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Socio-Economic and Perceptual Determinants of Street Medicine Use in Brazzaville, Republic of the Congo—January 2024

Arsène Constant Gongault Bany[1], Gilbert Ndziessi[2*], Ange Clauvel Niama[2], Yambaré Anki[2], Ange Antoine Abena[3], Wilfrid Sylvain Nambei[1]

[1]Faculty of Health Sciences, University of Bangui, Bangui, Central African Republic
[2]Faculty of Health Sciences, Marien Ngouabi University, Brazzaville, Republic of the Congo
[3]Denis Sassou N'Guesso University, Brazzaville, Republic of the Congo

Email: gongaultdebany@gmail.com, *ndziessi@yahoo.fr, clauvelniama@gmail.com, yambarel@yahoo.fr, abena_cg@yahoo.fr, wilfrid.nambei@gmail.com

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Abstract

Introduction: The widespread use of street medicines (SM) represents a significant public health concern across Africa. This study aimed to identify the socio-demographic, economic, and perceptual factors associated with SM use in Brazzaville, the capital of the Republic of the Congo. **Methods:** A cross-sectional analytical study was conducted in January 2024, involving 734 individuals across 720 households in Brazzaville. Data were collected using a structured, pre-tested questionnaire through face-to-face interviews. Descriptive statistics, Pearson's chi-square tests, and binary logistic regression were used to explore associations. Analyses were conducted using R software version 4.4.1, with significance set at $p < 0.05$. **Results:** Of all respondents, 88.4% reported using SM. Use was significantly higher among individuals aged 50 and above (60.4%, $p < 0.001$). Although male respondents were slightly more likely to use street medicine, this association was not statistically significant ($p = 0.113$). Participants earning the statutory minimum wage (SMIG) were more likely to use SM (OR = 3.64; 95% CI: 1.18 - 11.20; $p = 0.024$). Traders made up 43.1% of users. Residents of Ouenzé district had higher odds of use (OR = 10.68; $p < 0.001$). A positive perception of SM quality was also strongly associated (OR = 7.81; $p < 0.001$). **Conclusion:** Street medicine use in Brazzaville is widespread and associated with age, gender, income, occupation, residential area, and perception. Urgent measures are needed to improve drug regulation and healthcare access.

Keywords

Street Medicines, Socio-Economic Factors, Brazzaville

1. Introduction

The use of street medicines (SM) constitutes a major public health concern, particularly in developing countries within Sub-Saharan Africa. SM refers to pharmaceutical products sold outside official distribution channels, notably in informal markets or on the streets. Unlike medicines dispensed through regulated healthcare systems, these products are not subject to quality control, safety checks, appropriate storage conditions, or traceability. Their use exposes populations to multiple risks, including therapeutic failure, severe adverse effects, toxicity, inappropriate self-medication, and the growing problem of antimicrobial resistance [1] [2].

Despite these well-documented hazards, the use of SM remains widespread, driven by increasing demand often linked to complex socio-economic realities: poverty, limited health insurance coverage, unequal access to healthcare, and distrust of the formal health system. Studies conducted in several African countries illustrate the scale of this issue: in Nigeria, 17% of medicines on the market are counterfeit, largely due to weak regulatory controls and limited access to genuine medicines in rural areas [3] [4]; in the Democratic Republic of the Congo, over 50% of medicines originate from the informal market, often of questionable quality or poorly stored [5]; in Côte d'Ivoire, so-called "ground pharmacies" are omnipresent in urban centres, selling low-cost but high-risk products to economically vulnerable populations [6].

In Brazzaville, the capital of the Republic of the Congo, this practice is also highly prevalent, affecting a large segment of the population, particularly the most disadvantaged. Barriers to accessing formal healthcare, whether economic, geographical, or structural largely account for this reliance. The high cost of medicines in licensed pharmacies, the remoteness of certain neighbourhoods, overcrowded health facilities, and negative perceptions of the official health system (often seen as inefficient or corrupt) all increase the appeal of the informal market. This parallel system is sustained by a well-established social dynamic, in which informal vendors are perceived as accessible, accommodating, and unconcerned with formalities such as prescriptions.

