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Structure and Economic Determinants of the Cost of Hypertension Care in a Public Hospital in Northern Benin

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Abstract

Introduction: In low-income countries, the predominance of out-of-pocket payments constitutes a major barrier to equitable access to care for chronic diseases such as hypertension. This study aims to analyze the structure and determinants of the annual direct cost of hypertension care at the Atacora Departmental Hospital Centre (CHD) in northern Benin. **Methods:** An analytical cross-sectional study was conducted from July to December 2024 among 295 hypertensive patients followed at the CHD Atacora in northern Benin. Direct costs (consultations, medications, biological and radiological exams, transport, and incidentals) were estimated and aggregated for each patient. The annual cost was dichotomized around the median. The determinants of a high cost were identified using multivariate logistic regression with a 5% significance level. **Results:** The median annual direct cost of care was $180.5 (Q1: $100.8; Q3: $268.3). This cost is dominated by medication costs (median = $140.0; Q1: $60.0 and Q3: $211.0) and the cost of biological tests (median: $16.7; Q1: $5.0 and Q3: $41.7). The components of the direct cost, especially medications and biological tests, are increasingly higher when income exceeds $166.7. The determinants of a high direct cost were: occupation as a manual laborer (OR = 2.14; 95% CI = 1.01 - 4.51; p = 0.045); tradesperson (OR = 3.65; 95% CI = 1.76 - 7.55; p = 0.000); income of [$166.7 - $416.7[(OR = 3.13; 95% CI = 1.26 - 7.81; p = 0.014); income ≥ $416.7 (OR = 3.34; 95% CI = 1.25 - 8.89; p = 0.015); good treatment adherence (OR = 1.97; 95% CI = 1.17 - 3.31; p = 0.010); and knowledge of cardiovascular risks (OR = 1.99; 95% CI = 1.18 - 3.34; p = 0.009). **Conclusion:** These results, which reveal the importance of socioeconomic factors in the care of hypertensive patients, argue for the

strengthening of financial protection mechanisms, health education, and increased access to essential medicines in order to reduce the financial vulnerability of hypertensive patients.

Keywords

Direct Cost, Hypertension, Economic Determinants, Out-of-Pocket Payments, Public Hospital, Benin

1. Introduction

Hypertension constitutes one of the main modifiable risk factors for cardiovascular morbidity and mortality worldwide [1] [2]. Although the global prevalence tends to stabilise, the number of people affected continues to rise, particularly in low- and middle-income countries [3]-[5]. In 2019, the prevalence of hypertension was 34% among men and 48% among women in sub-Saharan Africa [6]. In Benin, this prevalence was 32.90%, with only 42% of hypertensives aware of their condition and 46.30% of these receiving treatment [7].

In this challenging epidemiological and therapeutic context, numerous studies conducted in sub-Saharan Africa identify the direct cost of care as a major barrier to access and continuity of treatment. It has been reported that hypertensive patients bear high costs and that the prices of antihypertensive drugs vary considerably, particularly depending on whether or not they are included in national essential medicines lists [8]. In Nigeria, studies on the costs and effectiveness of hypertension screening and treatment within a health insurance programme report that the direct cost of care remains high and that programme outcomes are highly sensitive to assumptions regarding coverage and follow-up modalities [9].

In response to these observations, initiatives such as the roadmap from the African Society of Hypertension and other organizations suggest using generic rather than branded medications to reduce care costs, expand screening, and strengthen supply chains [10]-[12].

In the context of Benin, and particularly within public hospital services, few original studies have been conducted on the direct cost of hypertension care and its determinants. The present study aims to fill this gap by analyzing the determinants of the annual direct cost of hypertension management in a departmental hospital, in order to promote a more equitable health financing policy and improve access to care for hypertensive individuals.

2. Methods

2.1. Study Setting

The study was conducted in the commune of Natitingou, the capital of the Atacora department in northern Benin. The area has mountainous terrain and comprises

nine arrondissements and sixty-five villages or neighborhoods. Its population, estimated at 107,498 inhabitants in 2024, is predominantly rural (55.83%). The local economy is primarily based on agriculture (61% of the working population) and trade (17%), making Natitingou a significant centre for the exchange of agricultural and artisanal products in the region.

The study took place at the Atacora Departmental Hospital Centre (CHD), the main referral facility in the department, where the majority of hypertensive patients from the commune and surrounding areas are followed. The centre has several specialised departments, including internal medicine, which houses the cardiology unit responsible for managing patients suffering from hypertension.

