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Prevalence and determinants of urinary incontinence among adult women in the Democratic Republic of Congo: a community-based cross-sectional study

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ABSTRACT

Background: Urinary incontinence (UI) is defined as any complaint of involuntary urine leakage. In the Democratic Republic of Congo (DRC), no community-based data on UI prevalence among adult women are currently available. This study aims to determine the UI prevalence, the associated discomfort, and the risk factors among adult women in the DRC.

Methods: A community-based cross-sectional study was conducted between 2021 and 2023, involving 507 adult women across six provinces of the DRC. A multistage, geographically and ethnolinguistically stratified sampling approach was used. Pregnant or postpartum women ≤6 months, survivor of sexual violence and those with vesicovaginal fistulas were excluded. Data collection included the ICIQ-FLUTS questionnaire to assess urinary symptoms. Binary logistic regression was performed to identify the risk factors of UI ($p < 0.05$).

Results: The prevalence of UI was 31 % (95 % CI: 27–35.2 %), with 51 % of affected women reporting associated discomfort. Urgency urinary incontinence (63.7 %; 95 % CI: 55.7–71.2) was more frequently reported than stress urinary incontinence (11.5 %; 95 % CI: 6.9–17.5). UI was independently associated with occupations involving high-intensity physical activity (aOR: 1.71; 95 % CI: 1.06–2.74), body mass index (aOR: 1.06; 95 % CI: 1.01–1.11), constipation (aOR: 2.64; 95 % CI: 1.48–4.70), episiotomy (aOR: 1.80; 95 % CI: 1.11–2.89), perineal tears (aOR: 1.77; 95 % CI: 1.01–3.20), and the practice of labia minora elongation (aOR: 2.29; 95 % CI: 1.23–4.28).

Conclusion: UI is a multifactorial condition that affects one-third of adult women in the DRC and causes discomfort in nearly half of those affected.

1. Introduction

Urinary incontinence (UI) is a highly prevalent yet under-recognized health condition affecting millions of women globally, with profound implications for physical, psychological, and social well-being. Despite its burden, it remains largely absent from reproductive health agendas, particularly in low-resource settings. It is defined by the International Continence Society (ICS) as any complaint of involuntary leakage of urine [1]. The most common types of urinary incontinence (UI) include stress urinary incontinence (SUI), urgency urinary incontinence (UUI), and mixed urinary incontinence (MUI). SUI involves leakage during physical exertion, sneezing, or coughing, while UUI is characterized by involuntary leakage triggered by a sudden and intense urge to urinate. MUI combines features of both types. UUI typically results from detrusor

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overactivity, poor bladder compliance, and bladder hyperreactivity. SUI is associated with dysfunction of the urethral sphincter and pelvic floor muscles (PFM), as well as weakened support structures and increased urethral mobility [1–3]. Multiple risk factors have been identified, including age, parity, menopausal status, obesity, chronic constipation, and pelvic floor trauma. Social and cultural practices may also contribute to UI risk, although these remain poorly studied in low-income countries.

Prevalence estimates of UI in women range widely from 1.3 % to over 81 % depending on the population studied, diagnostic criteria, and data collection methods [4–12]. According to the recent systematic review and meta-analysis conducted by Jeanne et al. [10], its pooled prevalence in Africa is 24 % (95 % CI: 17–33 %). This systematic review highlights the scarcity of community-based studies conducted in Africa that assess the burden of UI among adult women aged 18 and over. This gap is particularly evident in Central Africa, where no studies have been identified from the Democratic Republic of the Congo (DRC). The authors therefore recommend that future research be conducted in these regions to better address urogynecological health among women in low- and middle-income countries (LMICs) [10].

In the DRC, there are no reliable data on the prevalence of UI among the adult female population. None of the Demographic and Health Surveys (DHS-DRC) conducted between 2007 and 2024 among the general population have addressed the magnitude of this condition [13]. Moreover, the few existing studies on UI have focused on specific subpopulations, which do not provide a clear understanding of its prevalence among community-dwelling adult women. For example, in 2020, a retrospective study based on patient conducted by Nzinga et al. [11] reported a UI prevalence of 1.3 % among women aged 15 and above who attended the University Clinics of Kinshasa. This low prevalence may be attributed to the study's retrospective design and the lack of systematic screening for UI, which likely underestimated the true burden in the community. In 2022, another study reported a UI prevalence of 25.6 %, but it primarily involved adolescent and young women students aged 14 to 30 years, living in Kinshasa and Mbandaka cities [14]. Other studies have focused on pregnant women, with reported prevalence rates ranging from 33 % to 73.2 % [15–17], and postpartum women (1 to 15 months after delivery), with a prevalence of 26.5 % [17]. This evidence gap hinders a comprehensive understanding of the burden of UI and limits the development of effective, context-specific interventions.

The objective of this study was to estimate the prevalence of urinary incontinence among community-dwelling women aged 18 years and older in the Democratic Republic of Congo, and to identify the associated risk factors. By providing robust context-specific epidemiological data, this research seeks to inform national public health strategies and guide the design of culturally relevant prevention and management interventions.

