Catastrophic Health Expenditure and Impoverishment Amongst Hepatitis B Patients in a Resource-Poor Setting

Abstract

Introduction
The economic burden of managing hepatitis B has become a concern because viral hepatitis disease is a global public health problem that resulted in more deaths in 2016 than HIV and AIDs, Tuberculosis and Malaria individually. This study aimed at estimating the catastrophic health expenditure associated with managing hepatitis B, the predictors of the same and the impoverishing effect that management of hepatitis B has on affected households.

Methods
A facility-based cross-sectional survey involving 135 hepatitis B patients selected through a two-stage sampling. Data was collected using a structured interviewer administered questionnaire and analyzed using SPSS version 25.

Results
The average age of the respondents is 41, 60% male, 40% female. About71% were married, and nearly two-thirds had tertiary education. Most (90.9%) paid for treatment out-of-pocket, only 7.6% had health insurance, and 1.5% were employer-covered. 71.1% of households spent over 10% of total expenditure on hepatitis B treatment, leading to financial catastrophe. Prevalence of Catastrophic health expenditure (CHE) was 71.1%, with a 20% overshoot and a mean positive overshoot of 28.1%. Being employed was protective against CHE. (OR=0.71; 95%CI=1.12 – 1.97)

Post-treatment, 25.2% fell into poverty, and 21.5% into extreme poverty.

Conclusion
Majority of hepatitis B patients pay out-of-pocket for healthcare. A major proportion of them are in financial catastrophe as a result of paying for treatment. The heavy reliance on out-of-pocket payment exposes the households of hepatitis B patients to catastrophic health expenditureand treatment of the condition impoverishes the affected households.

Key word:medical cost, Health Expenditure, health Scheme, Health Insurance

Introduction
"Economic burden in medicine is a term used to describe the problems patients encounter in relation to the cost of medical care and it is often expressed in terms of cost of illness, catastrophic health expenditure and impoverishment".[1] "The World Health Report on health systems financing states that globally, up to 150 million people suffer financial catastrophe annually while 100 million are impoverished as a result of payment for healthcare".[2] "According to the International LabourOrganisation (ILO), only one in five persons in the world has some form of broad-based social security protection that also covers for lost wages in the event of illness, and more than half of the world's population lack any form of formal social protection".[3] "The figures are even lower in Sub Saharan Africa and South-East Asia where only between 5

and 10% of people are covered. The vast majority of the people are left to suffer financial catastrophe and impoverishment as a result of payment for healthcare".[3]

"Catastrophic health expenditure occurs when payment for healthcare threatens a household's capacity to maintain a daily living".[4] "The World Health Organization has proposed that health expenditure is said to be catastrophic when it equals or exceeds 40% of non-subsistence income".[4] "Non-subsistence income being income available after the basic needs of the household has been met. Some other researchers have proposed that household expenditure be considered catastrophic when it equals or exceeds 10% of total expenditure. These figures are not absolute as countries may choose to use higher or lower figures in planning their health policy".[4]
"Impoverishment, on the other hand, is said to have occurred when the average household consumption after health care payment is below the pre-specified international or national poverty line. When a non-poor household pays for healthcare and subsequently becomes poor as a result of health spending, that household is said to have been impoverished by health spending".[5,6]

"The financial burden of managing hepatitis B has become a concern due the fact that viral hepatitis disease is a global public health problem that resulted in the death of more people in 2016 than HIV and AIDS, tuberculosis and malaria individually".[7] "Viral hepatitis was responsible for about 1.35 million deaths in 2015, a figure that is comparable to deaths from tuberculosis and higher than deaths from HIV".[8] "Approximately 47% of the deaths from hepatitis are attributable to hepatitis B virus and 48% to hepatitis C virus while hepatitis A and E viruses are responsible for the rest".[9] Globally, approximately 240 million people are living with chronic hepatitis B virus infection.

