS |  |
| No | 624 (45%) |
| Yes | 767 (55%) |
| Occupation |  |
| Farmer | 604 (43%) |
| House Wife | 42 (3.0%) |
| Student | 256 (18%) |
| Trader | 16 (1.2%) |
| Unknown | 410 (29%) |
| Other | 63 (4.5%) |
| Activity related to farming |  |
| Harvesting | 195 (14%) |
| Irrigation/hunting | 519 (37%) |
| Land preparation | 297 (21%) |
| Farming | 380 (27%) |
| Outcome |  |
| Died | 16 (1.2%) |
| Successful treatment | 1,371 (99%) |
| Transferred out | 4 (0.3%) |
| Length of stay | 3.00 (2.00, 4.00) |
| Unknown | 286 |
| 1Median (IQR); n (%) | |

## OOP for snakebite care at the hospital

The total OOP from 2016 to 2019 at the hospital was USD 61,224 (Table ) of which USD 12,274 were payments made by victims that had an insurance cover (presumed to be the Nation Health Insurance Service [NHIS]) at the time of admissions and 48,949 were paid by victims without insurance cover. The median amount paid by NHIS clients was USD 7 (4, 17) compared to a median (IQR) of USD 34 (22, 74) by non-insured clients. The total OOP by males was USD 41,674 compared to USD 19,550 among females. The median (IQR) OOP between gender was relatively similar even though it was higher in males [USD 29 (10, 62)] compared to females [USD 23 (7, 50)]. When the insurance cover of the victims was taken into account, uninsured victims paid over 4 times as much as those with insurance paid, with very little differences between males and females. From 2016 to 2018, there was a steady increase in the total OOP for snakebite victims at the hospital. However, the total OOP almost tripled, from USD 10,720 to USD 29,903. In response, the median (IQR) increased by about a factor of 4 from USD 22 (9, 32) in 2018 to USD 97 (22, 119) in 2019. The situation was much more dire for non-insured clients when the median(IQR) increased from USD 27 (18, 38) in 2018 to USD 103 (84, 124) in 2019. The insured clients were not spared the surge, paying a median(IQR) of USD 7 (5, 10) in 2018 to USD 92 (6, 103).

For a successful treatment, victims without insurance cover paid a median(IQR) of USD 34 (22, 72) compared to USD 7 (4, 17) who had insurance cover. It must be noted that, only 2 patients with an insurance cover died.

**Table** : Summary of OOP experienced by snakebite victims

|  | Total | Median(IQR) | Breakdown | |
| --- | --- | --- | --- | --- |
| Characteristic | N = 1,3911 | N = 1,3912 | Cash & Carry, N = 9352 | NHIS, N = 4562 |
| Payment mode |  |  |  |  |
| Cash & Carry | 48,949 | 34 (22, 74) |  |  |
| NHIS | 12,274 | 7 (4, 17) |  |  |
| Gender |  |  |  |  |
| Female | 19,550 | 23 (7, 50) | 32 (19, 74) | 7 (4, 17) |
| Male | 41,674 | 29 (10, 62) | 35 (22, 73) | 7 (4, 19) |
| Year |  |  |  |  |
| 2016 | 9,919 | 25 (5, 40) | 33 (23, 47) | 4 (2, 6) |
| 2017 | 10,682 | 23 (10, 40) | 34 (23, 49) | 10 (4, 14) |
| 2018 | 10,720 | 22 (9, 32) | 27 (18, 38) | 7 (5, 10) |
| 2019 | 29,903 | 97 (22, 119) | 103 (84, 124) | 92 (6, 103) |
| Season |  |  |  |  |
| Dry | 38,040 | 27 (9, 57) | 34 (22, 74) | 7 (4, 16) |
| Rainy | 23,184 | 27 (9, 65) | 33 (21, 72) | 8 (4, 28) |
| Activity related to farming |  |  |  |  |
| Harvesting | 10,571 | 29 (11, 95) | 35 (21, 106) | 8 (4, 44) |
| Irrigation/hunting | 22,227 | 29 (11, 59) | 36 (24, 75) | 8 (4, 18) |
| Land preparation | 12,503 | 24 (7, 51) | 34 (19, 69) | 6 (3, 13) |
| Farming | 15,922 | 24 (8, 49) | 31 (20, 53) | 7 (3, 17) |
| Outcome |  |  |  |  |
| Died | 1,252 | 62 (18, 87) | 62 (24, 86) | 180 (97, 264) |
| Successful treatment | 59,887 | 27 (9, 59) | 34 (22, 72) | 7 (4, 17) |
| Transferred out | 85 | 21 (1, 41) | 41 (41, 42) | 1 (0, 1) |
| 1Payment: Sum | | | | |
| 2Payment: Median (IQR) | | | | |

