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Chineye Fabian Adili-George

adiligeorgefabian@gmail.com

University of Geneva

Uchechi Ngozichukwu Obiefule

Lagos State University Teaching Hospital

Uwemedimo Sunday Isaiah

University of Uyo

Ruth Oreoluwa Adili-George

Rome Business School

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BEYOND CATASTROPHIC HEALTH EXPENDITURE: NON-FINANCIAL CONSEQUENCES AND INFORMAL CAREGIVING COSTS OF CHRONIC NON-COMMUNICABLE DISEASES IN LAGOS, NIGERIA

Chineye Fabian Adili-George¹, Uchechi Ngozichukwu Obiefule², Uwemedimo Sunday Isaiah³, Ruth Oreoluwa Adili-George⁴

¹Faculty of Medicine, Global Studies Institute, University of Geneva, Switzerland.

²Department of Nursing, Lagos State University Teaching Hospital, Lagos, Nigeria.

³Department of Psychology, University of Uyo, Uyo, Nigeria

⁴Rome Business School, Lagos, Nigeria

Corresponding author: Chineye Fabian Adili-George, adiligeorgefabian@gmail.com

Abstract

Background

The household burden of chronic non-communicable diseases (NCDs) in sub-Saharan Africa has been characterized largely in literature through out-of-pocket expenditure and catastrophic health expenditure thresholds, leaving the non-financial welfare losses and indirect economic costs of informal caregiving insufficiently measured. This study quantified patient-level social and lifestyle burden, the profile and economic cost of informal caregiving, and the independent predictors of patient-side and carer-side outcomes among adults receiving chronic NCD care across various tiers of Lagos public-sector facilities.

Methods

A facility-based cross-sectional survey conducted among 480 adults with confirmed chronic NCDs across two primary, three secondary, and one tertiary level public facilities in Lagos, Nigeria. Patient-level social burden was measured with four binary capability-relevant items- difficulty in affording basic needs, difficulty in maintaining lifestyle, reduced social participation, and abandonment of leisure activities- and high social burden was defined a priori as endorsement of three or more of these domains. Among patients with an active informal carer, carer role disruption was measured with a patient-reported binary item indicating whether the carer had left caring duties to earn money for the household, while carer days lost from productive work were measured as the patient-reported number of carer workdays lost in the preceding 30 days. Descriptive statistics summarized prevalence, chi-square tests and one-way analysis of variance assessed facility-tier differences, and binary logistic regression with average marginal effects estimated independent predictors of high social burden and carer role disruption. Statistical significance was set at $p < 0.05$.

Results

High social burden affected 45.6% of patients, with a facility-tier gradient in reduced social participation (39.4% primary to 67.5% tertiary) and leisure abandonment (40.6% to 67.5%) but uniform distribution of basic-needs and lifestyle constraints. Informal caregiving was common (67.3%) and family-based (children 46.4%, spouses 33.5%); 60.9% of carers had at some point left caring duties to earn money for the household, and among patients with complete patient and carer absenteeism data, households lost a mean of 14.0 productive days per month to illness-related absenteeism by patients and carers combined. Distress financing was the strongest independent predictor of high social burden (adjusted predicted probability 63.6% vs 38.2%; +24.7 percentage points, $p < 0.001$); multimorbidity was the strongest predictor of carer role disruption (73.8% vs 56.4%; +16.8 percentage points, $p = 0.003$).

Conclusions

The burden of chronic NCDs in Lagos public-sector care extends beyond catastrophic health expenditure and out-of-pocket spending. Distress financing translates financial shock into patient-side social and capability deprivation, while disease complexity drives carer-side role disruption and indirect

productivity loss. Financial-protection reform under the 2022 National Health Insurance Authority Act will therefore deliver its full welfare benefit only if it moves beyond expenditure protection alone to routinely measure distress coping, social disruption, and informal caregiving costs, and to recognize informal caregivers as economic actors within the chronic-disease policy architecture.

Keywords: chronic non-communicable diseases; catastrophic health expenditure; social burden of care; informal caregiving; carer role disruption; productivity loss; Lagos; Nigeria

Introduction

Chronic non-communicable diseases (NCDs) have become one of the defining public health challenges of the twenty-first century. Globally, they were responsible for at least 43 million deaths in 2021, representing approximately 75% of non-pandemic-related mortality, with nearly three-quarters of these deaths and more than four-fifths of premature NCD deaths occurring in low- and middle-income countries ¹. This burden reflects a profound epidemiological transition in which cardiovascular disease, diabetes, cancers, and chronic respiratory diseases now account for a growing share of adult morbidity, premature mortality, and long-term healthcare need in countries whose health systems have historically been organized around infectious, maternal, and child health priorities. In sub-Saharan Africa, this transition has been especially steep, with disability-adjusted life-years attributable to NCDs increasing by 67.0% between 1990 and 2017, from 90.6 million to 151.3 million DALYs ². Nigeria sits squarely within this regional shift, with NCDs estimated to account for 27% to nearly 30% of all deaths and a reported 22% probability of premature death from the four major NCDs among adults aged 30-69 years ^{3,4}. Within this changing disease landscape, chronic illness management in Nigeria's public hospitals is not a one-time clinical encounter but a continuing household financial obligation, requiring repeated spending on medicines, investigations, transport, and clinic visits, with cumulative burdens for income, consumption, and welfare ^{3,5,6}.

Documented empirical evidence on the extent of burden of NCDs has been largely concentrated on out-of-pocket health expenditure and its catastrophic consequences. A robust evidence base in sub-Saharan Africa shows that catastrophic health expenditure (CHE) attributable to NCDs is widespread, with pooled regional incidence of 16.5% at the 10% income threshold and 8.7% at the WHO 40% capacity-to-pay threshold, alongside evidence of worsening financial hardship in more recent periods ^{7,8}. Moreover, multinational household-survey evidence from the PURE study similarly confirms that NCD households in LMICs spend a larger share of effective income on healthcare and are more likely to forego prescribed medicines, with women in low-income settings particularly affected ⁹. Additionally, Nigerian facility-based and household-survey studies converge on the same finding: households affected by NCDs face elevated risks of catastrophic expenditure and impoverishment, driven primarily by recurring costs for medicines, diagnostics, and clinic attendance, and often accompanied by psycho-social strain and adverse coping strategies ^{3,5,6,10-13}. Therefore, what available literature captures with increasing precision is the financial transmission of chronic illness into poverty- what it, however, does not capture, is the wider set of welfare losses that chronic illness imposes on patients and households even before- and often instead of- the line at which expenditure becomes catastrophic.

The Capability Approach, developed by Sen and elaborated by Nussbaum, provides the normative scaffold for making these wider losses visible ^{14,15}. Its central claim is that human well-being is not adequately assessed by income or expenditure alone, but by people's substantive freedoms: what they are actually able to do and to be in everyday life ^{14,15}. Applied to chronic illness, this approach reframes disease burden as a set of restrictions on capabilities, including the ability to participate in social and family life, maintain usual routines, engage in productive work, enjoy leisure, plan for the future, and meet basic needs without compromise ¹⁶. Mitra's elaboration of the human-development model further demonstrates that capability deprivation among people with chronic conditions in LMICs is jointly produced by health states, resource constraints, and structural features of the environment, none of which is fully captured by expenditure-based metrics ¹⁷. For chronic NCD patients attending Nigeria's public hospitals, the conceptual implication is therefore direct: a patient who curtails meals, foregoes transport to religious or community activities,

withdraws from social gatherings, abandons leisure, or exits a savings group to afford monthly medicines may not cross a catastrophic-expenditure threshold, yet may still sustain a substantive loss of capability that the dominant expenditure lens cannot register.

