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Prevalence of Juvenile Diabetes among Children Aged 0 to 20 Years in Mbandaka, Democratic Republic of the Congo: A Cross-Sectional Study of Associated Factors and Treatment Conditions

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Abstract

Introduction: Type 1 diabetes (T1D), or juvenile diabetes, is a chronic autoimmune disease characterized by the destruction of pancreatic beta cells, leading to absolute insulin deficiency. It primarily affects children, adolescents, and young adults under 20 years of age. In the Democratic Republic of the Congo (DRC), particularly in Mbandaka, epidemiological data on juvenile diabetes remain scarce, hindering the development of effective prevention and treatment strategies.

Objective: To determine the prevalence of juvenile diabetes among children aged 0 to 20 years in Mbandaka, to identify associated factors, and to analyze treatment conditions.

Methods: A retrospective descriptive study with a quantitative approach was conducted at the Mbandaka Diabetic and Epileptic Clinic. Among 346 registered patients, 36 cases of type 1 diabetes met the inclusion criteria (age 0–20 years, confirmed T1D diagnosis). Data were extracted from medical records covering the period from January 2020 to December 2025. Descriptive analyses were performed using frequencies and percentages.

Results: A slight female predominance was observed (55.6% vs. 44.4%). The most affected age group was 15–19 years (38.9%), followed by 10–14 years (33.3%). The majority of cases came from urban areas (64%). Weight loss (55.5%), polyuria (22%), and fatigue (17%) were the main clinical signs. All patients were on insulin therapy (100%). Environmental factors (72%) dominated over family history (28%). The main treatment difficulties were lack of medication (44.4%), high cost (28%), and difficult access to care (28%). Diagnosis was delayed in 72.2% of cases (discovered during hospitalization).

Conclusion: Juvenile diabetes is a real and documented public health problem in Mbandaka. The null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. Strengthening early screening, improving access to care, and raising public awareness are urgently needed.

Keywords: Juvenile diabetes, type 1 diabetes, prevalence, Mbandaka, DRC, insulin therapy, environmental factors.

1. Introduction

Type 1 diabetes (T1D), commonly known as juvenile diabetes, is a growing public health problem worldwide. This chronic autoimmune disease is characterized by the destruction of pancreatic beta cells, leading to absolute insulin deficiency and requiring lifelong management (American Diabetes Association [ADA], 2023). It primarily affects children, adolescents, and young adults under 20 years of age and can lead to severe complications, including diabetic ketoacidosis, coma, and death, in the absence of early diagnosis and treatment (World Health Organization [WHO], 2023).

According to the International Diabetes Federation (IDF, 2021), more than 1.2 million children and adolescents under 20 years of age currently live with T1D worldwide, with an estimated annual increase in incidence of 3% to 5%. The highest incidence rates are observed in Nordic countries (Finland, Sweden), while lower rates are reported in sub-Saharan Africa. However, this geographical variation likely reflects differences in diagnostic capacity and health system performance rather than true biological differences (EURODIAB Study Group, 2020).

In sub-Saharan Africa, epidemiological data on juvenile diabetes remain fragmented and largely underestimated. Several factors contribute to this situation, including insufficient health infrastructure, lack of qualified personnel, limited access to insulin, high treatment costs, and low population awareness (Sobngwi et al., 2019; Moodley et al., 2021). Consequently, many children are diagnosed late, often at the stage of severe complications such as diabetic ketoacidosis.

In the Democratic Republic of the Congo (DRC), the situation is particularly concerning. The Ministry of Health (2021) reported that non-communicable diseases, including diabetes, are increasing but remain under-documented. A study conducted in Kinshasa by Mupenda et al. (2018) found a male predominance among T1D patients, but data specific to other provinces, including Équateur Province, are lacking.

In Mbandaka, the capital of Équateur Province, no previous study has documented the prevalence of juvenile diabetes. The absence of local epidemiological data makes it difficult to develop appropriate prevention and treatment strategies. This study therefore aimed to fill this gap by answering the following research question: **What is the prevalence of juvenile diabetes among children aged 0 to 20 years in Mbandaka, what factors are associated with its occurrence, and what are the conditions of its management?**

Two competing hypotheses were formulated:

- **Null hypothesis (H_0):** Juvenile diabetes among children aged 0 to 20 years is not a significant public health problem in Mbandaka. There is no documented prevalence, associated factors are not clearly identifiable, and treatment conditions do not present major specific difficulties.

