

Socio-Spatial Determinants of Accessibility and Utilization of Pediatric Services in Kinshasa, Democratic Republic of the Congo

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ABSTRACT

This study examines the socio-spatial determinants of accessibility to and utilization of pediatric services in Kinshasa. Using survey data from 1,164 parents and guardians and a series of binary logistic regression models, the analysis explores how geographic position, household socio-demographic profile, transport conditions, perceived barriers, and prior care experiences shape the choice between formal pediatric consultation and self-medication or other non-medicalized practices. The results show pronounced territorial inequalities in the distribution of respondents and in the spatial pattern of pediatric consultation and self-medication across the city. Among the respondents, 67.27% reported resorting to pediatric consultation while 32.71% relied on self-medication or related informal practices. In the bivariate models, consultation was significantly associated with male parenthood, health insurance for the child, non-biological caregiving, higher income brackets, and the use of motorized or public transport. By contrast, walking, lack of transport, and lack of information reduced the odds of formal consultation. In adjusted models, older parental age remained negatively associated with consultation, whereas male sex, Protestant affiliation, higher monthly income, older child age, public transport use, and some disease contexts increased the likelihood of consultation. Perceptions of service quality showed mixed and sometimes paradoxical effects: courtesy encouraged consultation, but long waiting times consistently reduced it, while evaluations of care quality were not uniformly associated with formal care-seeking. Overall, access to pediatric services in Kinshasa is jointly structured by socio-economic resources, mobility conditions, perceived constraints, and uneven urban geography. Policies that improve transport access, reduce waiting time, strengthen financial protection, and correct spatial disparities in service distribution could increase timely pediatric care utilization.

Keywords: pediatric services; accessibility; healthcare utilization; self-medication; socio-spatial inequalities; Kinshasa; logistic regression

1. INTRODUCTION

Access to healthcare services for children remains a critical challenge in rapidly urbanizing regions of sub-Saharan Africa. While the presence of healthcare facilities is often considered a key indicator of service availability, access to care is shaped by a complex combination of geographic, socioeconomic, and institutional factors. In large metropolitan areas, spatial inequalities in infrastructure distribution, transportation networks, and household socioeconomic conditions can significantly influence healthcare utilization patterns (Penchansky & Thomas, 1981; Noor et al., 2006).

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Urban health inequalities are particularly pronounced in African megacities experiencing rapid population growth and spatial expansion. As cities expand, healthcare infrastructure often develops unevenly, concentrating specialized services in central districts while peripheral and peri-urban areas remain relatively underserved. This uneven spatial distribution may generate significant barriers to healthcare utilization, particularly for vulnerable populations such as children (Tatem et al., 2012; Tanser et al., 2006). In such contexts, access to pediatric healthcare depends not only on the physical availability of services but also on household mobility, financial capacity, and perceptions of healthcare quality.

Kinshasa, the capital of the Democratic Republic of Congo (DRC), represents a particularly relevant context for examining these dynamics. With an estimated population exceeding fifteen million inhabitants, Kinshasa is one of the largest and fastest-growing cities in Africa. The city is characterized by strong territorial contrasts between central municipalities that concentrate administrative and economic activities and peripheral communes experiencing rapid demographic growth and limited infrastructure development (De Boeck & Plissart, 2014). These spatial disparities affect access to essential services, including healthcare, and contribute to unequal health outcomes among urban populations.

Child health indicators in the Democratic Republic of Congo remain a major public health concern despite improvements in recent decades. Infectious and parasitic diseases continue to represent the main causes of pediatric morbidity and mortality, particularly in densely populated urban environments where environmental conditions and limited access to healthcare services increase vulnerability (World Health Organization [WHO], 2022). Ensuring equitable access to pediatric healthcare services is therefore essential for improving child health outcomes and reducing preventable morbidity.

Previous studies have shown that healthcare utilization is influenced by multiple determinants, including socioeconomic status, educational level, cultural norms, and perceived quality of care (Andersen, 1995; Peters et al., 2008). In urban African settings, additional factors such as transportation availability, travel time, and perceived barriers to healthcare facilities further shape care-seeking behavior (Noor et al., 2006; Tatem et al., 2012). Parents may therefore resort to self-medication or informal healthcare practices when formal services are perceived as geographically distant, financially inaccessible, or poorly organized.

Beyond these individual determinants, spatial analysis has increasingly been used to understand geographic inequalities in healthcare access. Geographic Information Systems (GIS) provide powerful tools to assess the spatial distribution of health services, identify underserved areas, and evaluate the relationship between service location and healthcare utilization (Tanser et al., 2006). Integrating spatial analysis with socioeconomic determinants can thus provide a more comprehensive understanding of healthcare accessibility within complex urban environments.