Empirical work on these non-financial dimensions of NCD burden in sub-Saharan Africa remains comparatively thin and methodologically heterogeneous. Cross-sectional evidence from rural Tanzania shows that opportunity costs, foregone income, and curtailment of dietary, social, and productive activities are recurrent features of chronic illness and may be as consequential as direct healthcare outlays¹⁸. Community-based evidence from urban Accra has shown that people living with NCDs, including diabetes, hypertension, and obesity, report significantly reduced quality of life across physical, social, and environmental domains compared with peers without these conditions¹⁹. In Nigeria, longitudinal data from the Ibadan Study of Aging show that chronic conditions are independently associated with incident and persistent functional disability among older adults over five-year follow-up²⁰. Qualitative evidence from chronically ill older Nigerians further indicates that disease reorganizes social life: respondents describe concealing illness from friends and community for fear of stigma, withdrawing from religious and communal gatherings, and treating self-sufficiency as a moral obligation that progressively limits social participation²¹. What remains insufficiently measured, particularly in facility-based samples of working-age and older NCD patients in urban Nigerian settings, is how chronic illness reorganizes everyday capabilities through difficulty affording basic needs, lifestyle curtailment, reduced social participation, and foregone leisure as distinct burden domains rather than diffuse markers of quality of life. The WHO Innovative Care for Chronic Conditions framework conceptualizes chronic-illness response as operating across micro, meso, and policy levels²². This thus makes facility tier analytically important because the burden experienced by patients may differ across primary, secondary, and tertiary care, where case complexity, service intensity, referral pathways, and household costs are likely to vary.

Another key dimension that the cost-of-illness paradigm undercounts is informal caregiving. Caregiver-burden literature, anchored in Zarit's foundational work on relatives of impaired older people and Pearlin's stress-process model, distinguishes between objective burden- the quantifiable disruption to caregivers' time, work, and roles- and subjective burden, the perceived strain of providing care^{23,24}. Methodological work in health economics has long argued that ignoring the time related costs of informal care produces systematically biased estimates of the true economic burden of chronic disease and risks distorting decisions about formal-informal substitution²⁵. In sub-Saharan Africa, where informal carers, often female relatives, provide much of the daily support for patients with diabetes, hypertension, cancer, end-stage renal disease, and other chronic conditions, this burden has only recently been synthesized at scale. A 2024 systematic review of 47 studies across the region identified consistent patterns of physical and mental ill-health, lost employment, foregone income, and missed education among informal carers, with cancer and severe mental illness disproportionately represented and with recurring calls for financial-protection mechanisms for carers themselves²⁶. Available Nigerian evidence is consistent with this regional pattern. Among informal caregivers of cancer patients in Calabar, both objective and subjective burden were severe and increased with duration of caregiving^{27,28}. Additionally, among caregivers of stroke survivors at a Nigerian tertiary facility, caregiving burden reached 96.7%, with strain concentrated among those providing more hours of care and those with weaker social support²⁹. These studies establish that informal-care burden is real and measurable in Nigerian chronic-disease contexts. However, existing scholarships are yet to adequately connect caregiver absenteeism, role disruption, and days lost from productive work to a broader estimate

of the indirect economic burden represented by informal care across multiple chronic conditions and facility tiers.

Several converging gaps therefore frame the present study. The burden of chronic NCDs in Nigeria has been examined largely through a cost-of-illness lens, leaving the broader capability losses associated with chronic illness- difficulty meeting basic needs, restricted social participation, curtailed lifestyles, and foregone leisure- without systematic measurement in a multi-tier, facility-based sample. Moreover, the indirect economic burden of informal caregiving for NCD patients attending Nigerian public hospitals, including caregiver absenteeism, days off productive work, and disruption of usual roles, has also not been quantified in a way that engages the wider literature on objective and subjective burden. In addition, no published study has examined how these non-financial and indirect-cost burdens vary across the primary, secondary, and tertiary tiers of Lagos public hospitals, where disease complexity and case mix differ substantially. By addressing these gaps within a single theoretically grounded analysis, the present study moves beyond catastrophic health expenditure to provide a capability-anchored estimate of the non-financial and informal-caregiving burden of chronic NCDs in a Nigerian megacity setting, while offering an evidence base for aligning financial-protection policy with the wider welfare losses imposed on households in comparable low- and middle-income settings.

Methodology

Study Design and Setting

This was a facility-based cross-sectional survey conducted in Lagos State, the most densely populated and economically active state in Nigeria, with an estimated population of more than 25 million residents.³⁰ Lagos comprises 20 local government areas across three senatorial districts-Lagos Central, Lagos East, and Lagos West.^{31,32} Healthcare is delivered through a mixed public-private system organized into primary, secondary, and tertiary tiers.^{33,34} The Nigeria Health Facility Registry records more than 2,207 health facilities in the state, of which 81% are public.³³ The size, demographic complexity, and tiered public-sector structure of the Lagos health system make it an analytically appropriate setting in which to characterize the household-level burden of chronic non-communicable diseases across facility complexity.

Study Population and Eligibility Criteria

Eligible participants were adults aged 18 years and above with a confirmed chronic non-communicable disease diagnosis of at least three months' duration who were receiving ongoing care at one of the selected public facilities. Patients attending solely for acute conditions, and those without a confirmed chronic diagnosis meeting the set duration criteria of at least 3 months, were excluded.

Sample Size Determination

The minimum sample size was estimated using the single-population proportion formula for cross-sectional studies, $n = Z^2 \cdot P \cdot (1-P) / E^2$,³⁵ with $Z = 1.96$ (95% confidence), estimated proportion of the population (selected to maximize variance), $p = 0.50$, and the margin of error, $E = 0.05$; thus yielding 384 respondents. To accommodate an anticipated 20% non-response or incomplete-response rate, the sample was inflated to 480 participants.

Sampling Strategy

A multistage sampling procedure was employed in this study. The state was first stratified by senatorial district to ensure geographic spread, and two local government areas were selected from each district through computer-generated random selection, yielding six LGAs in total.³⁶ Within each LGA, one eligible public health facility was purposively selected to ensure representation across the three tiers of the Lagos public system- primary and comprehensive primary healthcare centers, general hospitals, and specialist or teaching hospitals.³³ The 480-participant target was allocated equally across the six facilities, giving 80 participants per facility. At each facility, eligible patients attending the General or Medical Outpatient Department were recruited through systematic random sampling: the clinic attendance register served as the sampling frame, the sampling interval was calculated by dividing the number of eligible attendees by the facility quota, a random starting point was selected, and every kth eligible patient was approached until the quota was reached. The combined design- geographic stratification, random LGA selection, purposive tier representation, and systematic patient recruitment- was intended to improve coverage across facility tiers while limiting selection bias.

Data Collection

Data was collected between November 2024 and April 2025 using a structured, pre-validated, interviewer-administered questionnaire adapted from Okediji and coauthors [5]. The questionnaire elicited information on sociodemographic and household characteristics, employment status, chronic NCD diagnosis and duration of treatment, out-of-pocket healthcare expenditure, illness-related productivity losses and income disruption, non-financial consequences of illness, and informal caregiving burden. The interviewer-administered approach was used to ensure consistency in data collection and to reduce missing responses among participants with different literacy levels.

The instrument also included open-ended questions asking respondents to describe activities, routines, or aspects of daily life they had given up since diagnosis. These short-text responses were coded inductively by two independent reviewers into five thematic categories: work and physical activity, dietary restriction, social and leisure participation, substance avoidance, and financial or emotional consequences. Coding discrepancies were resolved by consensus, and the final themes were entered as categorical variables for quantitative analysis alongside the structured questionnaire data.