- **Alternative hypothesis (H_1):** Juvenile diabetes among children aged 0 to 20 years constitutes a real public health problem in Mbandaka, with a documented prevalence, identifiable associated factors, and specific treatment difficulties (access to care, insulin availability, high cost).

The specific objectives were: (1) to evaluate the prevalence of juvenile diabetes in Mbandaka; (2) to identify sociodemographic, clinical, and anamnestic factors associated with its occurrence; (3) to analyze the conditions of diagnosis and treatment; and (4) to evaluate the influence of socio-health factors on disease management.

2. Methods

2.1. Study Design and Setting

This was a retrospective descriptive study with a quantitative approach, conducted at the Mbandaka Diabetic and Epileptic Clinic. The clinic is located in the Air-Congo neighborhood, on Ipeko Avenue No. 01, within the convent of the daughters of Charity Sisters (Mbandaka health zone), under the supervision of the Diocesan Bureau of Medical Works of Équateur (BDOM/Mbandaka). The study covered a five-year period from January 2020 to December 2025.

2.2. Study Population and Sampling

The target population comprised all patients registered in the clinic's database (N = 346). Inclusion criteria were: (1) confirmed diagnosis of type 1 diabetes (juvenile diabetes); (2) age between 0 and 20 years at the time of diagnosis. Exclusion criteria were: (1) type 2 diabetes; (2) epilepsy only (without diabetes); (3) age over 20 years. Exhaustive sampling was used, resulting in a final sample of 36 patients meeting all inclusion criteria.

2.3. Data Collection

Data were extracted from the clinic's diabetes care register and medical records. Variables collected included:

- **Sociodemographic variables:** sex, age, place of residence, education level.
- **Clinical variables:** clinical signs, mode of discovery, treatment received.
- **Etiological variables:** family history, environmental factors, genetic factors.
- **Treatment-related variables:** difficulties encountered (lack of medication, high cost, difficult access to care).

2.4. Statistical Analysis

Data were entered into Microsoft Excel and analyzed manually. Descriptive statistics were used, with results expressed as frequencies (n) and percentages (%). The formula used was: % = (Frequency / Total sample size) × 100.

2.5. Ethical Considerations

Research authorization was obtained from the academic authorities of ISTM-Mbandaka. Permission was obtained from the director of the Mbandaka Diabetic and Epileptic Clinic. Anonymity and confidentiality of patient data were strictly guaranteed. No patient names appear in any document related to the study results.

2.6. Limitations

Several limitations should be acknowledged: single-center study (does not cover all cases in Mbandaka); retrospective data from potentially incomplete registers; absence of population-based denominator for true prevalence calculation; exclusion of undiagnosed or undocumented cases; selection bias (only patients who consulted the clinic); absence of advanced statistical tests due to small sample size; and linguistic barriers during data collection.

3. Results

A total of 36 cases of juvenile diabetes were included in the analysis.

3.1. Sociodemographic Characteristics

Table 1. Distribution by Sex

Sex	Frequency (n)	Percentage (%)
Male	16	44.4
Female	20	55.6
Total	**36**	**100**

A slight female predominance was observed (55.6% female vs. 44.4% male).

Table 2. Distribution by Age Group

Age group	Frequency (n)	Percentage (%)
0–4 years	2	5.6
5–9 years	8	22.2
10–14 years	12	33.3
15–19 years	14	38.9
Total	**36**	**100**

The most affected age group was 15–19 years (38.9%), followed by 10–14 years (33.3%). These two age groups together accounted for 72.2% of all cases.

Table 3. Distribution by Place of Residence

Place of residence	Frequency (n)	Percentage (%)
Urban	23	64
Rural	13	36
Total	**36**	**100**

The majority of cases (64%) came from urban areas.

Table 4. Distribution by Education Level

Education level	Frequency (n)	Percentage (%)
Primary school	8	22.2
Secondary school	12	33.3
Humanities (high school)	14	39.0
None	2	5.5
Total	**36**	**100**

The majority of affected children were at the humanities level (39%), followed by secondary school (33.3%).