2. Methods

2.1. Guideline

This study was conducted and reported in accordance with the STROBE guidelines for reporting observational studies [18].

2.2. Ethical considerations

Ethical approval was obtained from the National Health Ethics Committee of the Ministry of Public Health, Hygiene, and Prevention of DRC, under number 423/CNES/BN/PMMF/2021. All participants provided written informed consent prior to data collection.

2.3. Study setting and design

This community-based cross-sectional study was conducted from 2021 to 2023 in six provinces of DRC, selected to represent the country's ethnolinguistic diversity to ensure national representativeness [19]. It was carried out in a health center within each of six health zones across six provinces of the DRC. These included Kasaï Orientale province, where Tshiluba is spoken by the Baluba community; Equateur, where Lingala is spoken by the Bangala; Nord-Kivu and Sud-Kivu, where Swahili predominates, and Kongo-Central, where Kikongo is spoken by the Bakongo. The City-Province of Kinshasa, a cosmopolitan area where Lingala is widely spoken by the Kinois population, was also included. All selected health zones were urban, except for that of Kongo-Central, which features both urban and rural characteristics. Due to time constraints, limited financial resources, and accessibility challenges, this study did not include women from rural areas.

2.4. Sample size and inclusion criteria

A multistage, geographically and ethnolinguistically stratified sampling approach was used to recruit women from the community. The first stage of the selection process involved grouping the regions of the DRC according to their ethnolinguistic characteristics to select one province per region (the Baluba, Bakongo, Bangala, Swahili and Cosmopolitan "Kinshasa" zones). The second stage involved selecting a city in each province, while the third stage involved selecting a health zone in each city. Women from the North and South Kivu provinces were grouped as the Swahili group. Community health workers helped raise awareness about recruitment within the community. In each selected health zone, they used a door-to-door approach for recruitment. After a thorough explanation of the nature of the study, women who agreed to participate then attended the selected health centre for the interview and examination.

Based on a prevalence of 20.5 % of pelvic floor dysfunction among women reported in the literature [20], the sample size was calculated to be 246 using the following formula: $n = z^2 \times p\,(1 - p)/i^2$, where n is the required sample size, $z = 1.96$ corresponds to the 95 % confidence level, p is the expected prevalence based on previous literature, and $d = 0.05$ represents the desired precision (or margin of error). A total of 519 adult women (≥18 years old) were recruited, of which 507, in apparent good health, were included in the study. Participants were required to speak French. When necessary, translation was provided by a qualified and trained healthcare professionals fluent in one of the national languages (Lingala, Tshiluba, Kikongo, or Swahili) spoken in these provinces. Pregnant women, those within six months postpartum, survivors of sexual violence, and women with vesicovaginal fistulas (extra urethral incontinence) were excluded from the study. The exclusion of women with these characteristics was justified, as they represent specific populations in which the prevalence of urinary incontinence tends to be higher and may not reflect that of the general community.

2.5. Outcomes

Socio-demographic and clinical data were collected, including age, residential setting, ethnic group, educational background, marital status, occupational status, body mass index (BMI), menopausal status, parity, gestity, mode of delivery, history of labia minora elongation, constipation, episiotomy, and perineal tears. The International Consultation on Incontinence Questionnaire - Women Lower Urinary Tract Symptoms Modules (ICIQ-FLUTS), validated in French, was used to evaluates urinary symptoms and their associated level of discomfort over the past four weeks, with a sensitivity of 86.7 % and specificity of 78.4 % for detecting UI. Items 9 to 13 of the scale were specifically used to calculate the UI sub-score. Each item is rated on a 5-point Likert scale, followed by a scale to assess its discomfort, scored from 0 (best) to 10 (worst) [21]. Constipation was evaluated using the Knowles Eccersley Scott Symptom (KESS) score, a validated diagnostic tool based on Rome II criteria. It includes 11 items, each offering four to five Likert-scale response options, with a total score ranging from zero (no symptoms) to 39, and a cut-off of ≥11 indicating constipation [22]. External genital

and perineal assessment, and digital vaginal palpation were performed to evaluate vaginal elasticity, vaginal introital gaping, labia minora elongation, pelvic floor muscle (PFM) functionality using the PERFECT scheme [23] and PFM tone [24]. The questionnaire and examinations were both carried out by two examiners specialised in perineal rehabilitation. To ensure the accuracy and appropriateness of the translation of these questionnaires into the national languages, preliminary pre-tests were conducted with the interpreters.

2.6. Defining concepts

Based on the International Continence Society (ICS) definition, responses were categorized according to different types of LUTS, including SUI, UUI, insensible urinary incontinence (IUI), MUI, and nocturnal enuresis (NE). The prevalence of any LUTS was defined by a symptom frequency threshold of at least "sometimes" on the five-point Likert scale from the ICIQ-FLUTS. A response of "All of the time" to any LUTS was considered to be "severe" [25]. Any UI was considered present when the woman exhibited at least one of the following symptoms: SUI, UUI or IUI. Discomfort was defined as a response of at least 1 out of 10, categorized into mild discomfort "1 to 3", moderate discomfort "4 to 6", and severe discomfort "7 to 10" to assess the severity of discomfort. Occupation status was categorized into two groups: occupations involving high-intensity physical activity (such as farmers, traders, and artisans) and occupations involving low-intensity physical activity (such as unemployed and civil or private servants).

