


Research Paper

Prevalence and patterns of gender-based violence among adolescent girls fetching water in Peri-Urban Settings of Kinshasa, DR CongoJean-Marie Mukiese Nlunda ^{a,*}, Jo-Anne Geere^b, Clémentine Biduaya Sangana^c, Joël Nkiama Konde^a and Guillaume Mbela Kiyombo^a^a Department of Environmental Health, Kinshasa School of Public Health, University of Kinshasa, The Democratic Republic Of The Congo^b School of Health Sciences, University of East Anglia, Norwich, United Kingdom^c Department of Sociology, Faculty of Humanities and social sciences, University of Kinshasa, The Democratic Republic Of The Congo

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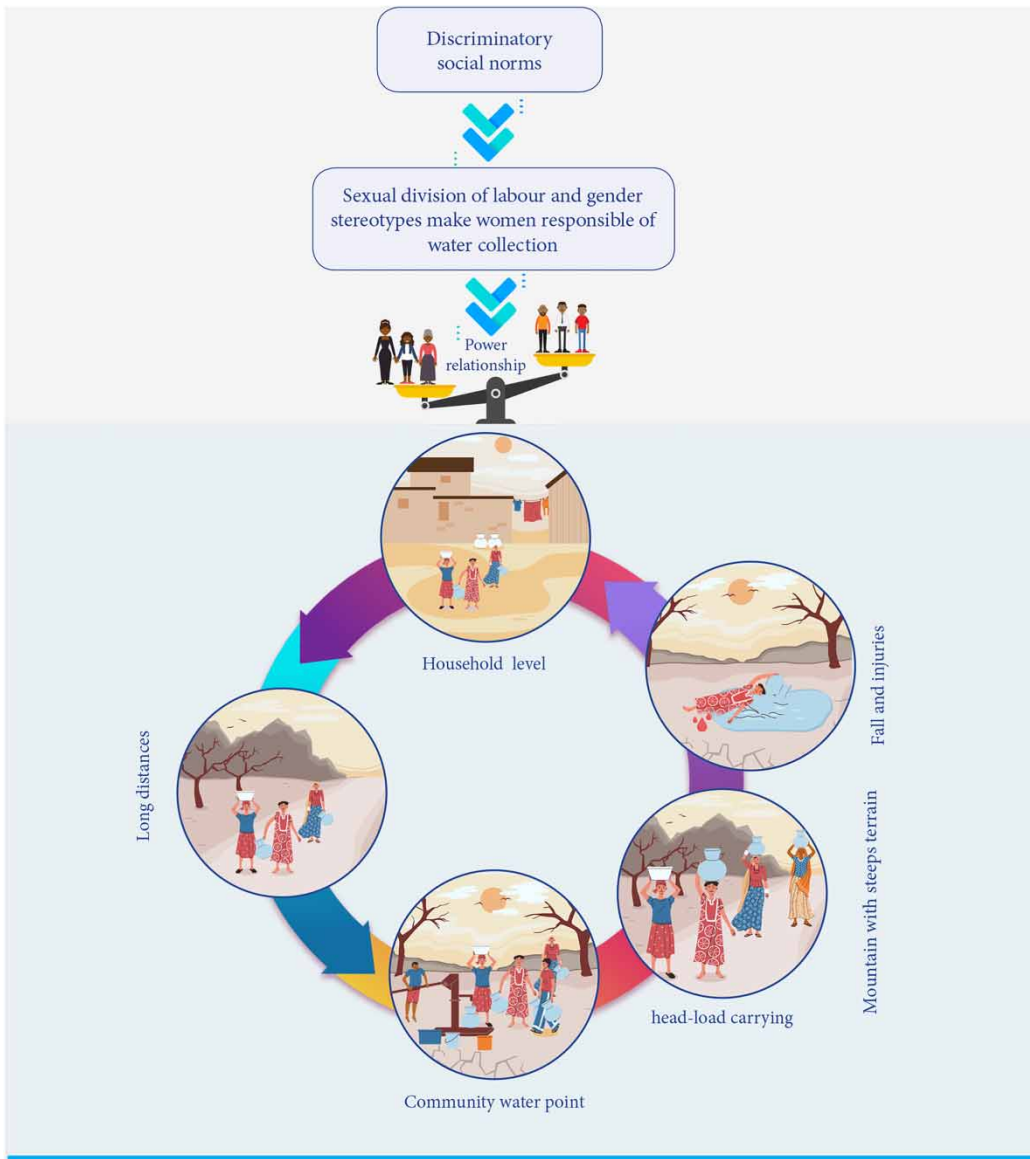
 J-MM, 0000-0002-7323-4436**ABSTRACT**