Despite the growing body of research on healthcare accessibility in Africa, relatively few studies have examined pediatric healthcare utilization in Kinshasa using an integrated socio-spatial perspective. Most existing studies focus either on health system performance or on socioeconomic determinants of healthcare demand, without explicitly considering the spatial organization of urban health services and mobility constraints.

In this context, the present study aims to analyze the socio-spatial determinants of accessibility to and utilization of pediatric healthcare services in Kinshasa. Specifically, the study seeks to examine how parental socio-demographic characteristics, economic conditions, child-related factors, transportation constraints, and perceptions of healthcare quality influence the probability of seeking formal pediatric consultation rather than relying on self-medication. Furthermore, the study explores how these determinants interact with the spatial distribution of healthcare services across the city.

By combining statistical modeling and spatial analysis, this research contributes to a better understanding of urban health inequalities in Kinshasa and provides evidence that may inform policies aimed at improving equitable access to pediatric healthcare services.

2. MATERIALS AND METHODS

2.1 Study area

The study was conducted in Kinshasa, the capital city of the Democratic Republic of Congo (DRC) (figure 1). With an estimated population exceeding fifteen million inhabitants, Kinshasa is among the largest and fastest-growing metropolitan areas in sub-Saharan Africa. The city is administratively divided into 24 municipalities (communes) distributed across several urban zones that differ considerably in terms of population density, infrastructure availability, and socioeconomic conditions (De Boeck & Plissart, 2014).

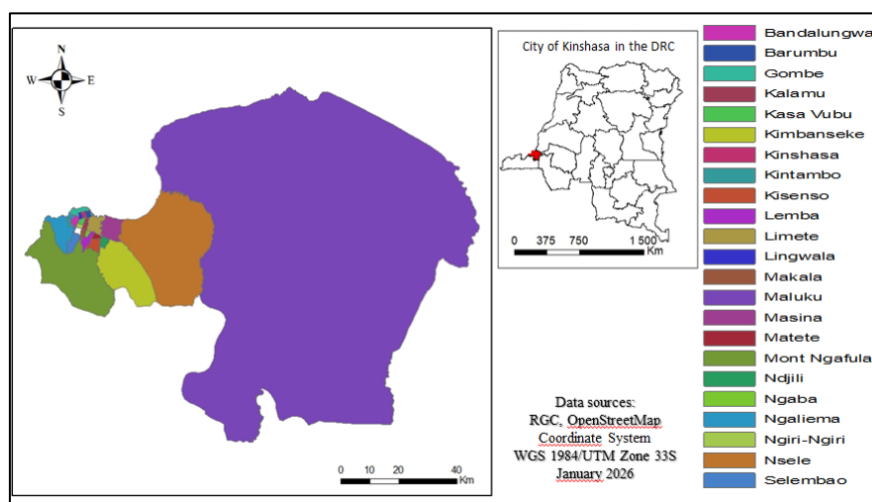


Figure 1: City of Kinshasa: Administrative and Geographic Setting

Kinshasa exhibits strong spatial inequalities in access to urban services, including transportation networks, sanitation, and healthcare infrastructure. While central municipalities such as Gombe, Lingwala, and Kintambo concentrate administrative functions and specialized health facilities, peripheral and rapidly expanding communes such as Masina, Nsele, Kimbanseke, and Maluku often experience limited infrastructure development and reduced access to healthcare services. These spatial disparities influence household mobility patterns and may affect healthcare-seeking behavior, particularly for pediatric services.

Urban expansion in Kinshasa has also resulted in increasing distances between residential areas and specialized health facilities. In such contexts, transportation availability, road conditions, and perceived accessibility of healthcare facilities become critical determinants of healthcare utilization (Noor et al., 2006; Tanser et al., 2006). Consequently, analyzing pediatric healthcare access in Kinshasa requires considering both household characteristics and the spatial organization of the urban health system.

2.2 Study design, population, and survey basis

This study is based on a cross-sectional analytical survey conducted among 1,164 parents and guardians of children aged 0 to 18 years residing in Kinshasa. The survey targeted adults responsible for healthcare decisions concerning children within their households. The analytical focus of the article is the choice between formal pediatric consultation and self-medication or other informal therapeutic practices.

The study relied on a mixed data collection approach, combining documentary review and field survey. The documentary approach consisted of consulting and critically analyzing official reports, policy documents, health statistics, and scientific publications from public institutions and international organizations, including the World Health Organization (WHO), UNICEF, the World Bank, the National Institute of Statistics (INS), and the Ministry of Health. The documentary sources included annual health-facility performance reports, health information databases such as DHS, DHIS2, and SNIS, scientific studies on urban health geography in Africa, and legal and regulatory texts governing the organization of the health system in the Democratic Republic of the Congo. This preliminary stage helped establish the conceptual and factual basis for the field investigation.