2.2. Study Participants and Eligibility Criteria

The target population consisted of individuals screened and followed for hypertension residing in the commune of Natitingou.

2.3. Inclusion Criteria

Patients were included in the study if they:

- had been diagnosed with hypertension for at least six (6) months;
- were regularly followed for hypertension at the CHD Atacora;
- were able to communicate orally in French, or, failing that, with the assistance of a trained interpreter;
- could provide reliable information about their care over the previous three months;
- had given their informed consent to participate in the study.

2.4. Non-Inclusion Criterion

Patients with a history of hypertension-related complications (stroke, renal failure, heart failure) dating back at least one year were not included.

2.5. Exclusion Criteria

Initially selected participants were excluded if they developed a complication of hypertension during the data collection period.

2.6. Study Design

This analytical cross-sectional study with prospective data collection, conducted from July to December 2024, recruited participants consecutively during follow-up consultations at the CHD Atacora. Direct cost components (consultations, biological and radiological exams, transport, and incidentals) were estimated on an annual basis by patients based on recall of the previous 12 months, while medication costs were collected monthly and then annualized (multiplied by 12).

The minimum sample size was 294 patients. This was calculated using Schwartz's formula, considering a hypertension prevalence of 25.90% [proportion of adults with either systolic blood pressure ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg;

or currently on medication for high blood pressure] [13]; a type I error of 1.96, and a precision of 5%.

$$N = \left(\varepsilon\alpha^2 pq\right) \Big/ \left(i^2\right) \quad (1)$$

2.7. Variables and Data Collection Tools

The dependent variable was the "annual direct cost of hypertension care." The study adopts the patient/household perspective. All cost data were collected through patient self-report using a structured questionnaire, cross-checked with available care documents (medical booklets, prescriptions). Annual costs were estimated directly by patients based on recall of the past 12 months for consultations, biological tests, radiological exams, transport, and incidentals. Monthly medication costs were multiplied by 12 to obtain the annual figure. The three-month recall criterion in the inclusion criteria refers to the minimum required capacity for reliable cost recall, not to the reference period used for annualization. The annual (total) cost per patient was then dichotomized into "high annual direct cost" and "low annual direct cost" depending on whether its value was above or below the median.

The explanatory variables were the sociodemographic characteristics of the users (age, sex, occupation, etc.), economic characteristics (average monthly income, possession of health insurance, payment method, etc.), and clinical and behavioural characteristics (presence of comorbidity, alcohol consumption, treatment adherence, etc.). Data were collected using a structured questionnaire, administered individually to patients by trained interviewers. Treatment adherence was assessed using the Girerd questionnaire (6-item scale); scores of 0 - 2 were classified as good adherence and scores of 3 - 6 as poor adherence. Knowledge of cardiovascular risk factors was assessed by asking patients whether they recognized each item from a predefined list of risk factors (obesity, smoking, physical inactivity, unbalanced diet, alcohol, stress, diabetes, dyslipidemia); a positive response to any item was sufficient for classification as knowledgeable (binary variable, no composite score). Comorbidity was defined as the presence of at least one physician-diagnosed condition (diabetes, chronic renal failure without acute complications, or dyslipidemia). Accessibility to care was assessed through a direct patient-reported question (Yes/No), with reasons for inaccessibility captured for negative responses.

2.8. Data Processing and Analysis

Collected data were entered and cleaned using Epi Info 7.2 software, then analyzed with SPSS version 25. No missing data were observed, as questionnaires were administered face-to-face with immediate completeness verification. A descriptive analysis was performed to calculate proportions followed by their 95% confidence intervals, means and standard deviations, and/or medians followed by the first and third quartiles (Q1; Q3). Associations between the annual direct cost per pa-

tient and the explanatory variables were identified at the 5% significance level. Variables associated with the outcome at the 20% significance level in bivariate analysis were included in the multivariate model, following standard recommendations for logistic regression modelling (Hosmer & Lemeshow). Model goodness-of-fit was assessed using the Hosmer-Lemeshow test ($p = 0.31$), indicating satisfactory calibration. Discrimination was evaluated using the area under the ROC curve (AUC = 0.744), reflecting acceptable discriminatory ability.