### OOP by services received

OOP on accounts of drugs purchases were USD 34,974.08 accounting for 57% of all OOP with a median(IQR)= 4.4(1.46 - 18.81) (Table ). This was followed by the provision of other services accounting for 36%, [Median(IQR) = 11.6(3.68 - 21.81)]. Such services included ward admissions, wound dressing, x-rays, etc. Lastly, USD 4,034.19 were OOP for consultation amounting to 7% [Median(IQR) = 3.3(1.54 - 4.14)].

**Table** : OOP by services received

| item | Cost | Median | IQR | Percent |
| --- | --- | --- | --- | --- |
| Consultation | 4,034.19 | 3.3 | 1.54 - 4.14 | 7% |
| Drugs | 34,974.08 | 4.4 | 1.46 - 18.81 | 57% |
| Services | 22,426.37 | 11.6 | 3.68 - 21.81 | 36% |

### Payments by mode of Insurance status

As indicated earlier, the total OOP at the hospital was USD 61,224, of which 48,949 were by victims without insurance cover at the time of admission. The median(IQR) was 33.9 (21.9, 74.2) and 7.2 (3.6, 17.2) for clients without insurance and those with the NHIS respectively. The median difference was statistically very significant. Victims without a health insurance cover paid a total of USD 3,524 for consultation compared to USD 510 among victims with the NHIS. bringing it to a total of 4,034. The median payment for consultation for victims without insurance cover at the time of admission was 3.7 (3.3, 4.1) compared to a median(IQR) of 1.2 (0.4, 1.5) among victims with insurance cover. The difference in medians again was statistically significant. Through the hospitals exemptions policy, and amount of USD 140 was exempted from patients with a health insurance cover but only USD 71 was exempted from those without an insurance. The median exempted amount was statistically different between those with insurance cover and those without insurance. Table details the breakdown of payments from drugs and other services at the hospital.

**Table** : Summary of payments by snakebite victims

|  | Total | | | Summary | | |
| --- | --- | --- | --- | --- | --- | --- |
| Characteristic | Cash & Carry, N = 9351 | NHIS, N = 4561 | Total1 | Cash & Carry, N = 9352 | NHIS, N = 4562 | p-value3 |
| Payment | 48,949 | 12,274 | 61,224 | 33.9 (21.9, 74.2) | 7.2 (3.6, 17.2) | <0.001 |
| Consultation | 3,524 | 510 | 4,034 | 3.7 (3.3, 4.1) | 1.2 (0.4, 1.5) | <0.001 |
| Drugs | 25,435 | 9,539 | 34,974 | 6.6 (2.6, 26.5) | 2.0 (0.1, 4.5) | <0.001 |
| Other Services | 20,062 | 2,365 | 22,426 | 17.2 (9.8, 26.5) | 3.5 (0.9, 6.8) | <0.001 |
| Exemptions | 71 | 140 | 211 | 0.0 (0.0, 0.0) | 0.0 (0.0, 0.0) | <0.001 |
| 1Sum | | | | | | |
| 2Median (IQR) | | | | | | |
| 3Wilcoxon rank sum test | | | | | | |

## Discussions

The object of the study was to describe the OOP experienced by victims of snakebites visiting a rural hospital in Ghana using the records available in the Electronic Health Records (EHR) of the hospital from 2016 to 2019. To the best of our knowledge, this is the first of its kind in Ghana and Sub-Saharan Africa. With a total of 1391 records retrieved, the total expenditure of the snakebite victims was 61,224. The victims were mostly males and younger.

Snakebite victims in rural Ghana experience a significant OOP irrespective of their health insurance , the most of which is through payment of drugs.

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| Characteristic | N = 4,1731 |
| --- | --- |
| Item |  |
| Consultation | 4,034.2, 3.3 (1.5, 4.1) |
| Drugs | 34,974.1, 4.4 (1.5, 18.8) |
| Services | 22,426.4, 11.6 (3.7, 21.8) |
| 1cost: Sum, Median (IQR) | |

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