Variable Operationalization

The analysis was organized around two interrelated dimensions of chronic-illness burden: patient-level social and lifestyle disruption, and household-level informal caregiving burden.

Patient-level social and lifestyle burden was measured through four binary items spanning capability-relevant domains- difficulty affording basic needs, difficulty maintaining lifestyle, reduced social participation, and abandonment of leisure activities since illness onset- summed into a 0-4 composite. High social burden was defined a priori as a score of three or more, a transparent analytic threshold indicating endorsement of at least three of the four constituent domains and intended to identify patients experiencing multi-dimensional capability deprivation rather than isolated single-domain disruption. Foregone-activity themes derived from the inductively coded open-ended responses provided complementary categorical

measures, with the 227 patients reporting substantive responses serving as the denominator for theme-specific prevalence estimates.

Informal caregiving was captured through three linked variables. Carer presence was a binary indicator of an identified informal carer at the time of survey, with relationships resolved by hierarchical priority coding to handle multiple-response entries. Carer role disruption- the primary outcome for Model B- recorded whether the carer had left caring duties at any point to earn money for the household, operationalizing the documented tension between caregiving and the carer's own economic participation in sub-Saharan settings.²⁶⁻²⁹ Carer days off productive work in the preceding 30 days was treated as a continuous variable among the 173 patients with complete numeric responses.

Indirect carer cost was valued at NGN 2,333 per day, the daily equivalent of Nigeria's statutory monthly minimum wage of NGN 70,000.³⁷ The minimum-wage anchor is consistent with the human-capital framework for valuing productive time loss^{38,39} and yields a deliberately conservative estimate appropriate to a setting without an established market for paid domestic care.⁴⁰ A sensitivity analysis at NGN 5,000 per day reflected urban Lagos median earnings. Total household indirect cost combined patient missed workdays with carer absenteeism at the same daily rate.

Predictors of high social burden and carer role disruption comprised age (continuous), sex, education (four-level ordinal), employment status, health insurance, pension receipt, household size, multimorbidity (≥ 2 concurrent conditions), treatment duration (four-category ordinal), facility tier, and log-transformed total out-of-pocket expenditure ($\log[\text{OOPE}+1]$). Distress financing- coded from direct questions on borrowing for treatment or sale of household assets- was entered as a distinct predictor of social burden in light of evidence linking such coping strategies to consumption depletion, asset erosion, and disruption of daily living and social participation in comparable low- and middle-income settings.⁴¹⁻⁴³

Statistical Analysis

Analysis was conducted in Stata version 19 (StataCorp LLC, College Station, TX, USA).⁴⁴ Personal identifiers were removed from the analytic dataset at the point of data entry and replaced with study-specific identification codes. Descriptive statistics summarized demographic, socioeconomic, clinical, and caregiving characteristics. Prevalence estimates for social-burden and caregiver-burden outcomes were reported with 95% exact binomial confidence intervals using the Clopper-Pearson method.⁴⁵ Facility-tier differences were examined using Pearson's chi-square test for categorical variables and one-way analysis of variance for continuous variables; bivariate associations between social-burden outcomes and key explanatory variables- catastrophic healthcare expenditure, post-payment impoverishment, distress financing, and multimorbidity- were assessed using chi-square or independent-samples t-tests, as appropriate.

Binary logistic regression was used to identify factors independently associated with high social burden among all participants (Model A) and with carer role disruption among the subset with an active informal carer (Model B). Full models were fitted with all prespecified predictors and reduced through backward elimination, with likelihood-ratio tests comparing reduced to full models; model adequacy was assessed against events-per-variable considerations. Associations were presented as adjusted odds ratios and as average marginal effects (absolute percentage-point changes in predicted outcome probability), with adjusted predicted probabilities used to illustrate clinically meaningful patterns across covariate levels. A sensitivity analysis for caregiver burden used any caregiver days off work as an alternative binary outcome

among respondents with complete data. Because the main outcomes were common, supplementary modified Poisson regression models with robust standard errors estimated prevalence ratios as a conservative alternative to odds ratios.⁴⁶ Statistical significance was set at two-sided $p < 0.05$.

Ethical Approval

Ethical approval for the study was obtained from the Lagos State University Teaching Hospital Health Research Ethics Committee, Ikeja, Lagos State, Nigeria (Reference Number: LREC/06/10/2651). Written informed consent was obtained from all participants before enrolment. Participation was voluntary, and respondents were informed of the study purpose, procedures, confidentiality protections, and their right to decline or withdraw without any effect on their care. No compensation was offered to avoid coercion in a financially constrained sample. These procedures were consistent with internationally accepted ethical principles for research involving human participants, including prior ethics review and informed consent requirements described in the World Medical Association Declaration of Helsinki.⁴⁷

Results

Table 1. Sociodemographic, clinical, and financial characteristics of chronic NCD patients by healthcare facility tier.

Chi-squared test for categorical variables; one-way ANOVA for continuous. This table presents characteristics directly relevant to the social and caregiving burden analysis of this study.

Variable	Total (n=480)	Primary (n=160)	Secondary (n=240)	Tertiary (n=80)	Test statistic	p-value
<i>Sex, n (%)</i>						
Female	289 (60.2)	104 (65.0)	146 (60.8)	39 (48.8)	$\chi^2=5.96$	0.051
Male	191 (39.8)	56 (35.0)	94 (39.2)	41 (51.2)	—	—
<i>Age, years</i>						
Mean (SD)	56.5 (14.9)	56.4 (13.6)	57.2 (15.0)	54.6 (17.0)	F=0.89	0.411
18–50, n (%)	154 (32.1)	47 (29.4)	73 (30.4)	34 (42.5)	$\chi^2=6.43$	0.170
51–65, n (%)	187 (39.0)	70 (43.8)	91 (37.9)	26 (32.5)	—	—
≥66, n (%)	139 (29.0)	43 (26.9)	76 (31.7)	20 (25.0)	—	—
<i>Employment status, n (%)</i>						

Employed or self-employed	331 (69.0)	112 (70.0)	161 (67.1)	58 (72.5)	$\chi^2=0.94$	0.624
Not economically active or unemployed	149 (31.0)	48 (30.0)	79 (32.9)	22 (27.5)	—	—
Education level, n (%)						
No formal or primary education	94 (19.6)	32 (20.0)	54 (22.5)	8 (10.0)	$\chi^2=10.42^*$	0.034*
Secondary education	167 (34.8)	55 (34.4)	88 (36.7)	24 (30.0)	—	—
Tertiary education	219 (45.6)	73 (45.6)	98 (40.8)	48 (60.0)	—	—
Marital status, n (%)						
Married	297 (61.9)	100 (62.5)	145 (60.4)	52 (65.0)	$\chi^2=0.57$	0.750
Widowed, divorced, or single	183 (38.1)	60 (37.5)	95 (39.6)	28 (35.0)	—	—
Household size						
Mean (SD)	4.97 (2.17)	4.93 (2.21)	4.97 (2.16)	5.01 (2.12)	F=0.05	0.951
1–4 members, n (%)	192 (40.0)	74 (46.3)	92 (38.3)	26 (32.5)	$\chi^2=5.05$	0.282
5–7 members, n (%)	254 (52.9)	75 (46.9)	132 (55.0)	47 (58.8)	—	—
≥8 members, n (%)	34 (7.1)	11 (6.9)	16 (6.7)	7 (8.8)	—	—
Health insurance, n (%)						
Uninsured	412 (85.8)	137 (85.6)	210 (87.5)	65 (81.3)	$\chi^2=1.94$	0.380
Insured (any scheme)	68 (14.2)	23 (14.4)	30 (12.5)	15 (18.8)	—	—
Pension, n (%)						
No pension	430 (89.6)	143 (89.4)	221 (92.1)	66 (82.5)	$\chi^2=5.92$	0.052
Receives pension income	50 (10.4)	17 (10.6)	19 (7.9)	14 (17.5)	—	—
Number of chronic conditions, n (%)						
Single condition	358 (74.6)	125 (78.1)	178 (74.2)	55 (68.8)	$\chi^2=2.52$	0.284
Two or more conditions (multimorbidity)	122 (25.4)	35 (21.9)	62 (25.8)	25 (31.3)	—	—
Treatment duration, n (%)						