Prior to multivariate modelling, collinearity between occupation and income was assessed using the Variance Inflation Factor (VIF). VIF values were 1.29 for occupation and 1.29 for income, both well below the commonly accepted threshold of 5, indicating no problematic collinearity. Both variables were therefore retained in the final model, as they capture conceptually distinct dimensions of socioeconomic status.

2.9. Ethical Considerations

The study complied with the ethical and deontological principles of health research in the Republic of Benin. Its protocol received a favorable opinion from the Local Committee for Biomedical Research Ethics of the University of Parakou under number 873/2024/CLERB-UP/P/SP/R/SA. Administrative authorizations were obtained from the health authorities. Patient participation was voluntary, and their free and informed consent was obtained after the study's objectives were presented. The anonymity and confidentiality of the collected information were strictly respected.

3. Results

3.1. Sociodemographic, Economic, Biological, and Clinical Characteristics of the Respondents

The sample was predominantly composed of patients aged over 50 years (42.03%), with secondary education being the most common (36.95%) (**Table 1**). The unemployed or retired represented the main occupational category (35.25%) for both patients and their spouses. Nearly half had a monthly income below $86.7 (47.80%), and the majority reported good accessibility to care (84.41%), with insufficient financial means constituting the main barrier (58.70%).

Almost all respondents estimated the annual cost of consultations to be between $5.0 and $8.3 (97.29%). The cost of medication was generally less than $13.3 (54.58%), and the cost of biological tests was less than $26.7 (57.63%). Transport costs accounted for 77.29% of responses in the lowest category. Care was predominantly paid for in cash (94.92%). Clinically, 17.29% consumed alcohol, 6.44% used tobacco, and 58.31% had good treatment adherence. Half of the patients presented with a comorbidity (51.79%), and 27.12% reported a family history of hypertension. Finally, 28.47% resorted to traditional medicine, and 46.10% had knowledge of the cardiovascular risk factors for hypertension.

Table 1. Distribution of respondents according to sociodemographic, economic, biological, and clinical characteristics, Atacora Departmental Hospital, 2024 (n=295).

Variables	n	Proportion (%)	95% CI
Age (years)			
≤40	73	24.75	20.12 - 30.02
[41 - 50]	98	33.22	28.05 - 38.82
>50	124	42.03	36.49 - 47.78
Education level			
No formal education	87	29.49	24.53 - 34.97
Primary	44	14.92	11.26 - 19.48
Secondary	109	36.95	31.60 - 42.63
Higher	55	18.64	14.57 - 23.53
Patient's main occupation			
Unemployed/Retired	104	35.25	29.98 - 40.91
Manual workers/Labourers	49	16.61	12.76 - 21.33
Tradespeople	60	20.34	16.10 - 25.34
Executives, civil servants, and entrepreneurs	82	27.80	22.95 - 33.21
Spouse's main occupation			
Unemployed/Retired	113	38.31	32.89 - 44.01
Manual workers/Labourers	79	26.78	22.01 - 32.15
Tradespeople	11	3.73	2.06 - 6.62
Executives, civil servants, and entrepreneurs	92	31.19	26.13 - 36.73
Rumors about other treatment practices			
Yes	93	31.53	26.44 - 37.08
Economic characteristics			
Monthly income (USD)			
<$86.7	141	47.80	42.11 - 53.53
[$86.7 - $166.7[	83	28.14	23.27 - 33.57
[$166.7 - $416.7[	37	12.54	9.20 - 16.86
≥$416.7	34	11.53	8.33 - 15.72
Accessibility to care			
Yes	249	84.41	79.77 - 88.13

Continued

Reasons for inaccessibility to care			
Long distance between health centre and home	13	28.26	16.82 - 43.41
Insufficient financial means	27	58.70	43.57 - 72.33
No qualified staff at the health centre	2	4.35	1.03 - 16.53
Poor road conditions to the health centre	2	4.35	1.03 - 16.53
Not specified	2	4.35	1.03 - 16.53
Estimated annual cost of consultations (USD)			
<$5.0	1	0.34	0.04 - 2.39
[$5.0 - $8.3[	287	97.29	94.65 - 98.64
≥$8.3	7	2.37	1.13 - 4.91
Estimated monthly cost of medication (USD)			
<$13.3	161	54.58	48.82 - 60.20
[$13.3 - $33.3[	104	35.25	29.98 - 40.91
[$33.3 - $50.0[	19	6.44	4.13 - 9.90
≥$50.0	11	3.73	2.06 - 6.62
Estimated annual cost of biological tests (USD)			
<$26.7	170	57.63	51.87 - 63.17
[$26.7 - $66.7[	101	34.24	29.01 - 39.87
[$66.7 - $83.3[	11	3.73	2.06 - 6.62
≥$83.3	13	4.41	2.56 - 7.46
Estimated annual cost of transport to health centre (USD)			
<$1.7	228	77.29	72.12 - 81.73
[$1.7 - $8.3[	52	17.63	13.66 - 22.43
≥$8.3	15	5.08	3.07 - 8.28
Estimated annual cost of radiological exams (USD)			
<$16.7	148	50.17	44.45 - 55.88
[$16.7 - $33.3[	128	43.39	37.81 - 49.14
[$33.3 - $50.0[	12	4.07	2.31 - 7.04
≥$50.0	7	2.37	1.13 - 4.91