Field data collection was then conducted to complement secondary data and obtain direct information from both users and providers of pediatric services. Two structured questionnaires were developed: one for health facility managers or heads of health facilities, designed to collect institutional information such as staffing, equipment, service capacity, consultation frequency, and logistical constraints; and one for households with children aged 0–18 years, aimed at documenting perceptions, healthcare-seeking behavior, and difficulties in accessing pediatric services. For the present article, the quantitative analysis focuses exclusively on the household survey data.

2.3 Sampling procedure

A stratified sampling design was used for the field investigation. The three health districts of Kinshasa—Kinshasa Centre, Kinshasa West, and Kinshasa East—served as the primary strata. Within each stratum, health zones, health areas, and health facilities were selected through proportional random sampling, following the sampling principles described by Cochran (1977), Kish (1965), and Lohr (2010).

Randomization procedures were implemented using RStudio version 2024.04.2-764, including the dplyr package.

A total of 11 health zones out of 35 were selected:

- **Kinshasa Centre:** Ngiri-Ngiri, Kalamu I, Lemba, Limete
- **Kinshasa West:** Lingwala, Mont-Ngafula II, Binza Météo, Mont-Ngafula I
- **Kinshasa East:** N'djili, Kingasani, Masina I

Within these selected health zones, 40 health areas were chosen through proportional random sampling. Thirteen health areas were selected in Kinshasa Centre, fifteen in Kinshasa West, and twelve in Kinshasa East. Households were then surveyed within the selected health areas.

The household survey targeted adults permanently residing in the selected health areas and responsible for healthcare decisions concerning at least one child aged 0–18 years.

This sampling structure ensured representation across the major health districts of Kinshasa while preserving proportionality between strata and sampled units.

2.4 Inclusion criteria

The inclusion criteria referred to both the study population and the sampled health structures. Included in the study were:

- children aged 0 to 18 years receiving care in, or eligible for care from, pediatric services in public or private health facilities;
- health facilities with a functional pediatric service and regular data recording during the study period;
- households permanently residing in the selected health areas and willing to participate in the survey.

At the household level, the respondent had to be a parent or guardian directly involved in healthcare decision-making concerning the child.

These criteria ensured that the study included only actors directly concerned with pediatric healthcare accessibility in Kinshasa.

2.5 Outcome variable

The primary outcome variable was utilization of pediatric services, operationalized as a binary variable reflecting healthcare-seeking behavior during child illness.

It was coded as follows:

- **1 = formal pediatric consultation**, defined as recourse to recognized health facilities or pediatric services;
- **0 = no formal pediatric consultation**, corresponding to self-medication or other non-medicalized practices, including home treatment, traditional remedies, religious healing practices, or informal therapeutic advice obtained outside the formal health system.

This dichotomization allowed the use of binary logistic regression to model the probability of formal pediatric consultation relative to informal care-seeking.

2.6 Variables and conceptual framework

The explanatory variables were organized into four analytical domains, reflecting the multidimensional nature of healthcare accessibility described by Penchansky and Thomas (1981) and the healthcare utilization framework proposed by Andersen (1995).

2.6.1 Socio-demographic and socio-cultural characteristics

These variables included:

- age of the parent or guardian
- sex
- educational level
- employment or professional status
- religious affiliation
- marital status or household marital type
- monthly household income
- household size

These variables capture the social and economic conditions that may influence healthcare-seeking behavior.

2.6.2 Child and household characteristics

These variables included:

- relationship between respondent and child (biological or non-biological caregiver)
- sex of the child
- age of the child
- health insurance coverage of the child
- number of children younger than 18 years in the household
- illness or hospitalization context

These factors reflect household composition and caregiving dynamics likely to influence pediatric healthcare decisions.

2.6.3 Accessibility and transport-related variables

Accessibility variables captured both physical mobility and perceived barriers to healthcare services. These included:

- municipality of residence
- distance between residence and the pediatric health facility
- main mode of transport used
- availability and quality of transport

- perceived barriers such as poor road conditions, lack of transportation, congestion, bad weather, and lack of information

These variables were included to assess how urban mobility constraints influence access to pediatric healthcare services.

2.6.4 Perceived quality of care

Perception-based variables captured parents' experiences and evaluations of pediatric healthcare services. These included:

- perceived affordability of care
- courtesy of medical staff
- professionalism of healthcare personnel
- listening attitude of staff
- perceived reception quality
- perceived quality of care
- adequacy of medical infrastructure
- availability of medical personnel
- waiting time before receiving care
- maintenance and cleanliness of facilities

These dimensions allowed the study to assess how perceptions of service quality influence healthcare utilization.