2.7. Statistical analysis

Data collection and entry were performed using REDCap, a secure and structured web-based platform that ensures data integrity through authentication, audit trails, and encryption. Statistical analyses were subsequently conducted using IBM SPSS Statistics version 29. Missing data completely at random, representing less than 5 % of the total population, were treated by simple imputation (by mean or median, as appropriate). For modeling purposes, observations with missing data not at random were excluded, and a sensitivity analysis was performed to estimate the potential biases associated with this exclusion.

Normally distributed (Shapiro-Wilk test) variables were summarized using means ± standard deviation (SD), while discrete or not normally distributed variables were represented by medians with interquartile range (IQR). Categorical variables were expressed as frequencies and percentages (%) with 95 % confidence intervals (CI). Inferential statistics were performed at a significance level of $p < 0.05$. The characteristics of women with UI were compared to those without the condition. Normally distributed continuous variables were compared using independent samples *t*-test, while discrete variables were analysed using Wilcoxon's rank test. Categorical variables were compared using Pearson's Chi-square test or Fisher's exact test, when appropriate. When a significant difference was detected, the effect size was computed for each test: Cohen's *d* for *t*-tests, r for Wilcoxon's rank test, and Cramér's V for Chi-square/Fisher's exact tests. Effect sizes were interpreted as follows: small ($r < 0.3$; $V \leq 0.2$; $d \leq 0.2$), medium ($0.3 < r \leq 0.5$; $0.2 < V \leq 0.6$; $0.2 < d \leq 0.8$), and large ($r > 0.5$; $V > 0.6$; $d > 0.8$). Spearman's correlation was used to assess relationships between ordinal variables of different UI. Binary logistic regression was used to identify factors associated with UI. A univariable analysis was first conducted to explore the association between each independent variable and the dependent variable (UI). Results of univariable analyses are presented as crude odds ratios (COR) with corresponding 95 % confidence intervals (CI). Variables were selected for inclusion in the multivariable model based on a univariable p-value <0.05 or clinical relevance to ensure no important predictors were omitted. The enter method was applied. Multicollinearity was assessed using the variance inflation factor (VIF), with a value of <2.5 indicating the absence of substantial multicollinearity. In such cases, the variable that was less clinically relevant was excluded from the model. The goodness-of-fit of the model was assessed using the Hosmer-Lemeshow test. A p-value greater than 0.05 indicates that the regression model is well fitted. Associations were reported using adjusted odds ratios (aOR) with 95 % CI.

3. Results

3.1. Sociodemographic and clinical characteristics of women with and without UI

A total of 507 women (97.7 %) were included in the study. Among them, 85 (16.7 %) initially refused vulvar examination, and 110 (21.7 %) declined the digital vaginal examination. These women presented significantly different characteristics compared to those who accepted the examination ($p < 0.005$).

Table 1 shows the characteristics of the study population. The results indicate that the women had a mean age of 33.6 ± 14.6 years and a mean body mass index (BMI) of 22.8 ± 4.3 kg/m^2. The medians for PFM strength, endurance, repetition, and fast contraction were 2/5; 4/10; 2/10, and 3/10, respectively. Furthermore, 6.9 % of the women reported nocturnal enuresis, 15.8 % experienced constipation, and 12.6 % had practiced labia minora elongation (Table 1). The mean age (36.9 ± 15.1 vs. 32.2 ± 14.2 years; $p < 0.001$) and BMI (23.7 ± 4.9 vs. 22.4 ± 3.9 kg/m^2; $p < 0.001$) were significantly higher in women with UI compared to those without the condition. Women with UI were more likely to have constipation (23.6 % vs. 12.3 %; *p=0.002*), nocturnal enuresis (19.1 % vs. 1.4 %; *p<0.001*), engage in high-intensity physical activity (52.9 % vs. 37.7 %; *p=0.002*), a history of delivery (85.4 % vs. 74.0 %; *p=0.005*), a reduced vulvar elasticity (34.8 % vs. 22.6; *p=0.009*), and a history of labia minora elongation (18.5 % vs. 10.0 %; *p=0.008*) (Table 1).

3.2. Prevalence of urinary incontinence

As defined by the International Continence Society (ICS), the prevalence of any UI in the general population of 507 women was 30.9 % (95 % CI: 27 %–35.2 %). The prevalence of UI types in this population was as follows: isolated UUI at 19.7 % (95 % CI: 16.2 %–23.2 %), isolated SUI at 3.5 % (95 % CI: 1.9 %–5.2 %), MUI at 7.1 % (95 % CI: 4.9 %–9.3 %), and insensible UI at 0.6 % (95 % CI: 0.5 %–1.8 %). Among incontinent women only (N = 157), the prevalence rates were 63.7 % (95 % CI: 55.7 %–71.2 %) for isolated UUI, 11.5 % (95 % CI: 6.9 %–17.5 %) for isolated SUI, 22.9 % (95 % CI: 16.6 %–30.3 %) for MUI, and 1.9 % (95 % CI: 0.4 %–5.5 %) for IUI (Table 2). UI prevalence increased significantly with age ($p = 0.028$), from 23.7 % in young adults to 39.1 % in older adults. Higher parity was also associated with increased UI prevalence ($p = 0.021$). No significant differences were observed based on menopausal status or urban/rural setting. Differences in subtype distribution were noted across ethnic groups ($p = 0.037$), although overall prevalence did not significantly differ. Regarding ethnic groups, no significant difference was observed in the any prevalence of UI ($p > 0.05$), whereas the distribution of incontinence types varied significantly between groups (*p = 0.037*) (Table 3).