Continued

Estimated annual cost of incidentals (USD)			
<$6.7	215	72.88	67.48 - 77.67
[$6.7 - $16.7[	51	17.29	13.36 - 22.06
[$16.7 - $33.3[	18	6.10	3.86 - 9.49
≥$33.3	11	3.73	2.06 - 6.62
Payment method for care			
Cash payment	280	94.92	91.71 - 96.92
Health insurance	15	5.08	3.07 - 8.28
Biological and clinical characteristics			
Treatment duration (months)			
<12	16	5.42	3.33 - 8.69
[12 - 59[	172	58.31	52.56 - 63.83
[59 - 120[	65	22.03	17.64 - 27.15
≥120	42	14.24	10.67 - 18.73
Alcohol consumption			
Yes	51	17.29	13.36 - 22.06
Tobacco use			
Yes	19	6.44	4.13 - 9.90
Treatment adherence			
Good	172	58.31	52.56 - 63.83
Presence of comorbidity			
Yes	130	51.79	45.57 - 57.95
Family history of hypertension			
Yes	80	27.12	22.32 - 32.51
Use of traditional medicine			
Yes	84	28.47	23.58 - 33.92
*Participation in CCC on hypertension**			
Yes	33	11.19	8.04 - 15.34
Knowledge of cardiovascular risk factors			
Yes	136	46.10	40.45 - 51.84

CI = Confidence Interval; CCC = Communication for Behavioral Change.

3.2. Assessment of Hypertension Care Costs Per Patient

3.2.1. Annual Direct Cost of Hypertension Care

The annual cost of hypertension care had a median of $180.5, with an interquartile range of $100.8 to $268.3. The mean cost was estimated at $225.9 ± $167.4.

3.2.2. Structure of the Annual Direct Cost of Hypertension Care According to Patient Income

Figure 1 presents the components of the direct cost of hypertension care, described using the median and the first and third quartiles. The graphical representation uses a logarithmic scale to account for the skewness and heterogeneity of the cost distributions.

Overall, the annual direct cost of hypertension care for a patient at the departmental hospital is primarily composed of medication costs, with a median of $140.0 (Q1 = $60.0 and Q3 = $211.0), and the cost of biological tests, with a median of $16.7 (Q1 = $5.0 and Q3 = $41.7). The other components are consultation costs, which are nearly stable at $5.0, as well as the costs of imaging exams, transport, and incidentals.