3.2. Clinical Characteristics

Table 5. Distribution by Mode of Discovery

Mode of discovery	Frequency (n)	Percentage (%)
Consultation	4	11.1
Hospitalization	26	72.2
Screening	0	0
Other	6	16.7
Total	**36**	**100**

A striking finding was that 72.2% of cases were discovered during hospitalization, indicating delayed diagnosis.

Table 6. Distribution by Clinical Signs

Clinical signs	Frequency (n)	Percentage (%)
Polyuria	8	22.0
Polydipsia	2	5.5
Weight loss	20	55.5
Fatigue	6	17.0
Other	0	0
Total	**36**	**100**

Weight loss was the predominant clinical sign (55.5%), followed by polyuria (22%) and fatigue (17%).

3.3. Treatment and Associated Factors

Table 7. Distribution by Treatment Received

Treatment	Frequency (n)	Percentage (%)
Oral antidiabetics	0	0
Insulin	36	100
Total	**36**	**100**

All patients (100%) were on insulin therapy, consistent with international guidelines.

Table 8. Distribution by Medical History

History	Frequency (n)	Percentage (%)
Family history	10	28
Environmental factors	26	72
Genetic factors	0	0
Hereditary factors	0	0
Total	**36**	**100**

Environmental factors dominated (72%) over family history (28%).

Table 9. Distribution by Treatment Difficulties

Difficulties	Frequency (n)	Percentage (%)
Lack of medication	16	44.4
High cost	10	28
Difficult access to care	10	28
Other	0	0
Total	**36**	**100**

The main treatment difficulties were lack of medication (44.4%), high cost (28%), and difficult access to care (28%).

4. Discussion

4.1. Summary of Key Findings

This study documented 36 cases of juvenile diabetes in a single specialized clinic in Mbandaka over a five-year period. A slight female predominance (55.6%) was observed, contrasting with some studies reporting male predominance (Mupenda et al., 2018). The predominance of adolescents aged 10–19 years (72.2%) is consistent with the literature indicating a peak incidence during puberty (Rewers & Ludvigsson, 2016; EURODIAB, 2020).

The most alarming finding was the delayed diagnosis: 72.2% of cases were discovered during hospitalization, likely at the stage of diabetic ketoacidosis. This rate is dramatically higher than in developed countries (<10%) and reflects weak health systems, low awareness, and limited access to primary care (IDF, 2021; Sobngwi et al., 2019).

Weight loss was the predominant clinical sign (55.5%), followed by polyuria (22%) and fatigue (17%). The relatively low reporting of polydipsia (5.5%) may reflect recall bias or a lack of recognition of excessive thirst as a pathological sign in the local context. This pattern suggests that many children present at an advanced stage of catabolism.

The predominance of environmental factors (72%) over family history (28%) is consistent with the literature, which indicates that genetic factors (HLA predisposition) interact with environmental triggers (viral infections, toxins, diet) to initiate the autoimmune process (Rewers & Ludvigsson, 2016). The absence of documented genetic factors in medical records does not indicate their absence but rather a lack of systematic screening.

All patients (100%) received insulin therapy, which is reassuring and indicates that once diagnosed, treatment follows international standards (ADA, 2023). However, treatment difficulties were major: lack of medication (44.4%), high cost (28%), and difficult access to care (28%). These findings are consistent with studies from other sub-Saharan African countries (Moodley et al., 2021; Sobngwi et al., 2019) and highlight the structural barriers to effective T1D management.

4.2. Comparison with the Literature

International comparison: The slight female predominance in our study (55.6%) differs from the balanced distribution often reported in European studies (EURODIAB, 2020) but falls within the range of regional variations. The peak incidence during adolescence is consistent with global data (Rewers & Ludvigsson, 2016). The delayed diagnosis rate (72.2%) is comparable to other low-income settings but much higher than in high-income countries (IDF, 2021). The proportion of family history (28%) is similar to the 10–30% range reported in the literature.

African comparison: A study in Kinshasa reported male predominance (Mupenda et al., 2018), contrasting with our findings, highlighting the need for multicenter studies in the DRC. In Cameroon, Sobngwi et al. (2019) observed delayed diagnosis in 60% of cases, consistent with our results. In South Africa, the incidence of T1D is estimated at 1.5–4.2 per

100,000 children per year, with marked ethnic disparities (Moodley et al., 2021).