3.3. UI severity and level of associated discomfort

Half of the women with UI (51 %) reported experiencing discomfort. Discomfort levels were highest among those with IUI (median score 10; IQR: 2–10) and SUI (median 4; IQR: 0–10). A strong positive correlation was found between symptom severity and discomfort level (Spearman's rho ≥0.60; $p < 0.001$). Women experiencing urinary leakage multiple times per day were significantly more likely to report severe discomfort ($p = 0.004$). Interestingly, women engaged in low-intensity physical occupations reported greater discomfort than those in high-intensity roles (60.8 % vs. 42.2 %; $p = 0.020$) (Tables 4 and 5).

Table 1
Comparison of socio-demographic and clinical characteristics between women with and without UI.

Variables	Total (n=507)	UI (n=157)	No UI (n=350)	P-values	Effect size
Age group(years), *n(%)*					
Young adults (18–24)	*186(36.9)*	44(28.4)	142 (40.7)	***0.028***	*0.11*
Middle-aged adults (25–64)	*295(58.5)*	102 (65.8)	193 (55.3)		
Old adults (≥65)	*23(4.6)*	9(5.8)	14(4)		
Mean±SD [CI95 %]	*33.6 ± 14.6 [32.3-34.9]*	36.9 ± 15.1	32.2 ± 14.2	***<0.001***	*0.32*
Occupation status, *n(%)*					
High-intensity physical activity	*215(42.4)*	83(52.9)	132 (37.7)	***0.002***	*0.14*
Low-intensity physical activity	*292(57.6)*	74(47.1)	218 (62.3)		
Body mass index (kg/m2), *n(%)*					
Normal (18.5-24.9)	*322(63.6)*	97(62.2)	225 (64.3)	***0.048***	*0.11*
Thinness (<18.5)	*56(11.1)*	11(7.1)	45(12.9)		
Overweight/ obese (>24.9)	*128(25.3)*	48(30.8)	80(22.9)		
Mean±SD [CI95 %]	22.8 ± 4.3 [22.4–23.2]	23.7 ± 4.9	22.4 ± 3.9	***<0.001***	*0.32*
Delivery, *n(%)*					
Parous	*393(77.5)*	134 (85.4)	259(74)	***0.005***	*0.13*
Nulliparous	*114(22.5)*	23(14.6)	91(26)		
Median(IQR) [CI95 %]	*3(1–6) [2-3]*	4(1–6)	2(0–6)	***0.003***	*0.13*
Labia minora elongation, *n (%)*	64 (12.6)	29(18.5)	35(10)	***0.008***	*0.12*
Constipation, *n (%)*	80(15.8)	37(23.6)	43(12.3)	***0.002***	*0.14*
Noctural Enuresis, *n(%)*	35(6.9)	30(19.1)	5(1.4)	***<0.001***	*0.32*
	(n = 423)	***(n = 138)***	***(n = 285)***		
Introital gaping, *n(%)*	91(21.5)	37(26.8)	54(18.9)	0.06	
Vulvar dystrophy, *n (%)*	82(19.4)	33(23.9)	49(17.2)	0.10	
	(n = 398)	***(n = 132)***	***(n = 266)***		
No vulvar elasticity, *n (%)*	106(26.6)	46(34.8)	60(22.6)	***0.009***	*0.13*
Proper PFM relaxation, *n (%)*	246(61.8)	79(59.8)	167 (62.8)	0.57	
Tone at 6 o'clock, *n(%)*					
Normal	*192(48.2)*	55(41.7)	137 (51.5)		
Decreased tone	*111(27.9)*	40(30.3)	71(26.7)	0.16	
Increased tone	*95(23.9)*	37(28)	58(21.8)		
PERFECT method for PFM, *Median(IQR) [CI95 %]*					
Power (strength)/5	*2(1–3) [2–3]*	2(1–3)	2(2–3)	0.42	
Endurance/10	*4(2–7) [3–4]*	4(2–7)	3(2–6)	0.24	
Repetition/10	*2(1–4) [2–3]*	2(1–4)	2(1–4)	0.85	
Fast/10	*3(1–6) [3-3]*	3(1–7)	3(1–6)	0.74	

PFM: pelvic floor Muscle, IQR: Interquartile Range, SD: Standard deviation.

Table 2
Prevalence of urinary incontinence among community-dwelling adult women.