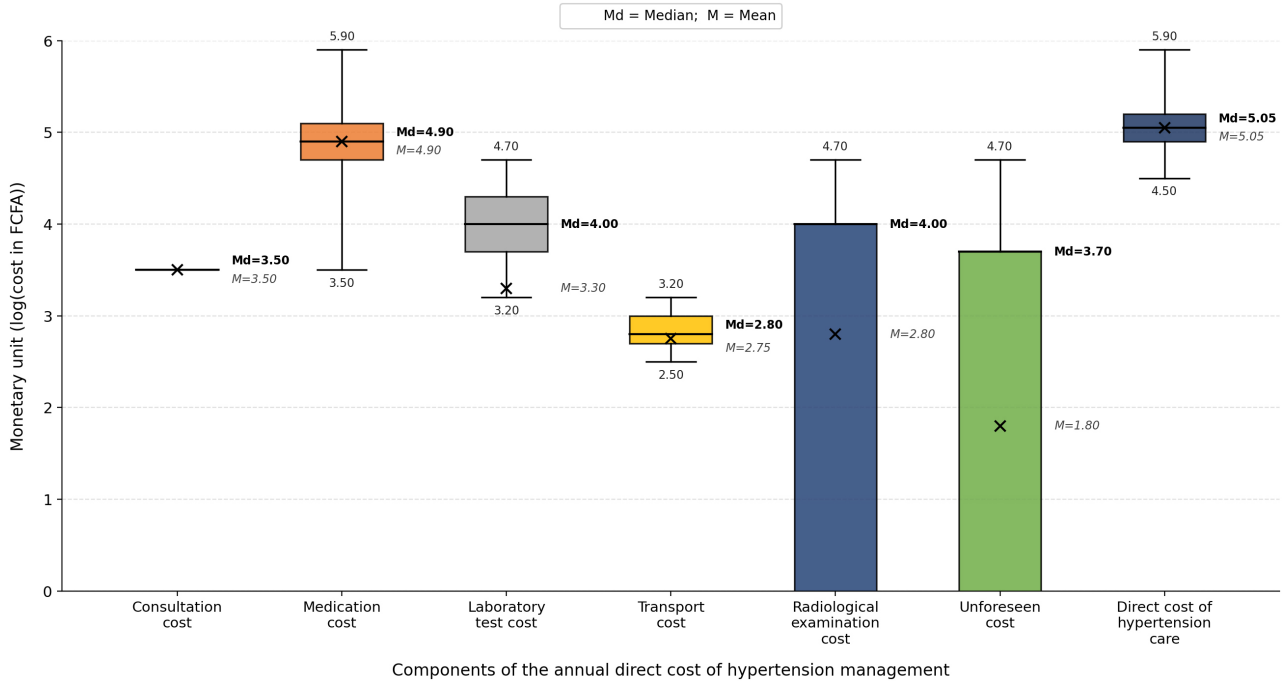

Figure 1. Central tendencies of the components of the annual direct cost of hypertension care, Atacora Departmental Hospital, 2024 (n = 295).

3.2.3. Cost of Hypertension Care According to Monthly Income

Median costs show an overall increasing trend with monthly income (Figure 2), particularly for medications, biological tests, and radiological exams, for which patients with an income ≥ $416.7 incur higher costs than those in other categories. Consultation and transport costs vary little across income levels, while costs for incidentals only appear from intermediate income levels upward.

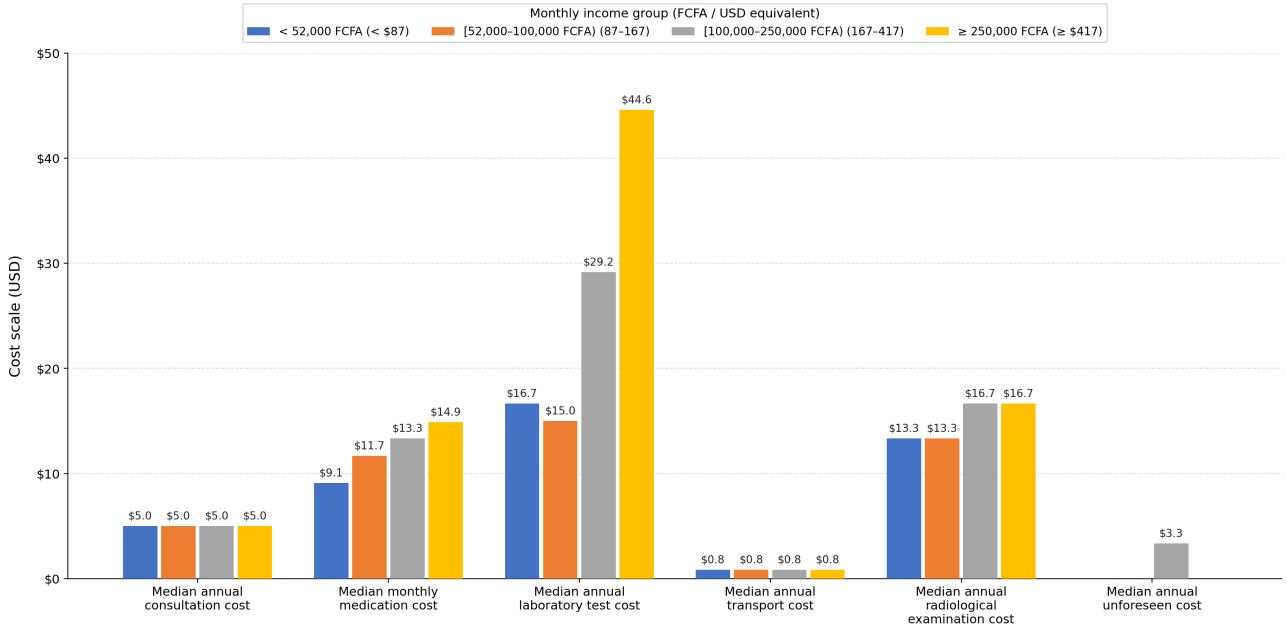

Figure 2. Distribution of the annual direct cost components of hypertension care by patient monthly income level, Atacora departmental hospital, 2024 (n = 295).