2.7 Operational definitions and coding

The dependent variable was coded as a binary outcome:

- formal pediatric consultation = **1**
- self-medication or informal care = **0**

Several explanatory variables were recoded into analytically meaningful categories to facilitate regression analysis. Age, education, income, transport modes, and quality-of-care variables were grouped into categories that reflected the distribution of the survey data and improved statistical interpretability.

2.8 Data collection tools

Field data were collected using KoboCollect, a mobile digital data collection application used to design and administer structured electronic questionnaires. KoboCollect enabled the collection of georeferenced data related to pediatric services, health infrastructure, and user perceptions.

Statistical analysis and modeling were conducted using R software, which was used for data cleaning, descriptive statistics, inferential analysis, and regression modeling.

2.9 Statistical analysis

The statistical analysis was conducted in three main stages.

2.9.1 Descriptive analysis

Descriptive statistics were used to summarize the characteristics of respondents, households, and children. Frequencies and percentages were calculated for categorical variables, while means and standard deviations were calculated for quantitative variables.

2.9.2 Bivariate analysis

Bivariate analyses were used to examine associations between the dependent variable and each explanatory variable. Cross-tabulations and chi-square tests were used for categorical variables.

2.9.3 Logistic regression

Binary logistic regression models were used to identify determinants associated with formal pediatric consultation.

The modeling approach followed methodological recommendations proposed by Hosmer et al. (2013), Menard (2002), Peng et al. (2002), and Agresti (2018).

Two sets of models were estimated:

1. **Bivariate logistic models**, estimating crude associations between each explanatory variable and pediatric consultation.
2. **Multivariate logistic models**, estimating adjusted associations while controlling for potential confounding factors.

Variables included in the adjusted models were selected based on their theoretical relevance and statistical significance in bivariate analyses ($p < 0.20$).

Results were expressed as odds ratios (ORs) with 95% confidence intervals (95% CIs), and statistical significance was evaluated at the 5% level.

Reference categories corresponded to analytically meaningful baseline groups, such as younger parents, female respondents, the lowest income group, uninsured children, or the absence of motorized transport.

2.10 Missing data management

After field collection, the data were downloaded, cleaned, coded, and verified before analysis. Observations with missing values on key variables were excluded from regression analyses using a complete-case approach. The proportion of missing data was low and did not substantially affect the analytical sample.

2.11 Spatial and cartographic analysis

In addition to statistical analysis, the study used cartographic analysis to examine the geographic distribution of respondents and healthcare utilization patterns across Kinshasa. Maps were produced to identify territorial disparities in pediatric consultation and self-medication between municipalities and health areas.

This spatial component complements the statistical analysis by providing a socio-spatial interpretation of healthcare access, consistent with approaches emphasizing the role of geographic accessibility in healthcare utilization (Noor et al., 2006; Tanser et al., 2006).

2.12 Ethical considerations

Participation in the survey was voluntary. Respondents were informed about the purpose of the study prior to data collection. Confidentiality and anonymity were ensured during data processing and analysis.

Authorization for field data collection was obtained from local administrative and health authorities in Kinshasa, and the study adhered to general ethical principles governing research involving human participants.

2.13 Methodological limitations and potential biases

Several limitations should be considered when interpreting the results:

- potential limitations in the availability and quality of health data;
- the use of Euclidean distance as an approximation of spatial accessibility;
- possible spatial aggregation effects related to the modifiable areal unit problem (MAUP);
- the cross-sectional nature of the data, which limits causal interpretation.

Despite these limitations, the combined use of survey data, statistical modeling, and spatial interpretation provides valuable insights into the socio-spatial determinants of pediatric healthcare access in Kinshasa.

3. RESULTS

3.1 Respondent profile and child characteristics

The surveyed population was dominated by adults in active parenting ages. Parents aged 31-40 years represented 31.36% of respondents, followed by those aged 41-50 years (21.82%). Men accounted for 61.77% of respondents, and 66.15% had university education. Most respondents were employed (83.16%). On the socio-cultural side, Protestants constituted the largest religious group (55.84%), and 88.4% of respondents reported living in monogamous unions. Economically, 44.76% of households had a monthly income not exceeding USD 200, indicating that a large share of the sample lived under constrained financial conditions.

Most children were under the care of a biological parent (85.14%). Girls accounted for 59.45% of children in the sample, and only 29.55% had health insurance. Infectious and parasitic diseases overwhelmingly dominated the reported morbidity profile (90.98%), whereas surgical and organic diseases (5.58%) and non-communicable or metabolic diseases (3.44%) were much less frequent.