"Hepatitis B virus disease is reported to be responsible for almost half of all deaths from viral hepatitis globally".[10] It also accounts for half of all deaths from liver cancer and a third of all deaths from liver cirrhosis,[10] yet it was completely neglected in the Millennium Development Goals. "Before 2008, none of the 8000 WHO employees had viral hepatitis as part of their job title(no desk officer assigned to the control of hepatitis) and there were no non-governmental organizations that focused on people living with viral hepatitis throughout the world but thanks to evidence-based advocacy, viral hepatitis has now been named alongside HIV and AIDS, tuberculosis and malaria in the sustainable development goal target 3.3".[10]
"Reports from a study in Shandong China estimated the direct cost of managing hepatitis B related diseases at a whopping $7,218 per patient per year. This figure is over 40% of the disposable household income of the sampled population, making it a catastrophic expenditure for the sampled households".[11]

Treatment of hepatitis B related diseases like symptomatic acute hepatitis B disease, chronic hepatitis B, liver cirrhosis and liver cancer have been demonstrated to have catastrophic financial consequences on sufferers and their families in China and some other parts of the world.[11] But no studies have been done to estimate how much hepatitis B patients spend on their management in a year in Port Harcourt, Rivers State, Nigeria. Furthermore, the burden on them and their families have not been quantified. Findings from this study will attempt to bridge that gap

The Rivers State Ministry of Health reported in 2017 that the proportion of catastrophic health expenditure in the state is as high as 50.3%.[12] Also, health insurance coverage in Nigeria is still

very low, hovering around 3% of the population[13] with the figure even less in Rivers state where it is said that less than 2% of the population is covered by any form of pre-payment and risk pooling scheme.[12]

The objectives of this study are to estimate the proportion of HBV affected households that experience catastrophic health expenditure due to the disease, to determine the predictors of catastrophic health expenditure in HBV affected households and assess the impoverishing effect that the management of hepatitis B have on affected households.

METHODS

Study design

This was across-sectional study.

Study Setting

This is a health facility-based study that collected data from adult HBV-infected patients receiving care in two teaching hospitals in Port Harcourt, Rivers State. "These two tertiary facilities have the manpower with requisite skills to manage hepatitis B disease and receive referrals from all other health facilities in Port Harcourt. Sample was collected over four months using a structured, close-ended, interviewer-administered questionnaire adapted from a previous study".[14]"The cost was collected in naira and converted to dollars at the rate of $1 = N380".[15]

Study participants

A two-stage sampling method was used to recruit 107 hepatitis B patients at various stages of the disease. Stage 1 was a simple random sampling with which 16 clinic days were selected by balloting while stage 2 involved a systematic sampling to recruit the eligible patients for the study.

"The inclusion criteria were patients on management for HBV that have been on treatment for at least six months and those that have completed treatment. Six months allowed for enough time for the treatment pattern to be established and a patient can be completely treated and discharged within this time".[10] Coinfected patients were excluded from the study for ease of analysis and clarity in communicating the findings.

Variables

The variables measured in this study include the sociodemographic characteristics, direct medical cost, direct non-medical cost and indirect cost.

Bias

Recall bias was a concern in this study seeing that respondents needed to remember how much they spent on services accessed up to a three month prior to the time. This was mitigated by verifying the services respondents received within the period from their hospital folders and attaching their known prices from hospital price list to reduce the impact of recall bias.

Study size

Fischer's Sample Size Determination Formula was used.

$$n = \frac{Z^2 PQ}{d^2}$$

Where n = minimal sample size
Z = standard normal deviate taking as 1.96
P = Proportion of catastrophic expenditure in a previous study for hepatitis B = 50%

$$\frac{50}{100} = 0.50$$

Q = the complimentary probability of P which is (1 – p) 1-P =1-0.50=0.50
D = degree of accuracy desired at 0.1

$$n = \frac{1.96^2 \times 0.50 \times 0.50}{0.1^2} = \frac{3.8146 \times 0.25}{0.01} = 96$$

To compensate for non-response an adjustment to the sample size was made; the anticipated

response rate was set at 90%

$$n_s = \frac{n}{e}$$

Where, n_s = desired sample size adjusted for non-response

n = the minimum required sample size

e = expected response rate set at 90% or 0.9

$$\frac{96}{0.9} = 107$$

ns = 107

Statistical analysis
Data was analysed using Statistical Package for Social Sciences version 25 and frequencies presented in tables and charts.
Direct medical cost included the cost of consultation, drugs (orthodox and alternative medicine), investigations and admission/hospital stay. This cost was collected per month and extrapolated to a year. The cost of all this haven been collected as described above was calculated as the direct medical cost for the different stages of hepatitis B and C disease using the formula below.

