

Prevalence of Non-Communicable Diseases among People living with HIV on Antiretroviral Therapy in Enugu, Southeast Nigeria

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Abstract

Human Immunodeficiency Virus remains a global public health concern, with over 91.4 million people affected worldwide and 3.2 million in Nigeria. While lifelong Antiretroviral Therapy (ART) has improved survival, concerns persist about its link to non-communicable diseases (NCDs). This study investigated the prevalence of NCDs and associated risk factors among People Living with HIV (PLHIV) on ART in Enugu, Southeast Nigeria. A hospital-based cross-sectional design was employed to abstract socio-demographic and clinical data from adult PLHIV (≥ 18 years). Data were analyzed using IBM SPSS Statistics 25, with results presented as frequencies, percentages, and mean $\pm$ standard deviation. Adjusted odds ratios and p -values ≤ 0.05 at 95% confidence interval were used to test associations. Hypertension (17%) was the most prevalent NCD, followed by obesity (13%) and diabetes (1.3%). Socio-demographic analysis showed most participants were aged 41–60 years, married, educated at the secondary level, and employed. Females were significantly associated with higher prevalence of hypertension and obesity ($p < 0.05$). Age, marital status, education, and occupation predicted NCD onset. The study concludes that hypertension is a leading NCD among PLHIV in Enugu and a major risk factor for cardiovascular diseases. Integrating routine screening into HIV services and engaging policymakers to institutionalize preventive interventions are recommended to improve the quality of life of PLHIV.

Keywords: Antiretroviral Therapy, Human Immunodeficiency Disease, Non-Communicable Diseases, People Living with HIV (PLHIV), Predictors, Prevalence.

Introduction

The advent of Antiretroviral Therapy (ART) has transformed HIV from a fatal disease to a manageable chronic condition, significantly extending the lifespan of People Living with HIV (PLHIV). However, this increased longevity has brought to light a new set of health challenges, prominently among them the rising incidence of Non-Communicable Diseases (NCDs) [1]. NCDs, which include cardiovascular diseases, diabetes, cancers, and chronic respiratory diseases, are now a leading cause of morbidity and mortality globally, and PLHIV on ART are particularly susceptible to these conditions [1, 2].

The prevalence of non-communicable diseases (NCDs) has been discovered to vary across different populations and sub-groups; a study conducted in Ghana found the overall prevalence of selected NCDs to be 26.7%, with hypertension being the most common at 22.7% [3]. A large study in Qatar found out approximately 16% of the total population had one or more NCDs. The age-adjusted prevalence rates per 1000 population were: Coronary Heart Disease (CHD) 16, stroke 1, Peripheral Vascular Disease (PVD) 0.3, cancers 6.1, chronic obstructive pulmonary diseases (COPD), and type 2 diabetes 201.4. [4]. Another study conducted among university employees in India indicated that the overall

prevalence of NCDs was found to be 10.15% with the prevalence of diabetes, cardiovascular diseases and hypertension at 7.2%, 3.2% and 17% respectively [5]. In Nigeria, the prevalence of hypertension, diabetes and dyslipidemia was found to be 35.3%, 4.6%, and 10.3% respectively [6, 7].

Furthermore, several studies have reported the prevalence of non-communicable diseases (NCDs) among people living with HIV (PLHIV) on antiretroviral therapy (ART); A study conducted in Busia County, Kenya, the overall prevalence of NCDs among PLHIV was high, with hypertension being the most common at 73.3%, followed by arthritis at 15.6% [8]. In Kagera, Tanzania, 57.8% of PLHIV on ART reported having at least one NCD, with arthritis being the most common (57.8%) [9]. A study conducted among key population living with HIV on ART in Kenya, found the prevalence of NCDs to be 18.3% [10]. Another study in Cambodia reported a prevalence of 23.9% NCDs among PLHIV with hypertension being the most common [11]. In Nigeria, a study conducted in Makurdi found the prevalence of NCDs among PLHIV on ART to be 17.7%, with hypertension affecting 15.5% and diabetes mellitus affecting 1% [12].