Although this problem has been documented in several major African cities, data specific to Brazzaville remain scarce, both in terms of prevalence and in understanding the profiles of users and associated factors. Although available data estimate that 28% of the medicine supply comes from the illegal trade [7]. This lack of evidence impedes a nuanced understanding of local behaviours and limits the design of effective, targeted interventions. Consequently, there is a pressing need to undertake a comprehensive epidemiological study to describe the profile of SM users in Brazzaville and to identify the socio-demographic, economic, geographic, and perceptual factors associated with their use. The findings of this study may help to inform public policy, guide community-based interventions, strengthen pharmaceutical regulation, and raise awareness among the Congolese population regarding the risks associated with unregulated medicine consumption.

2. Methods

2.1. Study Design, Setting, and Target Population

This study employed an analytical cross-sectional design and was conducted in the urban setting of Brazzaville, Republic of the Congo. The study was conducted in January 2024, with data collection carried out from January 10 to January 28, 2024. The target population consisted of households within the city limits of Brazzaville containing at least one adult respondent (aged ≥18 years) deemed capable of providing reliable and informed responses to the structured questionnaire. Households without an eligible respondent present at the time of the visit were not considered for inclusion.

2.2. Sample Size

The sample size N of households was calculated using the following formula:

$$N = e\left[\frac{Z^2.p(1-p)}{d^2}\right]$$

where, $Z = 1.96$ (corresponding to a 95% confidence level), p is the expected proportion set at 50%, d is the margin of error set at 5%, and $e = 1.875$ is the design effect used to account for the sampling method. Using this formula, a total sample size of 720 households was obtained, *i.e.*, a sample of 180 households per health district will be included, based on 20 households per counting zone (CZ) and 6 CZs per district.

2.3. Sampling Procedure

A three-stage stratified sampling design was employed to generate a representative sample of the population residing in Brazzaville. At the first stage, four health districts, Bacongo, Djiri, Ouenzé, and Talangaï, were randomly selected from the ten administrative health districts constituting the city, using simple random sampling without replacement. At the second stage, within each selected district, six census zones (CZs) were selected using probability proportional to size (PPS) sampling. The selection probability for each CZ was proportional to the number of households recorded in the Fifth General Population and Housing Census (RGPH-5, 2023). This method ensured adequate representation of more densely populated zones and minimized spatial clustering bias. At the third stage, systematic random sampling was applied to select households within each selected CZ. The sampling interval was calculated by dividing the total number of households in the CZ by the target number of households to be surveyed (30 per CZ). The first household was randomly selected within the initial interval range, and subsequent households were selected using a fixed sampling interval. In each selected household, all adults present at the time of the survey visit were considered eligible. Adults who were present at the time of the survey but declined to participate were excluded from the study. Similarly, individuals who provided incomplete or internally inconsistent responses were not included in the final analysis. Non-re-

spondents were immediately replaced by another member of the household concerned. If it was not possible to substitute in the surveyed household, the next household was used and so on. A total of 734 individuals were interviewed across 720 households surveyed.

2.4. Data Collection

Data collection was conducted between 10 and 28 January 2024 in four selected health districts of Brazzaville: Bacongo, Djiri, Ouenzé, and Talangaï. A structured questionnaire was administered face-to-face to a responsible adult present in each selected household. The questionnaire was pre-tested on a pilot sample of 30 households to assess the clarity of the questions, item validity, and contextual relevance. Necessary modifications were made following the pre-test. Specifically, some questions were reworded to improve clarity, redundant items were removed, and certain culturally sensitive or ambiguous terms were revised to ensure better comprehension. Additionally, response options for several closed-ended questions were expanded to capture a broader range of participant experiences. The final questionnaire comprised sections on socio-demographic, economic, cultural, and perceptual characteristics, as well as on the use of street medicines. Interviews were carried out by trained fieldworkers under the supervision of experienced supervisors. Prior to the survey, all fieldworkers received specific training covering the objectives of the study, interview techniques, ethical considerations, and data confidentiality. Data were collected using paper-based forms and subsequently entered into a secure database using R software (version 4.4.1). A double data entry process was employed to minimise errors.