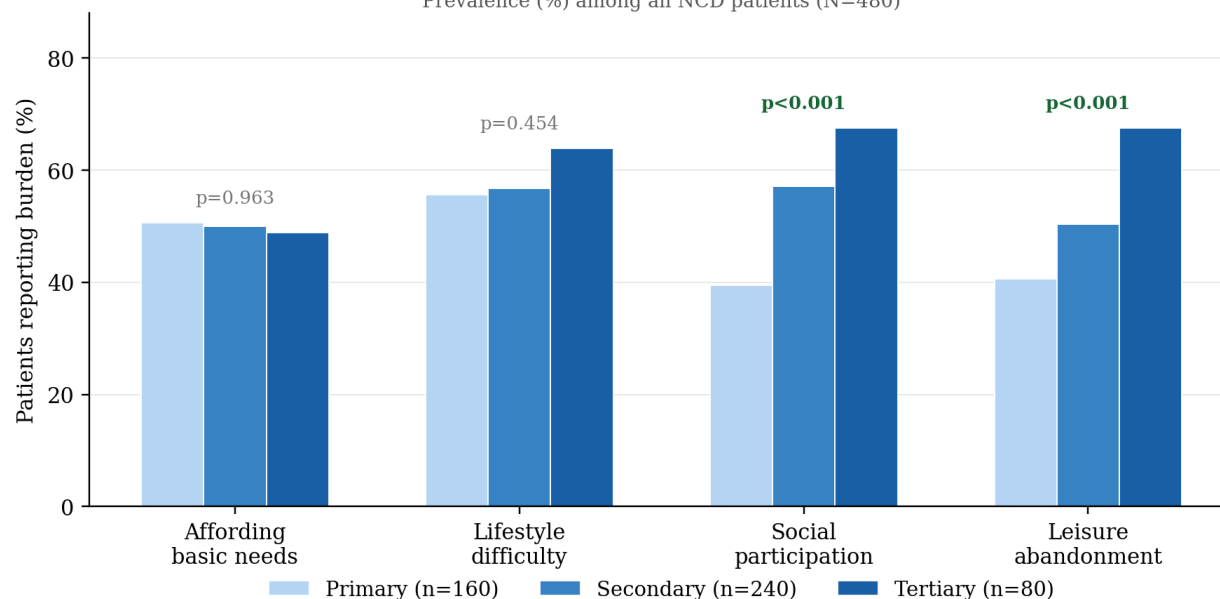
Less than 1 year	111 (23.1)	34 (21.3)	48 (20.0)	29 (36.3)	$\chi^2=13.18^*$	0.040*
1 to 4 years	143 (29.8)	44 (27.5)	74 (30.8)	25 (31.3)	—	—
5 to 9 years	115 (24.0)	38 (23.8)	63 (26.3)	14 (17.5)	—	—
10 years or more	111 (23.1)	44 (27.5)	55 (22.9)	12 (15.0)	—	—
<i>Out-of-pocket expenditure (OOPE) on illness, NGN</i>						
Mean (SD)	78,420 (74,310)	45,180 (39,450)	75,640 (68,720)	150,380 (100,640)	F=31.2***	<0.001
Median [IQR]	NGN 55,000 [28,000– 105,000] (USD 34 [18– 66])	NGN 32,000 [18,000– 65,000] (USD 20 [11–41])	NGN 52,000 [27,000– 95,000] (USD 33 [17–59])	NGN 120,000 [75,000– 200,000] (USD 75 [47–125])	—	—
Catastrophic expenditure (OOPE ≥10% of income), n (%)	327 (68.1)	87 (54.4)	165 (68.8)	75 (93.8)	$\chi^2=38.17^{***}$	<0.001
Post-OOPE income below poverty line, n (%)	399 (83.1)	132 (82.5)	199 (82.9)	68 (85.0)	$\chi^2=0.25$	0.881
<i>Financial coping behavior, n (%)</i>						
Borrowed money for treatment	127 (26.5)	43 (26.9)	68 (28.3)	16 (20.0)	$\chi^2=2.18$	0.336
Sold household assets for treatment	12 (2.5)	4 (2.5)	5 (2.1)	3 (3.8)	$\chi^2=0.72$	0.697
Distress financing (borrowed or sold assets)	137 (28.5)	47 (29.4)	69 (28.8)	21 (26.3)	$\chi^2=0.27$	0.876
<i>Social burden outcomes (primary outcomes of this study)</i>						
Difficulty affording basic needs since illness, n (%)	240 (50.0)	81 (50.6)	120 (50.0)	39 (48.8)	$\chi^2=0.08$	0.963
Difficulty maintaining lifestyle since illness, n (%)	276 (57.5)	89 (55.6)	136 (56.7)	51 (63.8)	$\chi^2=1.58$	0.454
Reduced social participation since illness, n (%)	254 (52.9)	63 (39.4)	137 (57.1)	54 (67.5)	$\chi^2=20.28^{***}$	<0.001
Gave up leisure activities or hobbies, n (%)	240 (50.0)	65 (40.6)	121 (50.4)	54 (67.5)	$\chi^2=15.44^{***}$	<0.001

High social burden (score ≥ 3 of 4), n (%)	219 (45.6)	67 (41.9)	108 (45.0)	44 (55.0)	$\chi^2=3.78$	0.151
Mean social burden score (SD), range 0-4	2.10 (1.60)	1.86 (1.59)	2.14 (1.60)	2.48 (1.54)	F=4.10*	0.017*
Informal caregiving (secondary outcomes of this study)						
Has an informal carer currently, n (%)	323 (67.3)	88 (55.0)	177 (73.8)	58 (72.5)	$\chi^2=16.52^{***}$	<0.001
Carer left duties to earn money (among carers), n (%)	195/320 (60.9)	54/87 (62.1)	96/175 (54.9)	45/58 (77.6)	$\chi^2=9.52^{**}$	0.009**
Carer had ≥ 1 day off work (among n=173 with data), n (%)	130/173 (75.1)	45/64 (70.3)	68/92 (73.9)	17/17 (100.0)	$\chi^2=6.50^*$	0.039*

Table 1 shows that the sample was broadly representative of urban NCD patients in Lagos public facilities, with hypertension (56.0%) and diabetes (28.1%) predominating. Tertiary patients were significantly younger on average and markedly better educated (60.0% with tertiary education versus 34.4% at primary; $p=0.034$). Employment distribution, marital status, household size, insurance, and pension coverage did not differ significantly by tier, indicating that the three cohorts were broadly socioeconomically comparable on binary measures. Multimorbidity was present in 25.4% of the overall sample and did not differ by tier.

Figure 1. Social burden dimensions by healthcare facility tier

Prevalence (%) among all NCD patients (N=480)



p-values from Pearson chi-squared tests across three facility tiers.

Prevalence (%) of each burden dimension by facility tier among all NCD patients. p-values from Pearson chi-squared tests across three facility tiers.