The risk factors associated with Non-Communicable Diseases (NCDs) among People Living with HIV (PLHIV) on Antiretroviral Therapy (ART) are multifaceted and can be broadly categorized into biological, lifestyle, and socio-economic factors [13-16]. The long-term use of ART, while crucial for managing HIV, has been associated with metabolic side effects such as dyslipidemia, insulin resistance, and changes in body fat distribution [17-21]. These side effects contribute to the heightened risk of developing NCDs among PLHIV. Furthermore, the persistent immune activation and chronic inflammation resulting from HIV infection, even when controlled, exacerbate the risk of NCDs [22, 23]. Lifestyle factors also play a significant role. Unhealthy dietary habits,

physical inactivity, smoking, and excessive alcohol consumption are prevalent among PLHIV and further elevate the risk of NCDs [24, 25]. Socioeconomic factors, including poverty, lack of education, and limited access to healthcare, compound these risks by hindering effective disease management and prevention efforts [26]. In Enugu, Southeastern, Nigeria, as in many other regions, the intersection of HIV and NCDs presents a complex healthcare challenge. Limited studies have been conducted to explore factors associated with non-communicable diseases among PLHIV on ART, especially in Nigeria. This study aims to explore the prevalence and predictors of NCDs among PLHIV on ART in Enugu State and to identify effective interventions to manage and prevent these conditions. By examining the interplay between HIV and NCDs and assessing current healthcare practices and community-based interventions, the research seeks to provide insights that can inform policy and improve healthcare delivery for this vulnerable population.

Materials and Methods

Study Design

This study employed a hospital-based cross-sectional study design to investigate prevalence and risk factors of non-communicable diseases (NCDs) among people living with HIV (PLHIV) of age ≥ 18 yrs on Antiretroviral Therapy (ART) in Enugu, Southeast Nigeria.

Study Area

Enugu State, located in the southeastern region of Nigeria (Latitude: 6.5° N and Longitude: 7.5° E), is a significant economic, geographical, and socio-economic hub. The state's economy is primarily driven by agriculture, with major crops including cassava, yams, and cocoa. Additionally, Enugu State is known for its rich mineral deposits, including coal, iron ore, and limestone, which contribute to its industrial and manufacturing sectors. The

state's strategic location along the major transportation routes of the East-West Highway and the Enugu-Umuahia-Port Harcourt Expressway makes it an important commercial center, facilitating trade and commerce within the region [27].

Geographically, Enugu State is characterized by a tropical savanna climate. The state's topography is marked by the presence of several rivers, including the Anambra and the Niger, which provide water resources for irrigation, drinking, and other uses. As well as characterized by its rolling hills, plateaus, and valleys, with an average elevation that provides a cooler climate compared to the tropical regions of Nigeria, it is bounded to the north by Kogi and Benue States, to the south by Abia State, to the east by Ebonyi State, and to the west by Anambra State. Furthermore, Enugu State's proximity to the Atlantic Ocean and its coastal cities, such as Port Harcourt, makes it an important link in Nigeria's maritime trade [28].

The health sector in Enugu State is a significant area of focus, with several major hospitals and healthcare facilities, including the University of Nigeria Teaching Hospital (UNTH) in Ituku-Ozalla and the Enugu State University Teaching Hospital (ESUTH) in Parklane. These institutions provide a range of medical services, including primary care, specialist care, and emergency services. The state also has a number of private healthcare facilities, offering additional options for patients. However, the health sector in Enugu State faces significant challenges, including inadequate infrastructure, limited resources, and a shortage of skilled healthcare professionals. These challenges have significant impacts on the health and well-being of the state's population [29, 30].

Socio-economically, Enugu State is characterized by a mix of urban and rural populations, with the state capital, Enugu, being the largest urban center. The urban areas, particularly Enugu City, are bustling with commercial activities, educational institutions,

and cultural events, contributing to a higher standard of living and increased opportunities for residents. Conversely, rural areas predominantly depend on agriculture, with subsistence farming being a common practice. The state's population is predominantly Igbo, with significant minority groups from other ethnic and religious backgrounds. The state's socio-economic profile is marked by a relatively high level of poverty, with many residents relying on subsistence farming and informal employment. However, the state is also home to a growing middle class, with increasing access to education, healthcare, and other social services. Administratively, the state is divided into three senatorial zones and seventeen Local Government Area [31, 32].

Study Site

The study was conducted in randomly selected health facilities providing HIV care and treatment in Enugu, Southeast Nigeria. Enugu State was randomly selected amongst five states that form the Southeastern region of Nigeria.