Annual cost per patient =
(Cost per visit X Visits per year) + (Cost per admission X Admissions per year)
Where;
Cost per visit includes the total amount spent on consultation, drugs, investigation on that particular visit.
Cost per admission includes the total amount spent on medical services during an admission episode.
The use of charge for estimation of cost was considered the most appropriate approach.

The cost computation was done for an average of six visits per year for hepatitis B.
All costs are derived in naira and converted to the dollar equivalent at the rate of $1 = N380.

Direct non-medical cost which includes the cost of travel (transportation to and from the hospital), meals and accommodation where utilized was done using the same formula below.
Annual cost per patient =
(Cost per visit X Visits per year) + (Cost per admission X Admissions per year)

Indirect cost was estimated using the human capital approach; this approach uses the gross salary in the days of absence from work due to a disease.The patient's income prior to the illness was used to estimate his/her income loss as a result of visiting the hospital. Each patient's income was reduced to the hour so it can be used for estimation. For those not working, productivity loss was estimated assuming the patient's income to be the minimum wage.
Time loss valuation (Human Capital Approach, not adjusting wages)
Indirect Cost = $(t_{visit} \times W) + (t_{hospitalisation} \times W) + (t_{travel} \times W) + (t_{pick\ up\ drugs} \times W)$
Where;
t_{visit}Time spent per visit including waiting time.
$t_{hospitalisation}$Hospitalisation (admission) duration
t_{travel}Travel time
$t_{pick\ up\ drugs}$ Time employed to pick up drugs.
W is patient-reported pre-illness wage (from the survey), or wage of the lowest paid unskilled government worker (minimum wage).

Estimation of guardian/companion cost
$C^g = TFO + IC^g$
Where;
C^g = Guardian cost
TFO = Travel + Food + Other (including accommodation)
IC^g= Guardian time loss value

Measurement of Catastrophic health expenditure and impoverishment
The percentage of healthcare expenditure on treating hepatitis B in relation to total income and non-food expenditure of households was calculated for each household and the proportion of household exposed to catastrophic health expenditure was determined in the study population. The economic burden of the cost of treating hepatitis B on households was assessed using concepts like catastrophic health expenditure, the catastrophic overshoot, mean positive overshoot and the impoverishing effect of health payment on households, explained below.
The definition of catastrophic health expenditure (CHE) in this study was taken as household expenditure on health that is equal to or greater than 10% of household total income. Impoverishment is considered to have resulted from health expenses when a non-poor household (household whose per capita income per day is above the poverty line) becomes poor after making payments for healthcare services. The poverty lines that were used in this study were the World Bank 2015 poverty lines for extreme poverty and poverty defined as living below $2 per day per person and $3 per day per person respectively. The prevailing exchange rate at the time of data collection was be used.

Respondents annual income was estimated using self-reported disposable individual income (disposable income here refers to income less of tax) for respondents who have regular jobs and earn monthly or the asset scoring method for those without a regular income.

Estimation of annual household income by asset scoring method
Xj = 111 + 187(Flush toilet) + 202(Piped water) + 13(Mattress) + 58(Radio) + 28(Cell Phone) + + 51(Wristwatch) + 11(Blanket)
Where Xj is total income in household j.