3.3. Factors Determining a High Annual Direct Cost for Hypertension Care

3.3.1. Bivariate Analysis

Several factors were associated with a high cost of hypertension care (Table 2). Patients with a primary education level (OR = 2.14; p = 0.043) or higher education level (OR = 3.05; p = 0.002), executives/civil servants/entrepreneurs (OR = 2.77; p = 0.001), tradespeople (OR = 1.98; p = 0.000), those with a monthly income of $166.7 - $416.7 and above, those with good accessibility to care (OR = 3.00; p = 0.002), or those who had participated in CCC (OR = 2.15; p = 0.048) incurred a higher cost.

Table 2. Associations between variables and the annual direct cost of hypertension care, Atacora Departmental Hospital, 2024 (n = 295).

Variables	Cost of Hypertension Care High n (%)	Odds Ratio (OR)	95% CI	p-value
Age (years)				
≤40	36 (49.32)	1.10	0.62 - 1.97	0.730
[41 - 50]	56 (57.14)	1.51	0.89 - 2.58	0.126
>50	58 (46.77)	1	-	-
Education level				
No formal education	33 (37.93)	1	-	-
Primary	20 (45.45)	1.36	0.65 - 2.84	0.408

Continued

Secondary	62 (56.88)	2.15	1.21 - 3.83	**0.009**
Higher	35 (63.64)	2.86	1.42 - 5.76	**0.003**
Patient's main occupation				
Unemployed/Retired	37 (35.58)	1	-	-
Manual workers/Labourers	22 (44.90)	1.47	0.73 - 2.94	0.270
Tradespeople	41 (68.33)	3.90	1.98 - 7.68	**0.000**
Executives, civil servants, and entrepreneurs	50 (60.98)	2.82	1.55 - 5.14	**0.001**
Spouse's main occupation				
Unemployed/Retired	63 (55.75)	1.75	0.98 - 3.14	0.057
Manual workers/Labourers	33 (41.77)	1	-	-
Tradespeople	7 (63.64)	2.43	0.65 - 9.01	0.181
Executives, civil servants, and entrepreneurs	47 (51.09)	1.45	0.79 - 2.66	0.224
Rumors about other treatment practices				
Yes	53 (56.99)	1.43	0.87 - 2.35	0.153
No	97 (48.02)	1	-	-
Monthly income (USD)				
<$86.7	60 (42.55)	1	-	-
[$86.7 - $166.7[	38 (45.78)	1.14	0.66 - 1.96	0.638
[$166.7 - $416.7[	26 (70.27)	3.19	1.46 - 6.96	**0.004**
≥$416.7	26 (76.47)	4.38	1.85 - 10.36	**0.001**
Accessibility to care				
Yes	134 (53.82)	2.18	1.13 - 4.20	**0.020**
No	16 (34.78)	1	-	-
Payment method for care				
Cash payment	142 (50.71)	1	-	-
Health insurance	8 (53.33)	1.11	0.39 - 3.14	0.843
Alcohol consumption				
Yes	23 (45.10)	1	-	-
No	127 (52.05)	1.32	0.72 - 2.42	0.367
Tobacco use				
Yes	4 (21.05)	1	-	-
No	146 (52.90)	4.21	1.36 - 13.01	**0.012**