Study Population

The study was conducted among People living with HIV (PLHIV) age ≥ 18 yrs, initiated on ART in Enugu State, Nigeria.

Sample Size Determination

The estimated number of mothers recruited for the study was determined using the sample size formula for estimation of single proportion.

$$N = \frac{Z^2 pq}{d^2}.$$

Where $Z = 1.96$ (standard normal deviate); $p = 50\% = 0.50$ (assumed prevalence of NCDs among PLHIV in South East Nigeria), $q = 1-p$; and $d =$ Level of precision set at 0.05 (95% confidence interval)

$$N = ((1.96)^2 * 0.5 * 0.5) / 0.05^2$$

$$N = 384.16.$$

$$\text{Non-response rate} = \frac{n}{1-Q}.$$

$Q =$ proportion of non-response = 10%

$$\begin{aligned}
 \text{Non-response rate} &= \frac{n}{1 - \left(\frac{10}{100}\right)} \\
 &= \frac{384}{1 - \left(\frac{10}{100}\right)} \\
 &= 426.6.
 \end{aligned}$$

Therefore, final sample size was approximated to be equal to 427.

Sampling Procedure

Multi-stage sampling technique was employed to select Local Government Areas (LGAs), health facilities and eligible clients that took part in the study. The three stages of sampling are further delineated below:

Stage 1

The State was clustered into 3 areas based on the senatorial zones (see Table 1).

Table 1. Distribution of LGAs Per Each Senatorial in Enugu, Southeast Nigeria

S/N	Local Govt. Area	Senatorial Zone
1	Igbo-Eze North	Enugu North
2	Igbo-Eze South	
3	Igbo-Etiti	
4	Nsukka	
5	Uzo-Uwani	
6	Udenu	
7	Enugu East	Enugu East
8	Enugu North	
9	Enugu South	
10	Nkanu East	
11	Nkanu West	
12	Isi-Uzo	
13	Aninri	Enugu West
14	Awgu	
15	Ezeagu	
16	Oji River	
17	Udi	

A sample frame of all Local Government Area in each senatorial zone was obtained after which proportional allocation was utilized to

calculate the number of LGAs that will be selected from each of the Senatorial zones in the study area. This is illustrated in Table 2.

Table 2. Proportional Allocation of LGAs to be Selected in Each Political Zone

Political Zones	Number of LGAs in each Zone	number of LGAs to be selected from each zone (Proportional Allocation)
Enugu North	6	$\left(\frac{6}{17}\right) * 5 = 2$
Enugu East	6	$\left(\frac{6}{17}\right) * 5 = 2$

Enugu West	5	$\left(\frac{5}{17}\right) * 5 = 1$
TOTAL	17	5

Simple random sampling technique was used to select the LGAs where the study will be conducted.

Two (2) LGAs were randomly selected from Enugu North and Enugu East Senatorial zones while one (1) LGA was randomly selected from Enugu West Senatorial zone respectively, using proportional allocation as illustrated in Table 2.

Eligibility Criteria

Inclusion Criteria

The following inclusion criteria was used to select eligible participants for the purpose of achieving the research objectives.

1. People living with HIV (PLHIV) aged ≥ 18 years and are currently engaged in HIV and care and treatment at the time of the study.
2. People living with HIV (PLHIV) who have been on ART for at least six months and actively engaged in HIV and care and treatment at the time of the study.
3. People living with HIV (PLHIV) on HIV Care and treatment who are willing to participate and provide informed consent.

Exclusion Criteria

The following exclusion criteria were used to exclude ineligible participants from the study.

1. People living with HIV (PLHIV) who are not on ART.
2. People living with HIV (PLHIV) who are below 18 years of age.
3. People living with HIV (PLHIV) on HIV care and treatment who do not consent to participate in the study.

Instrument for Data Collection

A medical health informatics script was designed and used to retrieve client level information of study participants from the hospital based electronic medical records

(EMR). Clinical chart abstraction was carried out to obtain clinical, socio-demographic, NCDs records and treatment information of study participants not originally captured on the EMR.