3.2 Spatial distribution and care-seeking patterns

The spatial distribution of respondents was uneven across Kinshasa. Peripheral and densely populated communes such as Nsele and Masina were the most represented, whereas administrative or commercially oriented communes such as Gombe and Lingwala had few respondents. The maps provided by the author further showed strong territorial heterogeneity both in self-medication and in pediatric consultation, with consultation concentrated in a limited number of central urban communes and lower levels observed in several peripheral areas.

Regarding healthcare utilization, 22.51% of respondents reported at least one child illness episode during the year. Overall, 67.27% indicated resorting to pediatric consultation, whereas 32.71% relied on self-medication or other informal practices. These descriptive results suggest that formal consultation predominated in the sample, but informal therapeutic strategies remained common.

3.3 Socio-demographic and economic determinants of pediatric consultation

In crude logistic regressions, parental age and sex were strongly associated with formal consultation. Compared with parents younger than 30 years, those aged 51-60 years had lower odds of pediatric consultation (OR = 0.61; $p = 0.019$), and the decrease was even sharper among parents older than 70 years (OR = 0.23; $p < 0.001$). By contrast, male respondents were more likely than female respondents to seek pediatric consultation (OR = 1.75; $p < 0.001$).

Education produced a counterintuitive pattern in crude analysis: respondents with secondary education (OR = 0.29; $p < 0.001$) and university education (OR = 0.51; $p = 0.012$) were less likely to report consultation than those with primary education. Employment status was not statistically significant.

Religion, marital type, and income also mattered. Compared with Catholics, Muslims had much higher odds of consultation in crude analysis (OR = 7.3; $p = 0.001$), and Protestants also showed higher odds (OR = 1.3; $p = 0.04$). Parents in polygamous unions were more likely to consult than those in monogamous unions (OR = 1.58; $p = 0.030$). Income gradients were evident: compared with households earning up to USD 200 per month, those in the USD 401-600 bracket had higher odds of consultation (OR = 1.75; $p = 0.0076$).

The adjusted model confirmed some of these patterns while attenuating others. Older parental age remained negatively associated with formal consultation, especially for the 41-50 years, 51-60 years, and above-70 years categories. Male sex remained a positive determinant. Protestant affiliation was associated with greater odds of consultation, and higher monthly

income, particularly USD 201-400, USD 401-600, and above USD 1,000, significantly increased the likelihood of consultation relative to the poorest households.

3.4 Child-related factors, insurance, and disease profile

Children cared for by non-biological guardians were more likely to be taken for pediatric consultation in crude analysis (OR = 1.56; $p = 0.017$). Child sex did not show a significant association. Health insurance had one of the clearest positive effects: insured children had twice the odds of formal consultation compared with uninsured children (OR = 2.04; $p < 0.001$).

Disease profile also influenced care-seeking. Compared with surgical and organic conditions, infectious and parasitic diseases were associated with lower odds of consultation in crude analysis (OR = 0.27; $p = 0.0005$), suggesting a tendency to treat common infections outside formal pediatric settings. In the adjusted model, the age of the child increased the likelihood of consultation, and the composite variable capturing disease case context had a very strong positive effect on formal care-seeking.

3.5 Transport, perceived barriers, and physical access

Transport played a central role in access to pediatric services. The descriptive profile showed limited use of bicycles and substantial reliance on taxis, motorcycles, and walking, while public transport was used by a smaller but important share of respondents. In crude regressions, motorized and collective transport modes clearly favored formal consultation: motorcycle use increased the odds of consultation (OR = 1.89; $p < 0.001$), taxi use had an even stronger effect (OR = 2.44; $p < 0.001$), and public transport also increased the odds substantially (OR = 2.31; $p < 0.001$). Walking reduced the likelihood of consultation (OR = 0.74; $p = 0.0398$).

Among access barriers, lack of transport strongly reduced formal consultation (OR = 0.35; $p < 0.001$), as did lack of information (OR = 0.24; $p < 0.001$). By contrast, poor road conditions were positively associated with consultation in crude and adjusted models, a paradoxical result that may indicate that the recognition of severe travel difficulties pushes households toward higher-level care once the decision to seek care has been made. Similarly, the perceived inadequacy of medical infrastructure was associated with consultation in crude analysis, which may reflect selective use of better-equipped structures. In adjusted analysis, public transport remained positively associated with formal consultation, whereas lack of transport and lack of information remained negative determinants. Objective distance to the pediatric center was not statistically significant.