Figure 1. Social burden dimensions by healthcare facility tier

Figure 1 shows that social burden was near-universal across all tiers for financial floor dimensions: roughly about half of the patients at every tier reported difficulty affording basic needs and lifestyle difficulty, with no significant tier variation ($p=0.963$ and $p=0.454$ respectively). By contrast, social withdrawal dimensions showed a pronounced dose-response gradient with facility complexity: reduced social participation rose from 39.4% at primary to 57.1% at secondary to 67.5% at tertiary ($p<0.001$), and leisure abandonment from 40.6% to 50.4% to 67.5% ($p<0.001$). This pattern suggests that financial floor effects are universal regardless of disease complexity, while social role disruption reflects the cumulative burden of longer illness duration and more intensive treatment.

Table 2. Foregone activities since illness onset among patients reporting specific changes (n=227), by facility tier, catastrophic expenditure status, and multimorbidity.

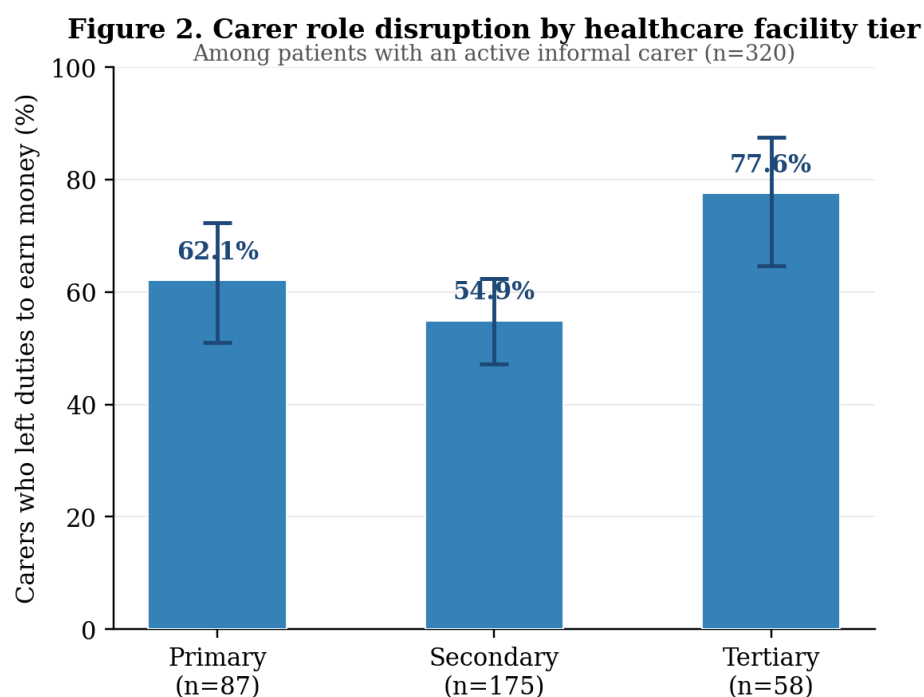
Among 227 of 480 patients who identified specific foregone activities. All proportions use the within-tier subsample as the denominator. Themes derived by inductive content analysis.

Foregone activity theme	Overall % (95% CI)	Primary (n=70)		Secondary (n=115)		Tertiary (n=42)	
		% (n/N)	p tier	% (n/N)	p CHE	% (n/N)	p MM
Denominator: 227 patients who reported specific foregone activities. Tier-specific denominators: primary n=70, secondary n=115, tertiary n=42.							
Work and physical activities	38.3 (32.0–45.0)	28.6 (20/70)	0.002	49.6 (57/115)	0.089	23.8 (10/42)	0.848
Dietary restrictions	30.0 (24.1–36.4)	28.6 (20/70)	<0.001	21.7 (25/115)	0.150	54.8 (23/42)	0.756
Social and leisure activities	29.1 (23.3–35.4)	35.7 (25/70)	0.164	23.5 (27/115)	0.021*	33.3 (14/42)	0.677
Substances (alcohol, tobacco, or similar)	8.4 (5.1–12.8)	11.4 (8/70)	0.539	7.0 (8/115)	—	7.1 (3/42)	—
Financial and emotional consequences	4.8 (2.4–8.5)	—	—	—	—	—	—

p tier = chi-squared test across all three facility tiers. p CHE = chi-squared between patients with and without catastrophic expenditure. p MM = chi-squared between multimorbid and single-condition patients. Categories are not mutually exclusive; respondents could report more than one foregone activity.

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Table 2 shows that among the 227 patients who reported specific foregone activities, work and physical activities were most commonly affected (38.3%), followed by dietary restrictions (30.0%) and social and leisure activities (29.1%). Dietary restrictions showed the strongest tier gradient, with tertiary patients reporting this at more than twice the rate of primary patients (54.8% vs 28.6%; $p < 0.001$), consistent with the complex dietary management demands of specialist-managed conditions. Categories are not mutually exclusive; the pattern confirms that the economic and social costs of chronic NCD extend well beyond healthcare expenditure into productive capacity.



$\chi^2=9.52$, $p=0.009$. Error bars = 95% Clopper-Pearson exact confidence intervals.
Denominator: carer-only patients who answered the role disruption question (n=320).

*Proportion of patients with an active informal carer whose carer left duties to earn money for the household, by facility tier.
Error bars = 95% Clopper-Pearson exact confidence intervals.*

Figure 2. Carer role disruption by healthcare facility tier

Figure 2 shows that the tier gradient in carer role disruption is clinically coherent and statistically robust: 77.6% of carers at tertiary facilities had left duties to earn money, compared with 62.1% at primary and 54.9% at secondary ($\chi^2=9.52$, $p=0.009$). The substantially wider confidence intervals at tertiary level (64.7–87.5%) reflect the smaller tertiary carer sample (n=58), but the point estimate is clearly elevated. The secondary tier shows the lowest disruption rate, possibly because secondary facilities attract more patients

with stable ambulatory disease that imposes lighter caregiving demands. Overall, more than three in five carers across all tiers reported role disruption, underscoring the household-level economic externalities of NCD care.

Table 3. Unadjusted and adjusted logistic regression for predictors of high social burden (Model A) and carer role disruption (Model B).

Parsimonious models selected by likelihood ratio test. Model B is restricted to patients with an informal carer (n=320). Full models included age, sex, education, employment, household size, multimorbidity, log OOPE, distress financing, and facility tier.

Note: Model B estimates pending reconfirmation after rerunning with corrected active-carer denominator; interpret with caution.

Predictor	Model A: High social burden (n=480)			Model B: Carer left duties (n=320)		
	UOR	AOR (95% CI)	p	UOR	AOR (95% CI)	p
<i>Distress financing behaviour</i>						
No distress financing (ref)	1.00 (ref)	—	—	1.00 (ref)	—	—
Distress financing: yes (borrowed or sold assets)	2.78***	2.83 (1.86–4.29)	<0.001*	0.98	—	—
<i>Financial exposure intensity</i>						
Log total OOPE (per unit)	1.23*	1.18 (1.02–1.37)	0.027	1.49**	1.39 (1.13–1.70)	0.002
<i>Number of chronic conditions</i>						
Single condition (ref)	1.00 (ref)	—	—	1.00 (ref)	—	—
Two or more conditions (multimorbidity)	1.45	1.40 (0.91–2.15)	0.126	2.13**	2.18 (1.26–3.77)	0.005
<i>Employment status</i>						
Not employed (ref)	1.00 (ref)	—	—	1.00 (ref)	—	—
Employed or self-employed	0.70	0.70 (0.46–1.05)	0.084	0.61	—	—

Age (per additional year)	1.00	—	—	1.01	0.99 (0.97–1.00)	0.150
Model performance statistics						
Sample size (n)	480	480	—	320†	320†	—
Number of events (outcome = 1)	219	219	—	195	195	—
Events per variable (EPV)	54.8	54.8	—	65.0	65.0	—
Area under ROC curve	—	0.650	—	—	0.652	—
Hosmer-Lemeshow p	—	0.624	—	—	0.943	—
LR test vs full model p	—	0.774	—	—	0.389	—

UOR = unadjusted odds ratio. AOR = adjusted odds ratio from parsimonious model.