Data Collection Method

Data was collected using Research assistants were recruited across the randomly selected facilities to work in the study. A 2-days training session was conducted for members of the research team prior to field visit. This was done to acquaint them with the objectives, data instruments and methodology. The process was facilitated by the lead researcher and trained health educators with sound knowledge of the subject matter.

Data Management and Analysis

Data was entered into and analyzed using IBM SPSS Statistics 25 software. Continuous variables were summarized as mean $\pm$ standard deviation if normally distributed; otherwise, median and range were presented. The hypotheses were tested using ordinal regression model and p values less than or equal to 0.05 were considered significant at 95% confidence interval.

Ethical Considerations

Ethical approval was obtained from the Enugu State Ministry of Health Ethical Review Committee and permission was granted by the Hospital management of the selected health facilities where the study took place. Informed consent was obtained from individual study participants, explaining that the study could be terminated at any time the participant opted out while ensuring confidentiality, anonymity, privacy and security of the participants' information. Furthermore, participation in the study was made strictly voluntary without any form of coercion.

Results

Prevalence of NCDs among PLHIVs

In this study, 5015 out of 8182 patients in the abstracted data had any evidence of NCD in their HIV clinical record signifying a weighted total percentage of 76.96% (95% CI: 68.33 – 79.19) as shown in Table 3. No significant difference was observed in the proportion of prevalence among the PLHIVs presenting with different NCD type in the study population ($\chi^2 = 3.321$, $p > 0.205$). The prevalence of

hypertension among PLHIVs on ART was observed to be 17% (95% CI: 12.72 – 25.83) while prevalence for diabetes and obesity was shown to be 1.27% (95% CI: 1.15 – 2.03) and 13.35% (95% CI: 10.78 – 29.71) respectively with the highest prevalence observed for cervical cancer at 40.87% (95% CI: 30.75 – 47.92) and an overall prevalence of NCDs comorbidity in PLHIVs on ART to be 72.49% although no significant difference ($\chi^2 = 5.35$, $p > 0.617$) was observed in the prevalence distribution.

Table 3. Prevalence of NCDs among PLHIVs on ART in Enugu, Southeast Nigeria

NCD	Frequency	Prevalence (95% CI)	No on ART	Prevalence (95% CI)
Hypertension	1144	13.98 (10.59 – 17.93)	853	17.00 (12.72 – 25.83)
Diabetes	81	0.98 (0.85 – 3.47)	64	1.27 (1.15 – 2.03)
Obesity	910	11.12 (9.07 – 13.23)	670	13.35 (10.78 – 29.71)
Cervical cancer	2880	50.88 (32.3 – 59.97)	2050	40.87 (30.75 – 47.92)
Total	5015	76.96	3637	72.49
$\chi^2 = 3.321$, $p > 0.205$			$\chi^2 = 5.35$, $p > 0.617$	

Distribution of NCDs among PLHIVs on ART in Enugu, Southeast Nigeria

The distribution of NCDs among PLHIVs is presented in Table 4. From the study population, it was observed that out of 8182 records of PLHIVs, 1144 individuals representing 13.98% (95% CI: 11.05 – 15.27) of the total study sample size had hypertension with 16.47% (95% CI: 13.47 – 19.93) on ART and 9.68% (95% CI: 7.65 – 11.14) not on ART. These values were shown to be not statistically significant ($p = 0.32$) between subjects on ART and not on ART. Similarly, 0.98% (95% CI: 0.71 – 1.12) of the 8182 records were shown to have diabetes representing 81 individuals of study participants with 1.23% (95% CI: 0.83 – 1.48) on ART and 99.43 (95% CI: 86.54 – 104.53) not on ART. This was also observed to be not statistically significant ($p = 0.15$). Likewise, 11.12% (95% CI: 9.92 – 14.95)

representing 910 individuals were observed to present with obesity among the study participants with 12.94% (95% CI: 9.87 – 14.93) being on ART and 7.98% (95% CI: 5.63 – 10.91) not on ART indicating a statistically insignificant difference ($p = 0.10$). However, statistical difference ($p = 0.032$) was observed between those on ART and not on ART among PLHIVs who did not present obesity as an NCD in the study population. Approximately half of the study population (50.88%: 95% CI: 35.92 – 54.13) representing 2880 participants of the 5660 female participants presented with cervical cancer as an NCD. In addition, 54.69% (95% CI: 48.32 – 55.67) were on ART while 43.41% (95% CI: 37.65 – 48.91) of those who had cervical cancer were found not to be on ART. This was, however, found to be statistically significant ($p = 0.007$) at 95% confidence interval.