Estimation of Catastrophic Health Expenditure
CHE (by total expenditure) = T⁄x> z
Where T is total income, x is the amount spent on treating the illness and z is 10% of total income

Estimation of Incidence of Catastrophic Health Expenditure (Catastrophic Head Count)
The number of respondents experiencing financial catastrophe as a result of treating hepatitis B and C was calculated using.

$$H = \frac{1}{N}\sum_{i=1}^{N} E_i$$

Where;
H is the fraction of households with health care budget shares that exceed the threshold z (the catastrophic headcount)
N is the sample size and E is a measure that assumes a value of 1 if the OOP payments of a household i is higher than the defined catastrophic expenditure threshold, and 0 if i is less than the threshold.

Estimation of Intensity of Catastrophic Health Expenditure (Catastrophic Overshoot)
The mean value by which household out-of-pocket expenditure on the treatment of hepatitis B, as a percentage of total household expenditure, exceeded the 10% threshold used to define catastrophic household expenditure.

$$O = \frac{1}{N}\sum_{i=1}^{N} O_i$$

Where O, the Catastrophic Overshoot represents the degree to which OOP payments exceeds the catastrophic threshold z.

RESULTS and DISCUSSION
Questionnaires were administered to 150 participants in the study with 135 returning complete responses making a response rate of90%.

As seen in Table 1, 60% of the respondents were male and 40% female. The average age of the hepatitis B patients was 41 years. Majority of the patients, 71% were married. Almost two – thirds of patients that participated in this study had tertiary education. They engaged in different occupations, ranging from civil service to artisanal jobs, some were professionals like engineers and teachers while others are retired. The majority of the patients (90.9%) pay out-of-pocket for their treatment. Only about 7.6% of them have a health insurance cover and about 1.5% were paid-for by their employers (Table 2).Up to 71.1% of the households of patients with Hepatitis B spend above 10% of total household expenditure in treating the condition therefore suffer financial catastrophe as a result.
The mean percentage of total income spent by households on the treatment of Hepatitis B in this study is 30% (Table 3).

Table 4 shows the intensity of catastrophic health expenditure among the responding households. The catastrophic headcount which is essentially the prevalence of catastrophic health expenditure among the respondents is 71.1% The catastrophic overshoot which represents the degree to which out-of-pocket payment exceeds the catastrophic threshold (10%) is 20%. Also, the mean positive overshoot is 28.1%.
As seen in table 5, payment method remained a significant predictor of catastrophic health expenditure and taking the effects of covariates into account, patients who pay out-of-pocket for treatment of hepatitis B were 4.65 times more likely to suffer financial catastrophe than those who had a prepayment cover.Before health payment, 7.4% of the responding hepatitis B households were in poverty (living on < $3 a day)). After health payment, 25.2% of the households were impoverished as a result of paying for the treatment of hepatitis B and 21.5% went into extreme poverty (Table 6)

Table1Socio-Demographic Profile of Respondents (patients)

Characteristics	**Hepatitis B**	
	Frequency (n=135)	**Percentage (%)**
Sex		
Male	81	60.0
Female	54	40.0
Age		
Young (<30)	20	14.8
Middle age (31 – 60)	109	80.7
Elderly (>60)	6	4.4
Marital Status		
Single	31	23.0
Married	96	71.1
Previously Married (D, S, W)	8	5.9
Education		
Primary	6	4.4
Secondary	34	25.2
Tertiary	91	67.4
No Education	4	3.0
Employment		
Employed	58	43.0
Unemployed	18	13.4

Not Active	20	14.7
Self Employed	39	28.9
Occupation		
Artisan	16	11.9
Business	49	36.3
Civil Servant	14	10.4
Farmer	6	4.4
Pensioner	5	3.7
Professional	26	19.3
Student	7	5.2
Unemployed	12	8.9

Table 2Main methods of payment for health care services

Method of Payment	Hepatitis B	
	Frequency	Percentage
Out-of-pocket	179	90.9
Employer	3	1.5
Health Insurance	15	7.6
Total	197	100.0

Table 3 Percentage of Household's that suffer financial catastrophe as a result of treating Hep B

Variable	Hepatitis B	
	Frequency	Percent
No Catastrophic Hlth Exp(<10%)	39	28.9

Catastrophic Hlth Exp(>10%)	96	71.1
Total	135	100.0

Table 4 Prevalence and Intensity of Catastrophic Health Expenditure among the responding households