3.6 Perceived quality of care and hospital experience

Perceptions of service quality showed an ambivalent influence on care-seeking. More than half of respondents judged care costs affordable, but 44.85% considered them costly or very costly. Slightly more than half judged staff courteous, whereas most respondents viewed staff as not professional and not attentive. A large majority were favorable to the establishment of new pediatric facilities in their neighborhood and to public awareness campaigns on pediatric care.

In crude models, costly care substantially reduced the odds of formal consultation (OR = 0.30; $p < 0.001$), and staff courtesy increased it (OR = 1.62; $p < 0.001$). Surprisingly, respondents who perceived staff as professional or attentive were less likely to report consultation, and this paradox also appeared in some adjusted models. Reception quality produced inconsistent associations, while poor perceived quality of care was consistently linked to lower formal utilization in crude analysis. In adjusted analysis, courtesy remained the only clearly positive determinant among the staff perception variables.

Waiting time emerged as one of the most robust negative determinants. In both crude and adjusted models, several categories indicating that waiting time was never, rarely, often, or always reasonable were associated with lower odds of formal consultation, implying that time accessibility remains a major deterrent. By contrast, positive opinions about expanding pediatric facilities in the neighborhood and about the usefulness of awareness campaigns were strongly associated with consultation in crude analysis.

4. DISCUSSION

The findings of this study highlight the complex socio-spatial dynamics shaping access to pediatric healthcare services in Kinshasa. Rather than being determined solely by the availability of healthcare facilities, pediatric healthcare utilization appears to emerge from the interaction between household socioeconomic resources, urban mobility constraints, perceived quality of care, and spatial inequalities within the metropolitan health system. This multidimensional interpretation is consistent with the conceptual framework proposed by Andersen (1995), which emphasizes that healthcare utilization results from the combined influence of predisposing factors, enabling resources, and perceived need for care.

Socioeconomic inequalities and financial access to pediatric care

One of the most important findings of this study concerns the role of economic resources in determining access to pediatric consultation. Households with higher monthly incomes were significantly more likely to seek formal pediatric care than those with very limited financial resources. This result aligns with numerous studies conducted in low- and middle-income countries, which demonstrate that financial capacity strongly influences healthcare utilization and the ability to access specialized medical services (Peters et al., 2008).

In contexts where health insurance coverage remains limited, out-of-pocket expenditures often represent the main mechanism through which families access healthcare services. In the present study, children with health insurance were twice as likely to receive formal pediatric consultation compared with uninsured children. Similar patterns have been reported in several African settings, where financial protection mechanisms substantially increase healthcare utilization and reduce reliance on informal treatment practices (Lagomarsino et al., 2012).

The persistence of income-related disparities suggests that financial barriers remain a key determinant of healthcare inequality in Kinshasa. Households with limited economic resources may delay consultation or rely on self-medication due to concerns about consultation fees, drug costs, and transportation expenses. This pattern has been widely documented in urban African environments, where economic vulnerability often leads families to adopt sequential healthcare-seeking strategies that begin with home treatment and escalate to formal care only when illness severity increases (Peters et al., 2008).

Mobility constraints and spatial accessibility

The study also demonstrates the central role of urban mobility in shaping pediatric healthcare access. Transport modes such as motorcycles, taxis, and public transportation significantly increased the likelihood of pediatric consultation, whereas walking and lack of transportation were associated with lower utilization of formal services. These findings support the argument that accessibility should not be understood solely in terms of geographic distance but rather as the effective capacity of households to move within the urban environment (Penchansky & Thomas, 1981).

In many rapidly expanding African cities, spatial mismatches between residential areas and healthcare infrastructure generate important mobility challenges. Peripheral neighborhoods often experience limited public transportation coverage and poor road conditions, which increase travel time and reduce the practical accessibility of health services

(Tatem et al., 2012). In such contexts, transportation availability becomes a crucial enabling factor for healthcare utilization.

Interestingly, the objective distance to pediatric centers did not appear as a statistically significant determinant in the regression models, whereas perceived transport barriers and mobility constraints did. This distinction between measured distance and experienced accessibility has been highlighted in several spatial health studies. Tanser et al. (2006), for example, showed that travel time, transportation availability, and road quality may be more relevant predictors of healthcare utilization than simple geographic proximity.

The spatial maps produced in this study further reinforce this interpretation. The distribution of pediatric consultations and self-medication practices across Kinshasa communes reveals a fragmented urban pattern in which central municipalities concentrate formal healthcare utilization, while peripheral areas display higher reliance on informal treatment strategies. Such spatial inequalities reflect broader patterns of urban development and infrastructure distribution within the city.