Table 4. Distribution of NCDs among PLHIVs on ART in Enugu, Southeast Nigeria

NCD	Total	% (95% CI)	No on ART	% On ART (95% CI)	Not on ART	% Not on ART (95% CI)	p-value
Hypertension (N = 8182)							
No	7038	86.01 (78.94 – 90.51)	4324	83.52 (78.67 – 91.02)	2714	90.31 (87.81 – 94.22)	0.205
Yes	1144	13.98 (11.05 – 15.27)	853	16.47 (13.47 – 19.93)	291	9.68 (7.65 – 11.14)	0.320
Diabetes (N = 8182)							
No	8101	99.01 (95.87 – 104.38)	5113	98.76 (89.51 – 102.56)	2988	99.43 (86.54 – 104.53)	0.112
Yes	81	0.98 (0.71 – 1.12)	64	1.23 (0.83 – 1.48)	17	0.56 (0.23 – 0.67)	0.150
Obesity (N = 8182)							
No	7272	88.87 (78.03 – 95.11)	4507	87.05 (83.97 – 92.07)	2765	92.01 (87.22 – 96.87)	0.032
Yes	910	11.12 (9.92 – 14.95)	670	12.94 (0.83 – 1.48)	240	7.98 (5.63 – 10.91)	0.10
Cervical cancer (N = 5660)							
No	2780	49.11 (38.17 – 53.94)	1698	45.30 (41.78 – 52.43)	1082	56.58 (47.33 – 59.82)	0.112
Yes	2880	50.88 (35.92 – 54.13)	2050	54.69 (48.32 – 55.67)	830	43.41 (37.65 – 48.91)	0.007

Table 5 below shows the prevalence of NCDs among PLHIVs on ART in the study area disaggregated by gender. It was observed that prevalence of hypertension in males was 35.99% (95% CI: 27.83 – 44.29) while females showed a higher prevalence than males at 64.01% (95% CI: 57.86 – 75.92) shown to be statistically significantly difference at 95% confidence interval ($p = 0.002$). The overall prevalence for diabetes was found to be 1.27% (95% CI: 1.15 – 2.03) with a higher prevalence

for females at 68.75% (59.01 – 76.49) than males at 31.25% (95% CI: 26.89 – 39.30) showing a statistically insignificant difference ($p = 0.072$) at 95% confidence interval. Similarly, obesity had an overall prevalence of 13.35% (95% CI: 10.78 – 29.71) with females observed to have a higher prevalence (77.61% [95% CI: 68.23 – 88.90]) as compared to males (22.38% [95% CI: 17.25 – 28.81]). This was found to be significantly different ($p = 0.001$) at 95% confidence interval.

Table 5. Prevalence of NCDs in PLHIVs on ART in Enugu, Southeast Nigeria, stratified by gender

NCD	Prevalence % (95% CI)	Males % (95% CI)	Females % (95% CI)	p-value
Hypertension	17.00 (12.72 – 25.83)	35.99 (27.83 – 44.29)	64.01 (57.86 – 75.92)	0.002
Diabetes	1.27 (1.15 – 2.03)	31.25 (26.89 – 39.30)	68.75 (59.01 – 76.49)	0.072
Obesity	13.35 (10.78 – 29.71)	22.38 (17.25 – 28.81)	77.61 (68.23 – 88.90)	0.001
Cervical cancer	40.87 (30.75 – 47.92)	-	71.18	-

Discussion

The current study investigated the prevalence and predictors of non-communicable diseases among people living with HIV on ART in Enugu, Southeast Nigeria with the specific objectives of profiling the socio-demographics of the study participants and analyzing risk factors that may be contributory to developing NCDs in the study population and exploring context-specific interventions for mitigating the double burden of HIV and NCD in developing countries. The methodology employed in the current study was a hospital-based cross-sectional study design predicated on data abstracted from EMR of the sampled health facilities in the study area.

Similar cross-sectional studies conducted in Tanzania [33], South Africa [1], Zimbabwe [34] reported that HIV and NCDs are major problems of public health concern in developing countries in line with the findings of this study that there is a prevalence of NCDs as well as risk factors among PLHIVs on ART.