Catastrophic payment measure	Threshold 10% of total income
Hepatitis B	
Headcount (H)	71.1%
Overshoot (O)	20%
Mean Positive Overshoot (MPO)	28.1%

Table 5Multivariate logistics regression analysis of the predictors of CHE in HBV Patients

Predictors	Crude OR[b] (95% C.I)	p-value	R^2	Adjusted OR[b] (95% C.I)	p-value	R^2
Age categories						
Young (<30yrs)	-			-		
Middle (30-60yrs)	0.93 (0.05-16.42)	0.96	0.432	0.16 (0.01-4.10)	0.27	0.456
Elderly (>60yrs)	0.13 (0.02-1.05)	0.06		0.12 (0.01-1.12)	0.06	
Employment status						
Unemployed	-			-		
Employed	0.49 (0.19-0.86)	0.03*	0.483	0.71 (1.12-1.97)	0.02*	0.435
Business	0.59 (0.21-1.68)	0.32		0.38 (0.11-1.34)	0.13	
Size of Household			0.367			
5 or less	-			-		
6 and above	0.46 (0.19-1.12)	0.09		0.42 (0.15-1.17)	0.10	0.394

**p-value < 0.05-variable is a significant predictor of CHE*

Table 6 Poverty, Extreme poverty and Impoverishment Estimates ($1 = N380)

	Before Health Payment (1)	After Health Payment (2)	Difference (Absolute) (3) = (2) – (1)
Hepatitis B			
(1,140 Naira ($3)/capita/day)[7]	**Poverty Line**		
Poverty Headcount (%)	7.4%	32.6%	25.2%
Poverty gap (N)	N407	N534	N127
Normalized Poverty Gap (%)	35.7%	46.8%	4.7%
(760 Naira ($2)/capita/day)[7]	**Extreme Poverty Line**		
Poverty Headcount (%)	4.4%	25.9.%	21.5%
Poverty Gap (N)	N227	N347	N120
Normalized Poverty Gap (%)	29.9%	45.7%	15.8%

"Although out-of-pocket payment for healthcare is considered a regressive method of health financing, it remains the prevailing method of financing the health system in most developing countries, including Nigeria. In this study, significantly more than two-thirds of hepatitis B patients pay out-of-pocket for health care. Just a small proportion of them have a health insurance cover and the rest are paid for by their employers. This means that the gross majority of these patients are exposed to the financial hardship that is known to follow this method of financing health care. This finding is similar to the prevalence of out-of-pocket payment for other long-term conditions as demonstrated in an earlier study in Port Harcourt[17], but higher than findings from other parts of the world like Azabaijhan at 72.1%, Cambodia at 74%, Sudan at 75.5% and Yemen at 76.6%"[,5,18]. "These countries though classified as developing countries like Nigeria, with similar socio-economic challenges were able to make these gains in the past few years due to their commitment to implementing the sustainable development goals. It is on record from the WHO report that countries that committedly implement these goals see improvements in these indices".[5]

Apart from health insurance, subsidies on other long-term conditions like HIV and Tuberculosis have recorded various levels of success and improved access to treatment of these conditions while reducing the economic burden on the patients. For instance, a study done in 2016, that looked at the economic burden of subsidized HIV treatment in three states in Nigeria reported significantly lower levels of catastrophic health expenditure among these patients. Tuberculosis is another long-term condition that enjoys such subsidies. The patients do not have to pay anything for drugs and investigations though other direct non-medical costs may persist. This has gone a long way to ease the burden on the patients.

This heavy reliance on out-of-pocket payment exposes a majority of the households to catastrophic health expenditure and impoverishment as a result of payment for healthcare.[19] This study found out that almost two-thirds of hepatitis B patients suffer financial catastrophe as a result of paying for the management of their condition. This finding is similar to that reported in Port Harcourt in 2015 which stated that the majority of households with long term illness suffer financial catastrophe as a result of paying for their treatment. This similarity may be traceable to the fact that the two studies are hospital-based and both in Port Harcourt. The findings are however significantly higher than what was reported in a study involving Akwa Ibom, Anambra and Adamawa states on HIV and AIDS in 2016[20]. This difference may be because HIV is a heavily subsidized program and the reported states all have a higher penetration of health insurance schemes.