2.5. Variables

Outcome variable

The outcome variable, use of street medicines (SM), was measured as a binary variable, distinguishing between individuals who reported using such products (users) and those who did not (non-users). This variable was assessed through a specific question addressed to each adult present in the household at the time of the survey: "Have you used any medicines purchased from informal vendors or in the street during the past 12 months?" Responses were coded as "1" for users and "0" for non-users. This operational definition allowed for a clear individual-level classification based on recent use of street medicines.

Predictor variables

Among the socio-demographic variables, age was categorised into three groups: under 30 years, 30–49 years, and 50 years or older, the latter representing a population potentially more exposed to chronic illnesses and therefore more likely to use medications. Sex was dichotomised as male and female, aiming to explore potential gender-related differences in health-seeking behaviours and access to care.

Monthly income was categorised into three groups: below the minimum wage, equal to the minimum wage, and above the minimum wage, in order to highlight

the potential impact of economic constraints on health-related behaviours. Educational level ranged from no formal schooling to higher education, allowing for the assessment of how educational capital may influence knowledge, perceptions, and the use of pharmaceutical products.

Marital status was classified as single, married, divorced/widowed, or in a consensual union. This variable may reflect levels of social or economic stability, which can in turn affect health behaviours.

Religion was categorised as Christianity, local/traditional religion, or no religion, with the aim of exploring the influence of spiritual beliefs and representations on health practices.

Socio-professional category distinguished between professionals, traders, students/pupils, manual labourers, and unemployed individuals, in order to capture occupational dynamics and their impact on healthcare access.

The number of dependents was classified as none, 1 to 5, and more than 5, reflecting the household's economic burden, which may influence therapeutic choices. Place of residence (Bacongo, Djiri, Ouenzé, Talangaï) was included to account for territorial disparities, both in terms of formal healthcare provision and the density of the informal medicine market.

Nationality (Congolese or foreign) was considered in order to assess potential discrimination or inequalities in access to healthcare linked to migration status.

Two perceptual variables were considered:

- *Perception of the quality of street medicines*, with four categories (worse, equivalent, better, no opinion), reflecting respondents' subjective judgements regarding the perceived effectiveness of these products compared to those from the formal pharmaceutical sector;
- *Awareness of the dangers of street medicines* (yes, no, no opinion), aimed at assessing the level of knowledge about the risks associated with such practices.

2.6. Data Analysis

Data were entered and analysed using R software, version 4.4.1. The first step consisted of a descriptive analysis to summarise the socio-demographic, economic, and perceptual characteristics of the participants. Qualitative variables were presented as frequencies and percentages. In the second step, a bivariate analysis was conducted to identify variables potentially associated with the use of street medicines (SM). Comparisons between "users" and "non-users" were performed using the chi-square test (or Fisher's exact test when expected cell counts were low). A p-value < 0.05 was considered statistically significant. Variables showing a significant association in the bivariate analysis ($p < 0.20$) were included in a multivariable binary logistic regression model to identify factors independently associated with the use of SM. Results were expressed as odds ratios (ORs) with their corresponding 95% confidence intervals (95% CI). Statistical significance was set at $p < 0.05$. The performance of the final model was assessed using the pseudo R^2 index, the likelihood ratio (chi-square) test, and the Akaike Information Criterion (AIC)

and Bayesian Information Criterion (BIC). Model validity was checked by examining residuals and ensuring the absence of multicollinearity between explanatory variables.