4.3. Hypothesis Testing

Null hypothesis (H_0): Juvenile diabetes is not a significant public health problem in Mbandaka.

- **Rejected.** The results show a documented prevalence of 36 cases in a single specialized facility (likely an underestimate), a concentration in the 10–19 age group (72.2%), delayed diagnosis (72.2% by hospitalization), and major treatment difficulties (lack of medication, high cost, difficult access). These elements demonstrate that juvenile diabetes is a real and significant public health problem in Mbandaka.

Alternative hypothesis (H_1): Juvenile diabetes constitutes a real public health problem in Mbandaka.

- **Accepted.** Associated factors were partially identified (environmental predominance 72%). Diagnosis is delayed. Treatment difficulties (lack of medication, cost, access) constitute objective barriers. The prevalence, although probably underestimated, is sufficiently significant to justify actions by health authorities.

4.4. Strengths and Limitations

Strengths: First study on juvenile diabetes prevalence specifically in Mbandaka; analysis of real data from a specialized facility; rigorous quantitative approach with exhaustive sampling.

Limitations: Single-center study (does not cover all cases); retrospective data from potentially incomplete registers; absence of population-based denominator; exclusion of undiagnosed cases; selection bias; absence of advanced statistical tests; linguistic barriers.

4.5. Implications for Practice and Research

Clinical implications: Healthcare professionals need training in early detection of T1D; standardized treatment protocols should be implemented at peripheral health facilities; therapeutic education for families must be strengthened.

Policy implications: Advocacy for free or subsidized insulin and monitoring equipment; improvement of the insulin supply chain; creation of a local juvenile diabetes registry; public awareness campaigns (radio, schools, churches, community leaders).

Research implications: Population-based prevalence study in Mbandaka; prospective cohort study to assess morbidity and mortality; research on environmental factors specific to Équateur Province; qualitative study with families to understand barriers to early diagnosis.

4.6. Recommendations

1. **To the Ministry of Public Health:** Include juvenile diabetes in national health priorities; ensure free insulin availability in public facilities; create a national childhood diabetes screening program.

2. **To the Provincial Health Division of Équateur:** Organize training sessions for healthcare providers; create a provincial juvenile diabetes registry; conduct media awareness campaigns.

3. **To the Mbandaka Diabetic and Epileptic Clinic:** Strengthen medical record-keeping; implement a patient recall system; develop group therapeutic education.

4. **To technical and financial partners:** Support insulin and monitoring equipment supply; fund awareness campaigns; support epidemiological research.

5. **To future researchers:** Conduct multicenter studies in Mbandaka; explore environmental determinants; evaluate the impact of care costs on treatment adherence.

5. Conclusion

This study demonstrates that juvenile diabetes is a real and documented public health problem in Mbandaka. A total of 36 cases were identified in a single specialized clinic over five years, with a predominance among adolescents aged 10–19 years (72.2%). The delayed diagnosis rate (72.2% discovered during hospitalization) is alarming and indicates major gaps in awareness, screening, and access to primary care.

The null hypothesis (H_0) is **rejected**, and the alternative hypothesis (H_1) is **accepted**. Environmental factors (72%) appear to play a more important role than family history (28%) in this context. All patients are on insulin therapy, but treatment is hindered by lack of medication (44.4%), high cost (28%), and difficult access to care (28%).

Juvenile diabetes in Mbandaka requires urgent, coordinated action from health authorities, healthcare professionals, international partners, and the scientific community. Strengthening early screening, improving access to affordable insulin and monitoring equipment, raising public awareness, and creating a local disease registry are essential priorities.

Conflicts of Interest: None declared.

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Author Contributions: Jonathan Mazongo Baboto conceived the study, collected and analyzed the data. Professor Max Ebengho Bokelo supervised the work and wrote the manuscript. Patrick Mundembe Bogbaka provided methodological guidance.

Final verdict on hypotheses:

- **Null hypothesis (H_0): REJECTED.**
- **Alternative hypothesis (H_1): ACCEPTED.**

Juvenile diabetes is indeed a real and significant public health problem in the city of Mbandaka, requiring concerted action from health authorities, healthcare professionals, international partners, and the scientific community.

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