Continued

Treatment adherence				
Good	100 (58.14)	2.02	1.26 - 3.24	**0.003**
Poor	50 (40.65)	1	-	-
Presence of comorbidity				
Yes	37 (46.25)	1	-	-
No	113 (52.56)	1.28	0.76 - 2.15	0.336
Family history of hypertension				
Yes	60 (46.88)	1	-	-
No	90 (53.89)	1.32	0.83 - 2.10	0.233
Use of traditional medicine				
Yes	35 (41.67)	1	-	-
No	115 (54.50)	1.67	1.00 - 2.79	**0.048**
Participation in CCC on hypertension				
Yes	22 (66.67)	2.09	0.97 - 4.49	0.058
No	128 (48.85)	1	-	-
Knowledge of cardiovascular risk factors				
Yes	87 (63.97)	2.70	1.68 - 4.34	**0.000**
No	63 (39.62)	1	-	-
Treatment duration (months)				
<12	10 (62.50)	2.22	0.68 - 7.24	0.186
[12 - 59[	87 (50.58)	1.36	0.69 - 2.69	0.370
[59 - 120[	35 (53.85)	1.55	0.71 - 3.39	0.268
≥120	18 (42.86)	1	-	-

3.3.2. Multivariate Analysis

After adjusting for the thirteen variables significant at the 20% threshold in the multivariate model, the annual direct cost of hypertension care was significantly associated with the patient's occupation (Table 3): manual workers/labourers (OR = 2.14; p = 0.045) and tradespeople (OR = 3.65; p = 0.000) presented a higher risk compared to the unemployed/retired. Having good treatment adherence also increased the risk (OR = 1.97; p = 0.010). A monthly income of $166.7 and above was associated with a higher cost. Furthermore, knowledge of cardiovascular risk factors (OR = 1.99; p = 0.009) was associated with a higher cost. The absence of multicollinearity between occupation and income (VIF = 1.29 for both) supports their simultaneous inclusion in the model and confirms the stability of the ad-

justed estimates.

Overall model fit was satisfactory (Hosmer-Lemeshow test: p = 0.31), and discriminatory ability was acceptable (AUC = 0.744).

Table 3. Final multivariate model of variables associated with the annual direct cost of hypertension care, Atacora Departmental Hospital, 2024 (n = 295).

Variables	Cost of Hypertension Care High n (%)	Odds Ratio (OR)	95% CI	p-value
Patient's main occupation				
Unemployed/Retired	37 (35.58)	1	-	-
Manual workers/Labourers	22 (44.90)	2.14	1.01 - 4.51	**0.045**
Tradespeople	41 (68.33)	3.65	1.76 - 7.55	**0.000**
Executives, civil servants, and entrepreneurs	50 (60.98)	1.62	0.77 - 3.38	0.199
Monthly income (USD)				
<$86.7	60 (42.55)	1	-	-
[$86.7 - $166.7[	38 (45.78)	0.97	0.52 - 1.81	0.927
[$166.7 - $416.7[	26 (70.27)	3.13	1.26 - 7.81	**0.014**
≥$416.7	26 (76.47)	3.34	1.25 - 8.89	**0.015**
Treatment adherence				
Good	100 (58.14)	1.97	1.17 - 3.31	**0.010**
Poor	50 (40.65)	1	-	-
Knowledge of cardiovascular risk factors				
Yes	87 (63.97)	1.99	1.18 - 3.34	**0.009**
No	63 (39.62)	1	-	-

4. Discussion

4.1. Direct Cost of Hypertension Care Per Patient

The present study highlights a median annual direct cost of $180.5 per hypertensive patient managed in a public reference hospital in northern Benin. Relative to the observed income levels, this amount constitutes a substantial financial burden for households, particularly in a context where almost all care is financed through out-of-pocket payments. This situation is characteristic of health systems in low- and middle-income countries, where direct expenses are largely predominant, exposing households to a high financial risk [3].

This level of direct cost per patient for antihypertensive treatment remains broadly consistent with those reported in sub-Saharan Africa. However, it is highly disparate, with a monthly average of nearly $37.80 in the Democratic Re-

public of Congo [14] compared to an annual average of $304.8 in Kenya, with medications constituting the predominant share [15]. This cost, which varies by country and healthcare facility, absorbs a significant portion of patient income [15].

These results confirm that hypertension, as a chronic disease requiring long-term follow-up, constitutes a major factor of financial vulnerability, which, in the absence of adequate financial protection mechanisms, exposes households to catastrophic health expenditures [16].

4.2. Components of Direct Cost and Distribution by Income

The detailed analysis of direct cost components shows that antihypertensive medications, biological tests, and radiological exams constitute the main expenditure items, while consultation and transport costs remain relatively low and show little differentiation by income level. This expenditure structure is consistent with the regional literature, which consistently identifies medication costs as the primary driver of direct expenses related to hypertension care [8] [15] [17].