Exact p-values reported; significance threshold $p < 0.05$

In Model A, distress financing was the dominant predictor of high social burden (AOR 2.83, 95% CI 1.86–4.29; $p < 0.001$), with an adjusted marginal effect of +24.7 pp. Log OOPE also independently predicted high burden (AOR 1.18, $p = 0.027$), confirming a dose-response between financial exposure and social disruption. Employment showed a borderline protective association (AOR 0.70, $p = 0.084$). In Model B, both log OOPE (AOR 1.39, $p = 0.002$) and multimorbidity (AOR 2.18, $p = 0.005$) independently predicted carer role disruption. Model B estimates are pending reconfirmation with the corrected active-carer denominator.

Table 4. Average marginal effects and adjusted predicted probabilities from parsimonious logistic regression models.

Derived from Table 3 parsimonious models. AME = percentage point change in probability of outcome holding all other covariates at observed values. APP = adjusted predicted probability at specified covariate value.

Predictor or subgroup	AME or APP	95% CI	p
Model A- Average Marginal Effects on probability of high social burden			
Distress financing (yes vs no)	+24.7 pp	15.2 to 34.2 pp	<0.001*
Log total OOPE (per unit increase)	+3.8 pp*	0.5 to 7.1 pp	0.024
Two or more conditions vs single condition	+7.8 pp	–2.1 to 17.5 pp	0.122
Employed or self-employed vs not employed	–8.3 pp	–17.5 to 1.0 pp	0.080
Model A- Adjusted Predicted Probability by distress financing status			

No distress financing	38.2%	33.0 to 43.4%	—
Distress financing (yes)	63.6%	55.4 to 71.8%	<0.001
<i>Model A- Adjusted Predicted Probability by multimorbidity status</i>			
Single condition	43.3%	37.9 to 48.6%	—
Two or more conditions	51.7%	42.4 to 60.9%	0.126
<i>Model A- Adjusted Predicted Probability across financial exposure levels</i>			
Low OOPE (log=8.0, ≈NGN 3,000 (≈USD 1.88))	35.8%	26.5 to 45.2%	—
Moderate-low (log=9.5, ≈NGN 13,360 (≈USD 8.35))	41.8%	36.1 to 47.5%	—
Moderate-high (log=11.0, ≈NGN 59,900 (≈USD 37))	47.9%	42.9 to 53.0%	—
High OOPE (log=12.5, ≈NGN 268,300 (≈USD 168))	54.2%	45.4 to 63.0%	—
<i>Model B- Average Marginal Effects on probability of carer leaving duties (n=320)</i>			
Two or more conditions vs single condition	+16.8 pp	5.8 to 27.9 pp	0.003
Log total OOPE (per unit increase)	+7.3 pp*	3.0 to 11.5 pp	0.001*
Age (per additional year)	-0.26 pp	-0.61 to 0.09 pp	0.145
<i>Model B- Adjusted Predicted Probability by multimorbidity status</i>			
Single condition	56.4%	49.8 to 63.0%	—
Two or more conditions	73.8%	64.6 to 83.0%	0.003
<i>Model B- Adjusted Predicted Probability across financial exposure levels</i>			
Low OOPE (log=8.0, ≈NGN 3,000 (≈USD 1.88))	41.0%	27.5 to 54.4%	—
Moderate-low (log=9.5, ≈NGN 13,360 (≈USD 8.35))	53.1%	45.4 to 60.8%	—
Moderate-high (log=11.0, ≈NGN 59,900 (≈USD 37))	64.8%	59.0 to 70.6%	—
High OOPE (log=12.5, ≈NGN 268,300 (≈USD 168))	75.0%	66.3 to 83.8%	—

Starred APPs indicate the margin differs significantly from the reference group. OOPE values are approximate: log 8.0 ≈ NGN 3,000 (≈USD 1.88); log 9.5 ≈ NGN 13,360 (≈USD 8.35); log 11.0 ≈ NGN 59,900 (≈USD 37); log 12.5 ≈ NGN 268,300 (≈USD 168).

Table 4 shows that the adjusted probability of high social burden rose from 35.8% at the lowest OOE level to 54.2% at the highest- an 18.4 pp gradient. Among distress financing users, adjusted probability was 63.6% versus 38.9% (+24.7 pp; 95% CI 15.2–34.2 pp). For carer role disruption, the OOE gradient was steeper (+34.0 pp), and multimorbid patients had an adjusted probability of 73.8% versus 57.0% (+16.8 pp; 95% CI 5.8–27.9 pp). These margins confirm that financial hardship and disease complexity jointly and independently amplify both patient social burden and carer role disruption.

Table 5. Total household indirect productivity burden: patient and carer productive days lost and estimated indirect cost

All indirect costs are estimated at NGN 2,333 per day (USD 1.46) (national minimum wage). Combined household estimates are based on n=173 patients with complete data for both patient missed workdays and carer days off productive work.

Productivity burden metric	n	Primary	Secondary	Tertiary	Mean (SD)	Total (sum)
<i>Patient productivity loss due to illness in the past 30 days</i>						
Patients missed workdays	480	4.94	5.20	3.53	4.84 (9.09)	2,321 days
Estimated indirect cost at NGN 2,333 per day (USD 1.46)	480	NGN 11,519 (USD 7.20)	NGN 12,141 (USD 7.59)	NGN 8,224 (USD 5.14)	NGN 11,281 (USD 7.05) (SD NGN 21,212 / USD 13)	NGN 5,414,893 (USD 3,384)
<i>Carer productivity loss due to patient illness- among n=173 with complete data</i>						
Carer days off productive work	173	5.3	7.1	5.9	6.3 (7.5)	1,092 days
Estimated indirect cost at NGN 2,333 per day (USD 1.46) (primary estimate)	173	NGN 12,285 (USD 7.68)	NGN 16,610 (USD 10)	NGN 13,724 (USD 8.58)	NGN 14,726 (USD 9.20) (SD NGN 17,474 / USD 11)	NGN 2,547,636 (USD 1,592)
Estimated indirect cost at NGN 5,000 per day (≈USD 3.12) (sensitivity estimate)	173	—	—	—	—	NGN 5,460,000 (USD 3,412)
<i>Combined household productivity burden- n=173 with complete data for both patient and carer</i>						
Total productive days lost per household	173	12.5	15.2	12.8	14.0 (15.1)	2,419 days

Total household indirect cost, primary estimate	173	NGN 29,199 (USD 18)	NGN 35,528 (USD 22)	NGN 29,780 (USD 19)	NGN 32,622 (USD 20) (SD NGN 35,145 / USD 22)	NGN 5,643,527 (USD 3,527)
Total household indirect cost, sensitivity estimate	173	—	—	—	—	~NGN 12,000,000 (≈USD 7,500)

Table 5 shows that household indirect productivity loss was substantial in this study. Patients missed a mean of 4.84 productive days in the preceding 30 days. Among patients with complete carer-days data, carers lost a mean of 6.3 productive days; tertiary-level carers showed complete absenteeism (100.0% with at least one day off). Among the 173 patients with complete data for both patient missed workdays and carer days off, the mean combined household productive days lost exceeded two working weeks per month (mean 14.0 days; total 2,419 days). At the national minimum wage of NGN 2,333 per day (USD 1.46), total household indirect cost was NGN 5,643,527 (USD 3,527) across the subsample (mean NGN 32,622 [USD 20] per household)- an indirect economic burden invisible to out-of-pocket expenditure analyses.