Sociodemographic determinants and household decision-making

The results also highlight the influence of caregiver characteristics on healthcare-seeking behavior. Parental age was negatively associated with pediatric consultation, particularly among older caregivers. This pattern may reflect generational differences in therapeutic preferences or trust in biomedical healthcare systems. Older caregivers may rely more strongly on traditional medicine, home remedies, or prior experience when managing common childhood illnesses.

Gender differences were also observed, with male respondents being more likely than female respondents to report pediatric consultation. This finding may reflect gendered patterns of household decision-making regarding financial expenditures and healthcare choices. In many African contexts, fathers often retain greater control over financial resources, which may influence the decision to seek formal healthcare services (Molyneux et al., 2002).

The education results observed in crude models appear counterintuitive, as respondents with secondary and university education were less likely to report pediatric consultation than those with primary education. However, this pattern may reflect confounding factors related to health knowledge and self-care strategies. More educated parents may feel more confident managing common childhood illnesses through home treatment before resorting to professional care. Similar findings have been reported in studies examining self-medication practices among educated populations (Hussain & Malik, 2016).

Disease profile and health-seeking behavior

The predominance of infectious and parasitic diseases in the reported morbidity profile is consistent with the epidemiological situation observed in many sub-Saharan African countries. Infectious diseases remain the leading cause of pediatric morbidity and mortality, particularly in urban environments characterized by overcrowding, inadequate sanitation, and environmental health risks (World Health Organization, 2022).

Interestingly, infectious and parasitic diseases were associated with lower odds of pediatric consultation compared with surgical or organic conditions. This result suggests that common childhood illnesses such as malaria, respiratory infections, or gastrointestinal diseases may frequently be treated at home or through informal healthcare channels. Such patterns have been documented in multiple African contexts where families often adopt stepwise healthcare strategies, beginning with self-medication before seeking formal consultation if symptoms persist or worsen (Colvin et al., 2013).

At the same time, the positive association between child age and pediatric consultation observed in the adjusted model may indicate that parents become more attentive to healthcare

needs as children grow older or develop more complex health conditions requiring medical attention.

Perceptions of healthcare quality and service experience

Perceived quality of care also played an important role in shaping healthcare utilization. Among the different quality dimensions analyzed, the courtesy of healthcare staff emerged as one of the most consistent positive determinants of pediatric consultation. This finding highlights the importance of interpersonal aspects of healthcare delivery. Positive interactions between healthcare providers and patients can build trust, increase satisfaction, and encourage repeated use of healthcare services (Gilson, 2003).

Conversely, waiting time emerged as one of the strongest barriers to pediatric consultation. Long waiting times have been widely recognized as a major deterrent to healthcare utilization, particularly in resource-constrained health systems where patient demand exceeds available capacity (Penchansky & Thomas, 1981). When parents perceive waiting time as excessive, they may prefer alternative treatment strategies that allow faster management of their children's illness.

Some perception-related variables produced paradoxical results, particularly regarding professionalism and listening attitude of medical staff. These inconsistencies may reflect perception bias or reverse causality. Parents who frequently interact with healthcare services may accumulate both positive and negative experiences, resulting in more critical evaluations of service quality.

Interpretation of paradoxical spatial barriers

Several results related to perceived access barriers require cautious interpretation. For example, poor road conditions and perceived infrastructure inadequacy were sometimes associated with higher pediatric consultation rates. Rather than suggesting that such barriers facilitate healthcare access, these results likely capture a behavioral process in which severe illness motivates households to overcome environmental obstacles in order to reach formal healthcare services.

Similar paradoxical associations have been reported in studies examining healthcare utilization under difficult access conditions. When perceived illness severity increases, families may mobilize additional resources and effort to reach higher-level healthcare facilities despite geographic constraints (Colvin et al., 2013). These findings therefore illustrate the complexity of healthcare-seeking behavior and highlight the need to interpret statistical associations within their broader social and spatial context.

Implications for urban health policy

Taken together, these results underline the importance of adopting an integrated approach to improving pediatric healthcare access in large African cities. Interventions aimed at reducing financial barriers, strengthening health insurance coverage, improving urban transportation systems, and reducing waiting times in healthcare facilities could significantly enhance access to pediatric services.

Moreover, the spatial inequalities revealed by this study suggest the need for more balanced geographic distribution of pediatric healthcare infrastructure across Kinshasa. Expanding pediatric services in underserved peripheral communes and improving transportation connectivity may help reduce disparities in healthcare utilization.

Finally, strengthening communication between healthcare providers and families and promoting community awareness campaigns may further encourage timely healthcare-seeking behavior among parents.