2.7. Ethical Considerations

The study adhered to ethical standards for research involving humans. Informed consent was obtained after explaining the study purpose, voluntary participation, and confidentiality assurances. Data were managed solely by the principal investigator to ensure privacy. All required approvals were secured from local health authorities and academic committees.

3. Results

3.1. Profile of Street Medicine Users in Brazzaville

Table 1 presents the socio-demographic and economic characteristics of participants according to their status of street medicine (SM) use. Among the 734 respondents, 88.4% (n = 649) were users. Users were predominantly aged 50 years or older (60.4%, $p < 0.001$) and male (65.5%), although the latter was not statistically significant ($p = 0.113$). They more frequently lived in cohabitation (34.4%, $p < 0.001$) and mainly had a secondary education level (52.4%, $p < 0.001$). Most users identified as Christian (64.4%) or adhered to local religions (22.8%, $p < 0.001$), and were often engaged in commercial activities (43.1%, $p < 0.001$). The majority had between one and five dependents (66.1%, $p < 0.001$) and reported a monthly income below the minimum wage (41.8%, $p = 0.027$). Geographically, they mainly resided in Ouenzé (31.0%, $p < 0.001$) and were primarily of Congolese nationality (87.8%, $p = 0.017$).

Table 1. Distribution of the study population by socio-demographic and economic characteristics.

Characteristics	Users (n = 649)		Non-users (n = 85)		Total (n = 734)		p-value
	n	(%)	n	(%)	n	(%)	
Age groups (years)							<0.001
<30	123	19.0	14	16.5	137	18.6	
30 - 49	134	20.6	39	45.9	173	23.6	
≥50	392	60.4	32	37.6	424	57.8	
Sex							0.113
Male	425	65.5	63	74.1	488	66.5	
Female	224	34.5	22	25.9	246	33.5	
Marital status							0.140
In a union	173	26.7	16	18.8	189	25.7	
Not in a union	253	39.0	53	62.4	306	41.7	

Continued

Level of education							<0.001
None	55	8.5	1	1.2	56	7.6	
Primary	98	15.1	8	9.4	106	14.4	
Secondary	340	52.4	16	18.8	356	48.6	
Tertiary	156	24.0	60	70.6	216	29.4	
Religion							<0.001
Christianity	418	64.4	58	68,2	476	64.9	
Local religion	148	22.8	5	5.9	153	20.8	
No religion	83	12.8	22	25.9	105	14.3	
Occupational category							<0.001
Middle/senior executive	125	19.3	22	25.9	147	20.0	
Business owner	280	43.1	13	15.3	293	39.9	
Student	79	12.2	27	31.8	106	14.4	
Laborer	128	19.7	11	12.9	139	18.9	
Unemployed	37	05.7	12	14.1	49	6.8	
Number of dependents							<0.001
None	68	10,5	25	29.4	93	12.7	
1 - 5	429	66,1	49	57.6	478	65.1	
More than 5	152	23,4	11	12.9	163	22.2	
Monthly income							0.027
Below the national minimum wage	271	41.8	47	55.3	318	43.3	
National minimum wage	122	18.8	8	9.4	130	17.7	
Above the national minimum wage	256	39.4	30	35.3	286	39.0	
District of residence							<0.001
Bacongo	122	18.8	60	70.6	182	24.8	
Djiri	159	24.5	12	14.1	171	23.3	
Ouenze	201	31.0	5	5.9	206	28.1	
Talangaï	167	25.7	8	9.4	175	23.8	
Nationality							0.017
Foreign	79	12.2	3	3.5	82	11.2	
Congolese	570	87.8	82	96.5	652	88.8	
Total	**649**	**100.0**	**85**	**100.0**	**734**	**100.0**	

3.2. Factors Associated with the Use of Street Medicines (SM): A Binary Logistic Regression Analysis

Table 2 highlights several factors significantly associated with the use of street

Table 2. Factors associated with the use of street medicines.