In the current study, prevalence of hypertension, diabetes, obesity and cervical cancer were observed to be 17% (95% CI: 12.72 – 25.83), 1.27% (95% CI: 1.15 – 2.03), 13.35% (95% CI: 10.78 – 29.71) and 40.87% (95% CI: 30.75 – 47.92) respectively indicating a marked prevalence of hypertension in the study population than the other NCDs with an overall prevalence of NCDs comorbidity in PLHIVs on ART of 72.49%. These findings are in consonance with the study of [1] who reported a higher prevalence of hypertension (34.6%) and obesity/overweight (66.7%) and also that of [35] who reported a prevalence of hypertension of 38% in PLHIVs in Cameroon also higher than that observed in this study. Furthermore, females showed higher prevalence for hypertension (64.01% [95% CI: 57.86 – 75.92]), diabetes (68.75% [95% CI: 59.01 – 76.49]) and obesity (77.61% [95% CI: 68.23 – 88.90]) than males in the study. These findings are in contrast to those reported by [1] who observed higher prevalence of

hypertension and obesity in males and females respectively suggesting that females in their study exhibited sedentary lifestyles and indulged in unhealthy dietary patterns. This finding was remarkable among females in the younger age category (18-24). While obesity may have been reported to have protective effects on HIV progression, it has been shown to have serious implications for development of cardiovascular diseases [36]. As women were found to have higher prevalence of NCDs, patients newly initiated on ART are advised not to consume energy-dense or high-calorie foods to avoid risk of developing obesity.

The nexus of a double burden of NCDs and communicable diseases in Africa is not in dispute as reported by [37-39]. The burden of hypertension and related CVDs irrespective of HIV status remains significant [40, 41]. Hypertension was found to be more prevalent in the study as similarly reported by [1, 42]. In this study, women had higher prevalence of hypertension than men, which was found to be in sharp contrast to the study conducted in Kenya where males had a higher hypertension prevalence of 11.2% as compared to 7.4% of females [43]. As suggested by previous studies, hypertension is the leading risk factor for development of cardiovascular diseases in the general population and could be a predisposing risk factor for people living with HIV on ART. With women presenting a higher prevalence of hypertension and other co-morbidities, several risk factors could be contributory ranging from age, gender, marital status, alcohol consumption, tobacco use and consuming unhealthy diets.

Conclusion

The current study findings support the established report that HIV and NCDs are major public health of significant impact in developing countries. This double burden can be addressed by imposing an integrated approach to management of HIV and NCDs in health facilities at both primary, secondary and

tertiary levels of care, which will have context-specific factors affecting the integration [44, 45]. It then can be concluded that there is prevalence of NCDs among PLHIVs on ART and that age and gender are predictors of selected NCDs under study in this work. This invariably suggests an urgent need for health interventions to control risk factors associated with NCD onset in HIV with a view to reducing chronic disease comorbidity. The risk of developing chronic non-communicable diseases is increasingly recognized as a major public health problem in individuals infected with HIV. Based on the findings of the study, the profile of patients infected with HIV and on ART is changing and this will have major implications for clinical care. The ageing HIV-infected population will put new demands on the health-care systems, which will have heavy implications for the health of HIV-infected patients in clinical care.

Conflict of Interest

There is no conflict of interest in this course of this publication.

Recommendations

With the prevalence of NCD indicated among PLHIVs on ART in the study population, it is imperative that urgent steps be taken for proactive interventions ranging from creating awareness of the rising prevalence to institutionalizing public health policies that require integrated screening of risk factors of

NCDs among PLHIVs and advocating lifestyle changes that increase quality of life of affected individuals. Governments as relevant stakeholders owe the bulk of the strategy in increasing awareness and creating enabling environment for policies bordering on NCD reduction among PLHIVs to thrive. Without government's support, these cannot be achieved. Furthermore, non-profit governmental organizations can leverage on the findings of this study to implement interventions that border on mitigating NCD occurrence in PLHIVs on ART. Our study indicates that community programs to reduce NCDs can be more effective if context-specific programs are tailored to existing socio-demographic dynamics and risk factors in mind highlighting the importance of evidence-based research on understanding gender differences in advocating for personalized medicine in PLHIV care.

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