5. CONCLUSION

This study provides empirical evidence that access to pediatric healthcare services in Kinshasa is shaped by a combination of socioeconomic, demographic, spatial, and institutional factors. The results demonstrate that pediatric healthcare utilization cannot be explained solely by the presence of healthcare facilities but must instead be understood within a broader socio-spatial framework where household resources, mobility constraints, and perceptions of healthcare quality interact.

First, socioeconomic conditions play a central role in determining healthcare-seeking behavior. Higher household income and health insurance coverage significantly increased the likelihood of pediatric consultation, confirming that financial protection mechanisms remain essential for improving access to healthcare services. Conversely, households with limited economic resources appear more likely to rely on self-medication or informal therapeutic practices.

Second, urban mobility emerged as a critical enabling factor. The use of motorcycles, taxis, and public transportation significantly facilitated access to pediatric consultation, whereas walking and lack of transport reduced the probability of seeking formal care. These findings indicate that effective accessibility to healthcare services in Kinshasa depends less on geographic proximity alone than on the ability of households to navigate the urban transport system.

Third, caregiver characteristics and household dynamics also influence pediatric healthcare utilization. Older caregivers were less likely to resort to formal pediatric consultation, possibly reflecting generational differences in healthcare practices. Gender differences in decision-making also appear to influence care-seeking patterns.

Fourth, the epidemiological context characterized by the predominance of infectious and parasitic diseases contributes to the persistence of informal treatment strategies. These illnesses are often perceived as manageable at home, which may explain the relatively high prevalence of self-medication observed in the study.

Finally, perceptions of healthcare quality significantly shape healthcare utilization patterns. Among the different dimensions examined, staff courtesy consistently promoted pediatric consultation, while long waiting times strongly discouraged the use of formal services. These findings highlight the importance of both structural and interpersonal aspects of healthcare delivery.

Taken together, these results emphasize that improving access to pediatric healthcare services in Kinshasa requires an integrated approach that addresses socioeconomic barriers, urban mobility constraints, spatial inequalities in healthcare infrastructure, and the quality of patient experience within healthcare facilities.

6. PRACTICAL IMPLICATIONS

The findings of this study suggest several practical implications for improving pediatric healthcare accessibility in Kinshasa.

- **Prioritize underserved peripheral communes** in the expansion of pediatric healthcare services in order to reduce spatial inequalities in healthcare access.
- **Improve functional accessibility** to healthcare facilities through better road conditions, enhanced public transportation networks, and improved urban mobility infrastructure.
- **Reduce financial barriers** by expanding health insurance coverage for children and introducing targeted subsidies or social protection mechanisms for low-income households.
- **Reduce waiting times** in pediatric services by improving patient flow management, staffing levels, and organizational efficiency within healthcare facilities.
- **Strengthen community awareness campaigns** to improve parental knowledge about childhood illnesses and appropriate care-seeking practices.

- **Improve interpersonal quality of care**, particularly healthcare staff courtesy and communication with parents, as these factors significantly influence healthcare utilization.
- **Promote equitable spatial planning of healthcare infrastructure**, ensuring that rapidly expanding urban neighborhoods are adequately served by pediatric healthcare facilities.

7. STUDY LIMITATIONS

Several limitations should be acknowledged when interpreting the results of this study.

First, the study relies on cross-sectional survey data, which limits the ability to establish causal relationships between explanatory variables and healthcare utilization. The observed associations should therefore be interpreted as indicative rather than strictly causal.

Second, the sampling procedure and representativeness of respondents across the municipalities of Kinshasa should be described more explicitly in the final version of the manuscript in order to better assess potential sampling biases.

Third, some perception-based variables produced paradoxical or inconsistent statistical associations. These patterns may reflect perception bias, residual confounding, reverse causality, or limitations in the measurement of subjective variables related to healthcare quality.

Fourth, the coding of variables and the choice of reference categories in logistic regression models should be clearly documented in the final manuscript to ensure full transparency and reproducibility of the analysis.

Finally, although spatial patterns of healthcare utilization were explored through cartographic analysis, the study did not employ advanced spatial statistical methods. Future research could benefit from integrating spatial econometric models or accessibility indices to deepen the understanding of geographic inequalities in pediatric healthcare access.

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Appendix. Core adjusted determinants to highlight in the Results and Discussion

Domain	Determinants associated with greater formal consultation	Determinants associated with lower formal consultation
Socio-demographic	Male parent; Protestant affiliation; higher income	Older parental age
Child and household	Child insurance; older child age; some disease contexts	Frequent infectious/parasitic conditions in crude analysis
Accessibility	Public transport; motorcycle/taxi in crude analysis	Walking; lack of transport; lack of information; long waiting time
Service experience	Courtesy of staff; favorable view of new centers and awareness campaigns (crude)	Perceived poor care quality in crude analysis; several unstable perception effects