On the predictors of catastrophic health expenditure, the study found that being employed is protective against CHE and taking the effects of covariates into account, people who are employed were 71% less likely to suffer catastrophic health expenditure in the treatment of hepatitis B.This finding is in keeping with the results reported by studies carried out in other parts of Nigeria.[22] The World Health Organisation has also reported similar trends among other low and middle-income countries that depend heavily on out-of-pocket payment[8]. It is however surprising to note that socio-demographic factors like age, marital status and even size of the household were not significant predictors of catastrophic health expenditure in this study. The size of the household not being a significant predictor of catastrophic health expenditure in this study may be explained by the fact that bigger households tend to have more than one financially viable members that contribute to the financing of the household needs.

The study showed that out-of-pocket payment for the management of hepatitis B impoverishes the households. A good percentage of the responding households who were living on the margins but above the poverty line were driven below it after payment for the treatment of their conditions. “This finding is similar to WHO reported trends in other low and middle-income coutries”.[5]Whereas without healthcare spending, poor households on the average suffer a deficit of $1.1 per head per day trying to meet basic necessities, this deficit is increased to approximately $1.4per head per person after accounting for spending for the treatment of hepatitis B. Healthcare expenditure, therefore diverts on the average $0.3per capita per day away from household resources needed to provide basic necessities of food, clothing, shelter and education. This means that reducing the heavy dependence on out-of-pocket payment for health care will directly reduce the financial hardship that these households face. Making a national policy on entrenching pre-payment plans for healhtcare or direct subsidy for the management of hepatitis B have that direct effect of liberating the economies of households from hardship.

Limitations (and efforts made to reduce the effects of the limitations)

The study is generally prone to recall bias as respondents are required to recall dates of diagnosis, treatment received, and expenses made. This was mitigated by consulting patient folder to corroborate provided information. Costs of treatment received sourced from folders were estimated based on prevailing prices.

Some key methodological challenges of this study relate to obtaining the appropriate measure of household income. Self-reported income can be unreliable, especially in settings like ours where the informal economy dominates. This is why the study combined the self-reported income for those with regular formal jobs with the asset scoring method for those without a regular income.

Secondly, the challenge posed when estimating patients' productivity loss that is required to account for the indirect costs was mitigated by adopting the Human Capital Approach which is the most used method with reliable outcomes in reviewed literature.[16]

Conclusion

Most hepatitis B patients face financial hardship due to out-of-pocket payments for their treatment, leading to catastrophic health expenditure. The suggestion is for the Rivers State Government to urgently implement a health insurance scheme to provide pre-payment coverage, reducing the burden of out-of-pocket expenses. The proposed scheme should be mandatory by law, requiring all residents and businesses in the state to contribute. Specific subsidies could target aspects like investigation and drug costs for hepatitis B treatment, with potential support from private companies and individuals as part of corporate social responsibility. Public health researchers are encouraged to conduct more studies on supplier/provider costs, government spending, societal costs, and hepatitis B prevalence in Port Harcourt, Rivers State. Public health experts should enhance health education efforts for patients, emphasizing available funding options, including the underutilized National Health Insurance Scheme. Regular enlightenment sessions during clinic days can help educate patients on the scheme's benefits and dispel any biases against enrolling.

Ethical Approval and Consent

The study received ethical approval from the Ethics Committee of both the University of Port Harcourt Teaching Hospital and the Rivers State University Teaching Hospital. Necessary permissions were obtained from the heads of different clinics, and informed consent was secured from the participating patients. Participants were guaranteed the confidentiality of their involvement and informed about the study's objectives. Subsequently, the study results and outcomes were communicated to the participants, and they were provided with health education regarding available pre-payment options and the enrollment process.

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