Urinary incontinence	n(Total)	Overall Prevalence (CI95 %)	Severe UI Prevalence (CI95 %)
Any UI (N = 507)	157(507)	30.9(27–35.2)	4.7(3.1–7)
UI symptoms according ICIQ-FLUTS			
UUI including MUI	136(507)	26.8(23–30.9)	3.2(1.8–5.1)
SUI including MUI	54(507)	10.7(8.1–13.7)	2(0.9–3.6)
IUI	3(507)	0.6(0.1–1.7)	0.4(0–1.4)
UI Types according to ICS definition among overall population			
Isolated UUI	100(507)	19.7(16.2–23.2)	
Isolated SUI	18(507)	3.5(1.9–5.2)	
MUI	36(507)	7.1(4.9–9.3)	
IUI	3(507)	0.6(0.5–1.8)	
UI Types according to ICS definition among UI female			
Isolated UUI	100(157)	63.7(55.7–71.2)	
Isolated SUI	18(157)	11.5(6.9–17.5)	
MUI	36(157)	22.9(16.6–30.3)	
IUI	3(157)	1.9(0.4–5.5)	

UI: Urinary incontinence, SUI: Stress urinary incontinence, UUI: Urgency urinary incontinence, IUI: insensible urinary incontinence, MUI: mixed urinary incontinence, ICS:International continence society; ICIQ-FLUTS: International Consultation on Incontinence Questionnaire - Female Lower Urinary Tract Symptoms Modules.

3.4. Determinants and associated factors of urinary incontinence in women

In multivariable analysis, several factors were independently associated with UI: high-intensity physical activity (adjusted odds ratio [aOR] 1.71; 95 %CI: 1.06–2.74), higher BMI (aOR 1.06; 95 % CI: 1.01–1.11), constipation (aOR 2.64; 95 % CI: 1.48–4.70), episiotomy (aOR 1.80; 95 % CI: 1.11–2.89), perineal tears (aOR 1.77; 95 % CI: 1.01–3.20), and labia minora elongation (aOR 2.29; 95 % CI: 1.23–4.28). No significant association was found between UI and PFM strength, endurance, or tone (Table 6).

4. Discussion

4.1. Prevalence of urinary incontinence

The prevalence of UI among community-dwelling adult women in the DRC was 30.9 % (95 % CI: 27 %–35.2 %), with 4.7 % experiencing severe UI. This prevalence falls within the mid-range of global estimates, which vary widely from 1.3 % to 81 % [4–12], indicating that the burden of UI in the DRC is comparable to that in similar contexts. The observed rate aligns particularly well with findings from studies involving community-dwelling women in low- and middle-income countries [6] and in Africa [10], where pooled prevalence rates of 30 % (95 % CI: 25 %–35 %) and 24 % (95 % CI: 15 %–34 %) have been reported, respectively. It is also consistent with studies conducted in Europe and Central Asia, which reported a prevalence of 32.2 % (95 % CI: 18.9 %–49.15 %), and in Latin America, where the rate was 28.8 % (95 % CI: 22.2 %–36.4 %) [9]. However, the prevalence reported in the present study is lower than that observed in some studies conducted in Central Africa, particularly in Rwanda [26], and in the United States [27] where prevalence rates of 42 % and 49.6 % have been reported respectively. This variation in prevalence rates across different studies may be attributed to several factors, including differences in the definitions of UI, target populations, study designs, assessment tools, age groups, healthcare availability and other contextual variables [9,12]. The prevalence of UI observed in the present study appears to be

Table 3
Prevalence of urinary incontinence stratified by age, residential setting, ethnicity, parity, and menopausal status.

Variables, *n (%)*	Urinary incontinence		UI types				
	n (Total)	Prevalence	UUI	SUI	MUI	IUI	Total
Age groups (years)							
Young adults (18–24)	44 (186)	23.7	25(56.8)	6(13.6)	12(27.3)	1(2.3)	44(100)
Middle-aged adults (25–64)	102 (295)	34.6	69(67.6)	11(10.8)	21(20.6)	1(1)	102(100)
Old adults (≥65)	9 (23)	39.1	6(66.7)	1(11.1)	2(22.2)	0(0)	9(100)
p value	***0.028***		0.81				
Residential setting							
Urban area	118 (397)	29.7	73(61.9)	15(12.7)	28(23.7)	2(1.7)	118(100)
Urban-rural area	39 (110)	35.5	27(69.2)	3(7.7)	8(20.5)	1(2.6)	39(100)
p value	0.25		0.73				
Ethnic groups							
Kinois	18 (56)	32.1	15(83.3)	2(11.1)	1(5.6)	0(0)	18(100)
Swahili	42 (111)	37.8	16(38.1)	7(16.7)	17(40.5)	2(4.8)	42(100)
Bakongo	39 (110)	35.5	27(69.2)	3(7.7)	8(20.5)	1(2.6)	39(100)
Bangala	30 (120)	25	24(80)	3(10)	3(10)	0(0)	30(100)
Baluba	28 (110)	25.5	18(64.3)	3(10.7)	7(25.2)	0(0)	28(100)
p value	0.13		***0.037***				
Menopausal status							
Premenopausal	120 (410)	29.3	73(60.8)	15(12.5)	29(24.2)	3(2.5)	120(100)
Postmenopausal	37 (97)	38.1	27(73)	3(8.1)	7(18.9)	0(0)	37(100)
p value	0.08		0.50				
Parity groups							
Nulliparous	23 (114)	20.2	19(82.6)	0(0)	4(17.4)	0(0)	23(100)
Primiparous	23 (76)	30.3	12(52.2)	3(13)	7(30.4)	1(4.3)	23(100)
Multiparous (2–4)	43 (135)	31.9	25(58.1)	9(20.9)	8(18.6)	1(2.3)	43(100)
Large multiparous (≥5)	68 (182)	37.4	44(64.7)	6(8.8)	17(25)	1(1.5)	68(100)
p value	***0.021***		0.19				