	aOR	IC (95%)	p-value
Monthly income			
Above the national minimum wage (ref)	1		
Below the national minimum wage	1.638	0.64 - 4.20	0.30
National minimum wage	3.643	1.18 - 11.20	0.02
Occupational category			
None (ref)	1		
Middle/senior executive	2.908	0.87 - 9.70	0.08
Business owner	3.35	1.16 - 9.70	0.03
Student	4.034	1.38 - 11.80	0.01
Laborer	3.024	0.99 - 9.20	0.05
District of residence			
Bacongo (ref)	1		
Djiri	2.974	1.16 - 7.60	0.023
Ouenze	10.682	3.32 - 34.40	<0.001
Talangaï	3.471	1.30 - 9.30	0.013
Level of education			
Tertiary (ref)	1		
None	5.724	0.58 - 56.8	0.136
Primairy	1.600	0.54 - 4.70	0.396
Secondairy	4.569	2.11 - 9.90	<0.001
Perception of SM quality			
No opinion (ref)	1		
Worse	0.352	0.14 - 0.90	0.028
Good opinion	2.953	1.13 - 7.70	0.028
Better	7.810	2.43 - 25.10	0.001
Awareness of the dangers of SM			
No opinion (ref)	1		
No	4.158	1.83 - 9.5	0.001
Yes	4.914	2.09 - 11.6	<0.001

medicines (SM). Compared to individuals earning above the minimum wage (SMIG), those with an income equal to the SMIG have a higher risk of SM use (OR = 3.643; p = 0.024). Certain occupational categories are also more exposed, notably traders (OR = 3.35; p = 0.026) and students/pupils (OR = 4.034; p = 0.011). Residence in Ouenzé (OR = 10.682; p < 0.001) is strongly associated with SM use, as it has a secondary level of education (OR = 4.569; p < 0.001) compared to higher education. A positive perception of the quality of SM, particularly when judged "better" than formal medicines (OR = 7.81; p = 0.001), significantly increases the likelihood of use. Finally, a lack of awareness about the dangers of SM is also a strongly associated factor (OR ranging from 4.158 to 4.914; p ≤ 0.001).

4. Discussion

The aim of this study was to investigate the factors associated with the use of street medicines (SM) sold in Brazzaville in 2024, in order to better understand the public health risks they pose. Our findings highlight the significant role of economic, social, geographical, and perceptual factors in SM use.

This study reveals a very high prevalence of street medicine use, confirming that this phenomenon constitutes a major public health challenge in urban areas of Sub-Saharan Africa [8], linked to the failures of health systems related to costs, physical accessibility, or perceived quality combined with an informal supply of unregulated medicines, and reinforced by cultural norms favoring self-management, this fuels risky health behaviors [9]-[11].

The predominance of users aged 50 and above highlights the health vulnerability associated with ageing, notably due to the increased prevalence of chronic diseases requiring regular and costly medical follow-up [12]. The study emphasises that this age group is particularly exposed to difficulties in accessing formal healthcare, compounded by physical limitations, reduced financial resources, and a lack of adequate support [13]. These findings confirm that the use of street medicines is not merely a choice, but a constrained response to structural barriers.

Economically, the link between low or minimum wage-level income and the use of street medicines clearly illustrates the direct effect of financial precariousness on health behaviours [6] [9]. The high costs of consultations, examinations, and official treatments, combined with still limited health insurance coverage, restrict access to conventional care and encourage the search for cheaper but potentially dangerous alternatives [14] [15]. This phenomenon contributes to widening social health inequalities by depriving the poorest of secure access to medicines. The role of socio-professional categories, notably traders and students, reflects economic insecurity and social vulnerability. These groups, often excluded from social protection schemes and faced with irregular incomes, favour quick and accessible solutions such as street medicines to manage their health on a daily basis. This underlines the need to target these populations in prevention policies and healthcare access initiatives.