Discussion

This study shows that the burden of chronic NCD care among adults attending public-sector facilities in Lagos extends beyond catastrophic health expenditure and travels along two largely distinct patient-household pathways. Almost half of patients (45.6%) carried what we operationalized as high social burden, with comprehensive capability deprivation concentrated among those who had borrowed for treatment or sold household assets- a pattern that aligns with what Sen and Nussbaum describe as the conversion of resource shocks into restrictions of substantive freedom¹⁴⁻¹⁶. Two-thirds (67.3%) of patients depended on an informal carer, six in ten of whom had at some point left caring duties to earn for the household; and the strongest determinant of that carer-side role disruption was not financial exposure but disease complexity. When read in concert, our study alludes to the fact that financial shock and clinical complexity emerged as analytically separable engines of household welfare loss- the first translated through the patient's diminished social participation, the second through the carer's diminished labour-market presence. Reframing chronic-illness burden as a household-level rather than purely patient-level phenomenon, and recognising that its non-financial weight is co-extensive with but not reducible to just its out-of-pocket weight, is the contribution this analysis makes to the Nigerian and broader sub-Saharan NCD literature.

The breadth of social and lifestyle disruption is the feature that warrants comment at the outset. All four domains including: affordability of basic needs, maintenance of lifestyle, social participation, and leisure were endorsed by close to half of patients, and 30.2% of the sample reported burden in every domain simultaneously. The bimodal distribution of the composite score (27.1% at zero, 30.2% at four) indicates that chronic illness in this setting does not produce a smooth gradient of capability loss; it sorts households into those who are largely insulated from welfare consequences and a larger subgroup whose lives are comprehensively reshaped by the disease and the response to it. Within that pattern, two domains traced a clear facility-tier gradient: reduced social participation rose from 39.4% at primary to 67.5% at tertiary facilities, and leisure abandonment from 40.6% to 67.5%. The most parsimonious reading is that these gradients reflect the more severe and longer-duration disease profile of patients who reach tertiary care,

together with the older age structure at that tier. Affordability of basic needs and lifestyle maintenance difficulty, by contrast, did not vary by tier; they appear to operate as a floor-level constraint, present wherever chronic NCDs are present, irrespective of where care is sought.

Against that descriptive backdrop, the regression result in this study that demands the closest attention is the dominance of distress financing over every other patient-level exposure in shaping comprehensive social burden. The adjusted predicted probability of being in the high-burden group was 63.6% among patients who had borrowed or sold assets, against 38.2% among those who had not- a 24.7 percentage-point gap that exceeded the contributions of facility tier, log out-of-pocket expenditure, employment, and multimorbidity combined. The mechanisms that plausibly link the act of distress financing to the patient's diminished social life are not exotic: resources diverted to debt service or asset replacement leave less for adequate nutrition, transport for social contact, or the small expenditures on which leisure depends; indebtedness itself generates stress and stigma that constrain social participation; and the depletion of saleable assets removes the household's traditional cushion against the next shock.⁴¹⁻⁴³ The implication is that out-of-pocket expenditure and distress financing are not interchangeable indicators of financial strain. Out-of-pocket expenditure is the dose; distress financing is the response, and the response is what tracks the social welfare consequence. The distinction matters analytically because the catastrophic-expenditure literature in this region has historically used OOPE thresholds as the proximal indicator of financial hardship,⁶⁻¹⁰ whereas the result here suggests that whether households are pushed into distress coping is the more proximate correlate of capability loss.^{42,43}

The thematic structure of foregone activities adds clinical texture to that finding. Work and physical-activity restrictions dominated overall (38.3% of patients with substantive responses) and were concentrated at secondary facilities, where the demographic skew toward middle-aged, economically active patients made labour displacement the most visible form of capability loss. Dietary restrictions, by contrast, were strongly concentrated at tertiary level (54.8% vs 28.6% primary and 21.7% secondary), a pattern that mirrors the complex management regimens demanded by the conditions managed at that tier- diabetes with end-organ complications, chronic kidney disease and dialysis, and advanced heart failure- and reflects the disease-severity differential rather than behavioural choice, in keeping with documented evidence on diabetes-management demands among Nigerian patients.⁴⁸ The social-leisure restriction was significantly elevated among patients with catastrophic expenditure (32.9% vs 16.7%, $p=0.021$), reinforcing the broader signal that financial constraint and social disengagement co-vary at the level of the individual case and not solely at the population level.

The caregiving findings recast the burden in household economic terms. Two-thirds of patients had an informal carer, and the family-based structure of that care was uniform across the public health system: children (46.4%) and spouses (33.5%) accounted for four in five carer relationships, with paid carers under 4%. Carer presence was lower at primary facilities (55.0% vs 73.8% at secondary and 72.5% at tertiary), consistent with the lower acuity managed at primary level and with patterns of variation in catastrophic health expenditure across facility tiers documented in comparable Nigerian public-sector settings.^{6,11} Six in ten carers had at some point left caring duties to earn money for the household, rising to 77.6% at tertiary level. This is a defining feature of informal care in sub-Saharan Africa that the regional literature has repeatedly documented, and our results reproduce it in a Lagos public-facility sample: caregiving and earning are not stable parallel activities but compete acutely for the carer's time and labour.²⁶⁻²⁹ The translation into household economics is substantial. Carer absenteeism reached three-quarters of carers in

the past month, with a mean of 6.3 lost workdays per carer; valued at the statutory minimum wage- a deliberately conservative anchor³⁸⁻⁴⁰- the carer-side opportunity cost averaged NGN 14,726 (USD 9.20) per patient over 30 days, and the combined patient-and-carer household productivity loss reached 14 days per month, more than two working weeks invisible to any analysis confined to out-of-pocket expenditure. The magnitude is congruent in directionality with - and exceeds- the time-cost burden documented in rural Tanzania for chronic-disease access by Verjans and colleagues,¹⁸ a divergence attributable to the more intensive treatment regimens managed at urban tertiary facilities and to the older patient profile in the present sample.

The cleanest analytical signal in the regression results concerned the determinants of patient-side versus carer-side burden. In the patient-burden model, distress financing was the dominant predictor and multimorbidity did not reach significance; in the carer-burden model, multimorbidity was the dominant predictor (adjusted +16.8 percentage points; predicted probability 73.8% vs 56.4%) and distress financing was non-significant. Log out-of-pocket expenditure contributed independently in both models. The reading we propose to this result- and the one most consistent with the regional evidence on chronic-care demands and family-labour reallocation²⁶⁻²⁹ - is that the demands of multimorbid disease (including more frequent appointments, more complex medication and dietary regimens, episodic acute decompensations requiring carer presence) fall on the carer's available labour time before they fall on the patient's social participation, while distress financing imposes a different signature on the patient's capability set through resource depletion and the social consequences of indebtedness. The two pathways are not entirely independent- log OOPE pulls in both directions- but the dominant determinant on each side of the household is different, and any framework that attempts to capture chronic-illness burden through a single composite risks averaging away the structural feature of greatest policy interest.