UI: Urinary incontinence, SUI: Stress urinary incontinence, UUI: Urgency urinary incontinence, IUI: insensible urinary incontinence, MUI: mixed urinary incontinence.

Table 4
Discomfort and its severity associated with different types of urinary incontinence and the frequency of urine leakage.

Discomfort, *n(%)*	Discomfort		Total	Discomfort level		Median (IQR)	*Rho (p value)*
	No	Yes		Mild-moderate	Severe		
Any UI	77 (49)	80(51)	157 (100)				
UUI (+MUI)	71 (52.2)	65 (47.8)	136 (100)	30 (21.6)	35 (25.2)	0 (0–7)	*0.60* (***<0.001***)
SUI (+MUI)	21 (38.9)	33 (61.1)	54 (100)	13 (24.1)	20 (37)	4 (0–10)	*0.69* (***<0.001***)
IUI	0 (0)	3 (100)	3 (100)	1 (33.3)	2 (66.7)	10 (2–10)	1
Frequency of Urine leakage							
≤1 per week	47 (67.1)	23 (32.9)	70 (100)	12(17.1)	11(15.7)		
2–3 per week	24 (50)	24 (50)	48 (100)	12(25)	12(25)		
1 per day	4 (44.4)	5 (55.6)	9 (100)	2(22.2)	3(33.3)	0 (0–7)	*0.58* (***<0.001***)
≥2 per day	8 (26.7)	22 (73.3)	30 (100)	6(20)	16(53.3)		
Total	83 (52.9)	74 (47.1)	157(100)	32(20.4)	42(26.8)		
p value	***0.002***						
Effect size	*0.30*						

Rho: Spearman's correlation coefficient (Rho), IQR: Interquartile Range, SUI (+MUI): Stress urinary incontinence including mixed urinary incontinence, UUI(+MUI): Urgency urinary incontinence including mixed urinary incontinence, IUI: insensible urinary incontinence.

age-related. This trend is consistent with findings in the literature, which demonstrate that advancing age is associated with a higher prevalence of any form of UI [28]. However, both the pattern of age-related increase and the distribution of UI subtypes vary across studies [29,30].

The present study found a predominance of UUI over SUI, a trend also observed in other research conducted in similar settings [11,14,17], as well as in several countries in Africa and other parts of the world [10, 31]. However, this contrasts with the global literature, which generally identifies SUI as the most common subtype [2,3,7–10]. This predominance of one type of UI over another remains a subject of ongoing scientific debate. Some hypotheses put forward racial and ethnic disparities as explanatory factors, suggesting that UUI is more frequent in women with black skin than in women with white skin due to physiological differences, such as higher urethral pressure, increased urethral volume and greater mobility of the bladder neck [32,33]. According to Kenton and Mueller [34], these differences remain poorly understood and could be influenced by genetic or cultural factors or variations in the definition and perception of UI. In the context of this present study, the predominance of UUI may also be attributed to a lack of awareness or understanding of the various symptoms of UI, as well as to specific sociocultural and behavioural factors. Possible contributing factors may include the habitual postponement of urination due to limited access to hygienic toilet facilities, as well as the use of traditional substances for intimate hygiene, as reported among Bangala women. These practices might lead to lower urinary tract irritation or changes in pelvic floor muscle function. In addition, medical factors such as low urinary tract infections, comorbidities, the use of specific medications and pelvic organ prolapse may also contribute to this observed prevalence. Future studies are required to confirm these hypotheses. As with any UI, the prevalence rates of UI subtypes depend on various factors, including age, ethnicity, the definitions used for each subtype, and the methodology applied. Consequently, significant efforts are needed to raise awareness, standardize assessment tools, and define UI symptoms consistently across different specific populations, such as those in

Table 5
Relationship between urinary incontinence discomfort and selected study variables.