The distribution of costs by income highlights a progressive increase in expenditure with rising monthly income, particularly for medications and ancillary tests. Patients with higher incomes appear to use formal care more intensively and benefit from more comprehensive management, with choices of more costly medications, potentially more in line with recent clinical recommendations. Conversely, as reported in other studies, low-income patients appear constrained to limit certain expenses through partial renunciation or spacing out of care, consultations, or resorting to less costly therapeutic alternatives [18].

This situation reflects the inequality in access to and utilization of care linked to the ability to pay. It raises a dual challenge of equity and efficiency: the poorest patients bear a proportionally greater financial effort while potentially receiving less comprehensive care.

4.3. Determinants of a High Direct Cost of Care

The multivariate analysis reveals that several socio-economic and behavioural factors are independently associated with a high annual direct cost. Occupation (OR $\leq$ 3.65; p $\leq$ 0.045) and income level (OR $\leq$ 3.34; p $\leq$ 0.014) emerge as major determinants: while manual workers and tradespeople have a significantly higher risk of incurring substantial costs compared to unemployed or retired individuals, patients with a monthly income of $166.7 or more have a higher probability of incurring significant expenses, reflecting a more intensive use of health services. These results align with economic analyses showing that an increase in the ability to pay is accompanied by a rise in healthcare consumption, including for chronic diseases [19]. Conversely, given the correspondence between occupation and income, individuals with a low ability to pay incur low direct care costs due to renouncing or delaying care [18].

Furthermore, good treatment adherence (OR = 1.97; 95% CI = 1.17-3.31; p =

0.010) and knowledge of cardiovascular risk factors (OR = 1.99; 95% CI = 1.18-3.34; p = 0.009), which appear to be related, are also associated with a high direct cost. Indeed, better-informed patients seem more engaged in their care pathway, and are therefore more adherent, more frequently using formal services and incurring higher healthcare expenses. This result highlights health education as a driver of adherence and quality of care, but also, in the absence of financial protection mechanisms, as a factor increasing the economic burden on patients. The influence of good adherence could be explained by the short-term increase in the consumption of medications, tests, consultations, and other services it generates; an increase that is largely offset in the long term by a reduction in hospitalisations, complications, and non-pharmaceutical medical costs, thereby improving the overall efficiency of health systems [20] [21].

Finally, the observed variations may also be influenced by factors related to the organization and regulation of health services, including the availability of tests, the tariff structure, and prescribing practices.

4.4. Limitations of the Study

This study has certain limitations. Costs were estimated from reported data, exposing the results to recall or reporting bias. The analysis was limited to direct costs, without integrating indirect costs such as productivity loss, time spent on care, or opportunity costs, which probably leads to an underestimation of the overall economic burden of hypertension. The cross-sectional nature of the study does not allow for an assessment of cost evolution over time nor for measuring the long-term economic benefits of good treatment adherence. Finally, conducting the study in a referral hospital may limit the generalizability of the results to other levels of the health system.

A further methodological limitation relates to potential endogeneity in the interpretation of certain predictors. Treatment adherence and knowledge of cardiovascular risk factors may not only influence service use and costs, but may themselves be shaped by prior care exposure: patients with greater access to or experience of formal healthcare may develop better knowledge and higher adherence, which in turn drives further care consumption. This bidirectional relationship cannot be disentangled in a cross-sectional design, and causal inference from these associations should therefore be made with caution. Longitudinal or instrumental variable approaches would be needed to establish directionality.

4.5. Implications for Health Policies

Overall, these results underscore the need to strengthen financial protection mechanisms, in line with the objectives of Universal Health Coverage, in order to reduce reliance on out-of-pocket payments and the financial vulnerability of hypertensive patients. They also argue for policies combining subsidies for essential medicines, efficient organization of chronic care, and health education, in accordance with recommendations from Disease Control Priorities [22].

5. Conclusion

This study highlights that the annual direct cost of hypertension care at the CHD Atacora is high for a significant proportion of patients and varies significantly according to socio-economic profile. Occupation, income level, treatment adherence, and knowledge of cardiovascular risk factors constitute major determinants of high cost, reflecting a socio-economic gradient in access to and utilisation of care. In a context dominated by out-of-pocket payments, these results underscore the financial vulnerability of hypertensive patients and call for strengthening financial protection mechanisms, improving access to essential medicines, and organising chronic care more efficiently.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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