However, one interpretive caution here warrants explicit engagement. Distress financing and out-of-pocket expenditure are not analytically orthogonal: distress financing is in part endogenous to OOPE, since borrowing and asset sale are themselves coping responses to the size of the bill. Flores and colleagues' work on coping-adjusted catastrophic expenditure demonstrates that conventional OOPE thresholds can simultaneously overstate the risk to current consumption- because coping smooths the immediate shock- and thus understate the long-run burden, because the coping debt has to be serviced.⁴⁹ The regression result- distress financing dominant, log OOPE significant- is consistent with that two-sided pattern and does not require an interpretation in which the two indicators capture wholly distinct exposures; what it does require is that distress financing carries information about the social welfare consequence of the financial event that the OOPE level alone does not.

When read alongside wider sub-Saharan evidence, these findings sharpen rather than supplant what regional literature has been describing. Catastrophic-expenditure analyses have charted the financial transmission of chronic NCDs into household poverty across LMIC settings with increasing precision^{7-9,12}; psychosocial and quality-of-life studies in Ghana and South-West Nigeria have documented the social withdrawal and lifestyle curtailment that travel alongside it;^{13,19} and systematic-review evidence on caregiver burden in sub-Saharan Africa has established that informal care is delivered overwhelmingly by family members at substantial cost to their own labor and wellbeing,²⁶ a pattern reproduced in Nigerian hospital-based caregiver assessments.²⁷⁻²⁹ What the present results add- and what is consequential for Nigerian and comparable LMIC policy environs- is the disaggregation of household-level chronic NCD burden into two pathways whose drivers are different and whose policy responses must therefore be

different. Catastrophic health expenditure captures the financial transmission of illness into household poverty, but it does not fully capture how households absorb, redistribute, and live with that shock. Distress financing on the other hand translated financial exposure into materially worse welfare outcomes for patients, suggesting that the same out-of-pocket expenditure level may carry different consequences depending on whether households are forced into borrowing or asset sale. Disease complexity, meanwhile, drove a parallel labour cost on informal carers through role disruption and productive days lost, a burden that remains invisible to measures built around the patient's expenditure alone. For Nigeria, where the 2022 National Health Insurance Authority Act⁵⁰ is now being operationalised against a baseline of 85.8% uninsurance in the public-facility population reported here and prior Nigerian evidence that the former National Health Insurance Scheme offered incomplete household protection against catastrophic health expenditure,⁵¹ the consequence is concrete: financial protection that addresses only the expenditure event will leave a substantial proportion of the welfare cost untouched. In comparable LMIC settings across West and East Africa, and the lower-middle-income strata of South and Southeast Asia where informal care is family-based and where social-protection coverage of carers is minimal, the implication is structurally identical- the welfare cost of chronic NCDs is not a property of the patient's wallet alone but of the household's combined financial coping and labour reallocation, and a policy architecture that measures only the first will misrepresent the size of the problem and underspecify the solution.

Policy Implications

Three policy implications follow from the patterns identified in this study, which are interlocking rather than additive. The dominance of distress financing as a predictor of social burden implies that the welfare-protection rationale for expanding prepayment mechanisms extends beyond preventing catastrophic health expenditure. It is not enough to prevent households from incurring debilitating medical bills; what the present results suggest is that it is also necessary to prevent them from being forced into borrowing and asset sale that, in themselves, produce social and capability harms. Systematic-review evidence on community-based health insurance uptake in low- and middle-income countries identifies trust, perceived benefit relevance, premium affordability, and enrolment-process simplicity as the dominant determinants of voluntary participation,⁵² and any expansion in Lagos or comparable settings will need to engage those determinants seriously rather than treat insurance design as a purely actuarial problem.⁵³

Furthermore, the indirect-cost finding implies that a credible account of household welfare in this setting must include carer time, and that any economic evaluation of NCD interventions that omits carer productivity losses will systematically understate the case for prevention and for chronic-disease management programmes that reduce caregiving intensity. The WHO Guide to Identifying the Economic Consequences of Disease and Injury makes precisely this argument,³⁹ and recent methodological work by Mennini and Gitto draws attention to the methodological pluralism that is now possible- from human-capital and friction-cost approaches to revealed and stated preference techniques- each with implications for the size of the estimate and for what counts as a defensible counterfactual.⁴⁰ In settings such as Lagos, where formal labour markets are thin, even minimum-wage valuations of carer time disclose substantial losses; alternative valuations would disclose more. Embedding a brief carer-productivity module within routine NCD clinic encounters would generate the kind of population estimates needed to size carer-focused interventions, and would do so at minimal marginal cost.

Moreover, the separation of pathways predicting patient social burden and carer role disruption implies that single-instrument policy designs are unlikely to be sufficient. Multimorbidity is associated with carer

burden but not with patient social burden, whereas distress financing is associated with patient social burden but not with carer role disruption. Integrated chronic-care models that pair consolidated multimorbidity management- aimed at reducing the frequency and complexity of clinic visits- with anti-distress-financing instruments such as emergency health-financing facilities, conditional fee waivers for chronic-disease patients, or expanded prepayment would address both pathways at once. The Innovative Care for Chronic Conditions framework articulated by WHO two decades ago anticipates this integrated approach²², and the present findings supply Nigerian quantitative support for its continued relevance.

Limitations

The cross-sectional design of this study supports prevalence estimation and adjusted association but cannot establish the directionality of the relationships at the heart of the study. Distress financing, social burden, and carer role disruption are likely to co-determine one another over the trajectory of chronic illness, and a longitudinal design would be required to resolve which precedes which and over what time horizon. Three further constraints temper the interpretation in this study. The caregiving variables herein were reported by the patient rather than the carer, and the absence of direct carer interviews means that subjective dimensions of caregiver strain documented in the regional literature²⁶⁻²⁸- emotional, psychological, and relational burden are not captured in this analysis. Besides, the valuation of carer time at the statutory minimum wage is conservative by design: it is justified by the absence of an established market for paid domestic care in this setting and is consistent with the human-capital framework,^{38,39} but it almost certainly understates the foregone earnings of carers in skilled or self-employed work, and the sensitivity estimate at NGN 5,000 (~USD 3.12) per day should be read as a lower-bound urban adjustment rather than a definitive upper bound. Moreover, the sample was drawn from public-sector facilities in a single megacity and weighted toward secondary facility tier; it does not represent patients receiving care exclusively through the private sector, the substantial uninsured fraction not currently engaging with the formal system, or rural Nigerian populations, where transport burden, distance to facilities, and the structure of household labour differ materially. The foregone-activities denominator (n=227) included only patients who provided substantive open-text responses, which may have produced a more articulate or more activity-disrupted subsample than the full study population.

Conclusion

The total burden of chronic NCDs in this Lagos public-sector sample extends beyond catastrophic health expenditure and is best understood as a coupled patient-household phenomenon in which financial hardship, social and lifestyle disruption, and informal caregiving losses are co-produced rather than merely co-occurring. In this study half of patients experienced disruption across three or more dimensions of everyday life; two-thirds depended on an informal carer whose own productive time was being depleted; and the typical household lost more than two working weeks of productive labor each month to illness and care. Distress financing dominated the determinants of patient social burden; multimorbidity dominated the determinants of carer role disruption- distinct pathways that nonetheless converge on a single household experience of welfare loss. These findings argue for a financial-protection and chronic-care agenda that goes well beyond the prevention of catastrophic expenditure to include the active mitigation of distress financing, the integrated management of multimorbid disease, and the explicit valuation of carer time in economic evaluation. Pursued together, these measures would begin to address the welfare losses that

chronic illness imposes on Lagos households- losses that, until now, have been hidden by the disciplinary boundaries of cost-of-illness measurement.

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