Variables, *n(%)*	UI Discomfort	No-Discomfort	Total	*p value*	*Effect size*
Residential setting					
Urban area	65(55.1)	53(44.9)	118(100)	0.07	
Urban-rural area	15(38.5)	24(61.5)	39(100)		
Educational background					
Beyond basic education	35(51.5)	33(48.5))	68(100)	0.91	
Up to basic education	45(50.6)	44(49.4)	89(100)		
Marital status					
Married/ cohabiting	42(46.2)	49(53.8)	91(100)	0.15	
Others	38(57.6)	28(42.4)	66(100)		
Occupational status					
High-intensity physical activity	35(42.2)	48(57.8)	83(100)	***0.020***	*0.18*
Low-intensity physical activity	45(60.8)	29(39.2)	74(100)		
Parity groups					
Nulliparous	14(60.9)	9(39.1)	23(100)	0.53	
Primiparous	11(47.8)	12(52.2)	23(100)		
Multiparous	24(55.8)	19(44.2)	43(100)		
Large multiparous	31(45.6)	37(54.4)	68(100)		
Age groups (years)					
Young adults (18–24)	27(61.4)	17(38.6)	44(100)	0.19	
Middle-aged adults (25–64)	46(45.1)	56(54.9)	102(100)		
Old adults (≥65)	5(55.6)	4(44.4)	9(100)		
Ethnic groups					
Cosmopolite	9(50)	9(50)	18(100)		
Swahili	29(69)	13(31)	42(100)	0.07	
Bakongo	15(38.5)	24(61.5)	39(100)		
Bangala	14(46.7))	16(53.3)	30(100)		
Baluba	13(46.4)	15(53.6)	28(100)		
Post-menopausal status	19(51.4)	18(48.6)	37(100)	0.95	

community-based studies. These steps are essential for improving the consistency of prevalence reporting across studies.

4.2. Urinary incontinence and related discomfort

Half of Congolese women experiencing UI reported feeling discomfort due to the condition. According to the literature, multiple factors can influence this discomfort, including ethnicity, type and severity of UI, living environment and socio-economic and cultural factors [7,33,35]. In the present study, discomfort level was positively correlated with symptom severity and frequency of leakage and was also associated with occupational status. Women experiencing IUI and SUI reported a greater discomfort than those experiencing UUI. In this community, seeing urgency-related leakage appears to be culturally perceived as more acceptable or normal compared to effort-related leakage.

Although perceived as causing less discomfort in this context, the literature suggests that urgency-related symptoms tend to be more disruptive, alarming and severe than those of SUI, leading to greater negative impact on quality of life [3]. Some authors have pointed out that, although women in developing countries experience similar levels of discomfort and complaints from pelvic floor disorders as those in developed countries, the consequences are often more severe and have a greater detrimental effect on their quality of life [5,36]. However, this situation is sometimes tolerated due to the low standard of living, precarious living conditions and limited access to appropriate healthcare. Added to this is the stigma surrounding urinary problems and the reluctance to seek medical help, which further exacerbates the vulnerability of women in traditional societies [5,7,36].

4.3. Risk factors associated with urinary incontinence in women

Several factors were initially associated with UI, among which occupations involving high-intensity physical activity, increased BMI, constipation, obstetric trauma such as episiotomy and perineal tears, and the practice of labia minora elongation remained independent predictive factors of UI among adult women living in the DRC. It is well established that childbirth is associated with the onset of UI as well as other pelvic floor dysfunctions. The results of the present study corroborate the hypothesis that it is not childbirth itself, but rather the childbirth process, including neuromuscular effects both antepartum and intrapartum, and the accompanying pelvic floor trauma (such as episiotomy and perineal tears) that are related to the development of UI. These effects are more pronounced with increasing parity and vaginal deliveries [37,38]. The weakening of the supportive structures of the pelvic floor and the increase in intra-abdominal pressure caused by carrying heavy loads, intense activities, and chronic straining can impact the development of incontinence [39,40]. This mechanism explains the involvement of obesity, constipation, and professions involving high-intensity physical activity in the onset of UI. The literature does not provide conclusive evidence on the long-term consequences of labia minora elongation in women. It is possible that certain substances used in this practice may induce vaginal tightening or increased muscle tone, which could potentially alter the functionality of the PFM and perineum, thereby contributing to urinary incontinence. These substances might also be implicated in bladder irritation or lower urinary tract infections. However, further research is needed to explore these hypotheses and better understand this potential relationship.

Moreover, when considering all known associated factors, a significant proportion of the attributable risk for urinary incontinence (UI) remains unexplained [41].

4.4. Scope and implications

The results of this study highlight that UI represents an underrecognized public health issue in the DRC, with a significant impact on the quality of life of affected women. These findings may inform the improvement of national health policies by supporting the implementation of locally adapted prevention and management strategies, such as pelvic health education, raising awareness among women about modifiable risk factors for UI (constipation, overweight, excessive physical strain), and promoting pelvic floor muscle strengthening exercises. They also emphasize the importance for women to seek medical consultation when experiencing urinary symptoms, as well as the need for healthcare professionals to incorporate systematic screening for these symptoms into reproductive health and primary care visits.

4.5. Strengths and limitations of the study

Estimating the prevalence of UI in the general population remains challenging. The estimation of UI prevalence in this study was based on self-reports from questionnaires without clinical confirmation, and its cross-sectional design does not imply a causal relationship. However, the ICIQ-FLUTS questionnaire used has proven to be a reliable and well-validated tool in French, with good correlation to objective clinical assessment. However, this scale has not been validated in the national languages of the DRC (Tshiluba, Kikongo, Swahili, and Lingala). Qualified and trained health professionals were therefore involved in the study for this purpose. Nevertheless, the lack of validated versions in the local languages spoken by the women may represent a potential source of bias. Since some of the data collected relied on participants' recollection of events from the past four weeks, there is a potential for recall bias. The nature of this study, focusing on the pelvic floor area and involving a sensitive topic, may have led some women to decline

Table 6
Binary logistic regression analysis of potential risk factors associated with any UI.