In Brazzaville, the Ouenzé district shows particularly high levels of street med-

icine (SM) use. The significantly higher odds of SM use in Ouenzé (OR = 10.682) may be partly explained by its lower healthcare infrastructure and higher population density compared to Bacongo. While Bacongo hosts several public health facilities, Ouenzé residents often face longer travel times to reach formal care providers, potentially incentivizing SM reliance. Limited access to formal healthcare, combined with distrust of the official health system, drives a large portion of the population towards these parallel channels [2] [16].

Interestingly, secondary education was strongly associated with SM use (OR = 4.569). This may reflect increased confidence in navigating informal markets or a lack of faith in formal healthcare despite moderate educational attainment. Further research is needed to explore these perceptions among the moderately educated.

Additionally, cultural factors, notably religious beliefs and social norms valuing self-management of health, strongly influence therapeutic choices and encourage the use of such alternatives [17] [18]. The close social ties between vendors and users reinforce trust in these products despite the health risks involved. These factors, coupled with insufficient regulation, explain the persistence of the informal market in this area. It is therefore essential to strengthen formal health services and develop adapted awareness campaigns involving local.

The study reveals a significant deficit in the perception of the quality of street medicines (SM), with some users considering these products to be "better" than official medicines. This relative confidence is concerning as it masks major health risks, notably the consumption of counterfeit, falsified, or inappropriate medicines [2]. Such trust may be reinforced by occasional positive experiences but is mainly fuelled by misleading campaigns from sellers and the lack of rigorous control.

The low level of awareness regarding the dangers associated with SM use constitutes an aggravating factor. Despite existing efforts, health education campaigns remain insufficient, poorly adapted to local realities, or inadequately disseminated among at-risk populations [19] [20]. This dual finding of inadequate awareness and misplaced trust in SM highlights the need for more targeted and participatory actions that integrate local social and cultural dynamics. Our results support the idea that the perception of the risks associated with street medicines is often very limited in Sub-Saharan Africa, even in contexts where falsified products are widely recognized as a major issue. To address this gap, it is crucial to strengthen awareness campaigns, taking into account the cultural, psychological, and structural dimensions specific to each region.

5. Public Health Implications

The results highlight several priority areas for action:

- Firstly, the establishment and strengthening of universal health coverage tailored to the Congolese context would help reduce the economic barriers to accessing formal healthcare, thereby limiting reliance on street medicines (SM).
- Secondly, it is essential to reinforce pharmaceutical regulation, particularly

through increased market inspections and the fight against counterfeit drugs, while improving the availability of primary healthcare services in disadvantaged neighbourhoods such as Ouenzé.

- Thirdly, awareness campaigns must be redesigned to be more effective: they should be adapted to local socio-cultural specificities, use diverse communication channels, and involve community and religious leaders in order to rebuild trust in the official healthcare system and dispel myths surrounding SM.
- Finally, training healthcare professionals and pharmacists is crucial so they can play a key role in preventing risky practices.

6. Limitations

Despite the interesting and informative findings, this study has several limitations. First, the reliance on self-reported data may introduce recall or social desirability bias. Second, the replacement of non-respondents might have introduced selection bias, potentially affecting the generalizability of the results. Additionally, the cross-sectional design limits the ability to establish causal relationships between the identified determinants and street medicine (SM) use.

7. Conclusion

This study reveals a high prevalence of street medicine use in Brazzaville, primarily linked to economic, socio-demographic, geographic, and perceptual factors. The reliance on street medicines reflects inequalities in access to formal healthcare and a lack of trust in the official system. To reduce this phenomenon, it is crucial to strengthen health insurance coverage, improve pharmaceutical regulation, and intensify awareness campaigns tailored to local contexts. These measures will help ensure safer and more equitable access to medicinal treatments.

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Authors' Contributions

ACGB wrote the protocol, collected data and drafted the manuscript. GN and ACN supervised and validated the various stages of the study. YA performed statistical analysis. GN, ACN, AAA and WSN contributed to supervision, database visualization, manuscript review and editing. All authors read and approved the final version of the manuscript prior to submission.

Conflicts of Interest

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

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