Factors	Any UI				VIF of variables included in the model
	COR (95 % CI)	*p*	aOR (95 % CI)	*p*	
Age *(years)*	1.02(1.01–1.03)	**0.001**	1.01(0.99–1.03)	0.24	1.87
BMI (Kg/m^2)	1.05(1.01–1.10)	**0.007**	1.06(1.01–1.11)	**0.027**	1.14
Gestity	1.07(1.02–1.13)	**0.005**			
Parity	1.07(1.02–1.14)	**0.007**	0.94(0.86–1.03)	0.18	1.86
Occupation status					
Low-intensity physical activity	*1*			1	
High-intensity physical activity	1.85(1.26–2.71)	**0.002**	1.71(1.06–2.74)	**0.028**	1.14
Marital status					
Others	*1*				
Married/cohabiting	1.27(0.87–1.86)	0.21			
Post-menopausal status	1.49(0.93–2.36)	0.09			
Constipation	2.20(1.35–3.58)	**0.002**	2.64(1.48–4.70)	**<0.001**	1.03
Mode of delivery					
No delivery	*1*				
Vaginal delivery only	1.90(1.14–3.18)	**0.013**			
Caesarean section only	0.60(0.12–2.88)	0.53			
Both	519(2.34–11.50)	**<0.001**			
Episiotomy	2.11(1.41–3.15)	**<0.001**	1.80(1.11–2.89)	**0.015**	1.05
Perineal tear	2.37(1.47–3.83)	**<0.001**	1.77(1.01–3.20)	**0.048**	1.07
Labia minora elongation	2.04(1.19–3.48)	**0.009**	2.29(1.23–4.28)	**0.009**	1.60
Introital gaping	1.56(0.97–2.53)	0.06	1.19(0.78–2.72)	0.59	1.47
Loss of vulvar tissue elasticity	1.80(1.16–2.90)	**0.009**	1.45(0.78–2.72)	0.23	1.07
PFM tone at 9 o'clock					
Normal	*1*				
Decreased tone	1.48(0.90–2.45)	0.12			
Increased tone	1.75(1.05–2.93)	**0.033**			
Power (strength) of PFM	0.95(0.81–1.11)	0.53			
Endurance of PFM	1.03(0.97–1.10)	0.23			
Repetitions of PFM	0.99(0.91–1.09)	0.98			
Fast of PFM	1.01(0.95–1.08)	0.59			

COR: crude odd ratio, PFM: pelvic floor muscle, BMI: body mass index, UI: urinary incontinence, aOR: ajusted odd ratio; VIF: variance inflation factor; Test of Hosmer and Lemshow ($p = 0.496$).

participation, which could introduce a selection bias. Furthermore, Although the methodology and sample size are adequate, the taboo nature of the subject, as well as the lack of data on women living in rural areas, limit the generalizability of the results to the entire female population of the DRC. The findings of this study are both crucial and original, as they reflect adult women (≥18 years) from various ethnolinguistic groups and regions of the country.

5. Conclusion

Urinary incontinence is a condition that affects approximately one-third of community-dwelling adult women in DRC. Its prevalence increases with age and parity. UUI was identified as the most common type of UI, although some women also reported experiencing stress urinary incontinence, mixed urinary incontinence or insensible urinary incontinence. Half of the women with any UI reported varying degrees of discomfort, influenced by both the type of incontinence and their occupational status. Women with insensible (IUI) and stress urinary incontinence (SUI) experienced greater levels of discomfort compared to those with urge urinary incontinence (UUI). The severity of discomfort was directly related to the frequency of urinary leakage throughout the day. Accordingly, both the severity of UI and the frequency of urine loss were positively correlated with the level of reported discomfort. Several factors were initially found to be associated with the occurrence of UI. However, in the multivariate analysis, only a subset remained independently associated. These included constipation, increased body mass index, episiotomy, perineal tears, occupations involving high-intensity physical activity and the practice of labia minora elongation. These findings underscore the multifactorial nature of urinary incontinence and emphasize the importance of targeted interventions and awareness campaigns tailored to the specific risk factors identified in this population.

Authors' contributions

•A-ML. Nzinga: Protocol/project development, Data collection or management, Data analysis, Manuscript writing.
•J. Bertuit: Protocol/project development, Supervision, Data analysis, validation, Manuscript editing.
•V. Feipel: Protocol/project development, Supervision, Data analysis, Validation, Manuscript editing.
•T. Reman: Protocol/project development, Data collection or management.
•R. Maroyi: Protocol development, Manuscript editing.
•D. Mukwege: Protocol/project development, Validation, Manuscript editing.

Ethics approval statement

The authors declare that this study involves Humans and the ethics approval statement is as follow: National Health Ethics Committee of the Ministry of Public Health, Hygiene, and Prevention of DRC, under number 423/CNES/BN/PMMF/2021.

Declaration of generative AI in scientific writing

The authors declare that no AI or AI-assisted technology was used in the writing process.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data are available on reasonable request.

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