In water-scarcity contexts, girls fetching water are exposed to gender-based violence (GBV), for which prevalence, types, and forms were unknown in the Peri-Urban Settings of Kinshasa. A cross-sectional study using multi-stage random sampling technique to select 684 adolescent girls was conducted to assess the extent of water scarcity and GBV affecting adolescent girls while fetching water. Findings indicate that 98.2% of adolescent girls were dealing with water shortage; 99.9% experienced at least one type of GBV, of which 97.1, 95.5, and 44.9% experienced sexual, psychological, and physical violence, respectively. Moral violence was more frequent at water points; physical violence in the household, while sexual violence was prevalent on the water route. Adolescent girls' age, weekly involvement in water collection, and distance were found to be the main factors associated with GBV, whereas reducing the number of daily round-trips, the distance travelled, and time devoted to water collection were found to be mitigating factors limiting GBV experience among adolescent girls. Policies promoting the at-home provision of water and community awareness-raising interventions will mitigate the GBV incidence.

Key words: adolescent girls, gender-based violence, Kinshasa, peri-urban settings, water collection**HIGHLIGHTS**

- Physical violence predominates at the household, moral violence at water points, and sexual violence on the water route.
- Girls feel pains in their hearts related to the socially assigned task of collecting water for which society repays them by the GBV.
- Communities are often silent to the GBV experienced by adolescent girls fetching water.
- Water scarcity favours gender-based violence, compromising the SDG5 achievement.

GRAPHICAL ABSTRACT



LIST OF ABBREVIATIONS

- AOR adjusted odds ratio
- CI confidence interval
- DRC Democratic Republic of Congo
- GBV gender-based violence
- PUSK Peri-Urban Settings of Kinshasa
- SPSS Statistical Package for Social Science
- WHO World Health Organization

INTRODUCTION

In Sub-Saharan Africa, 39% of the population does not have access to basic services within 30 min, among them 135 million that have limited water services and invested more than 30 min to collect water (Castañeda Camey *et al.* 2020; WHO & UNICEF 2021). In most African countries, water collection is a woman’s duty in accordance with the social division of

labour, patriarchy, and social norms that disadvantage women (Jacquemin *et al.* 2018). Therefore, adolescent girls in some communities bear up to 90% of the burden of water chores in their households (Graham *et al.* 2016; UNICEF 2016).

Water collection activities put adolescent girls at risk of experiencing at least one type of gender-based violence (GBV) including physical violence, sexual violence, and psychological violence (IRC 2017; Pommells *et al.* 2018; Cano-Lozano *et al.* 2021). GBV experienced by women, particularly adolescent girls, has been described as a major concern with social and public health implications (Aubert & Flecha 2021; Bukuluki *et al.* 2021), and has been widely documented in different contexts (Rahman 2019; Ubillos-Landa *et al.* 2019; Beyene *et al.* 2021). Most of these studies describe the diverse and ever-increasing scale of GBV and their negative effects against women and girls, particularly in the global south (Dowse *et al.* 2016; Zengenene & Susanti 2019; Phillimore *et al.* 2022).

However, GBV affecting adolescent girls engaged in water collection remains insufficiently documented, especially in Sub-Saharan African countries. Numerous factors including their age, their peri-urban location, the distance, and time devoted to water collection, may intersect, and increase their vulnerability to GBV (Sommer *et al.* 2015; Pommells *et al.* 2018; Lindsay *et al.* 2021). To date, most existing studies on GBV occurring during water collection are mainly focused on sexual assault and rape paying less attention to other forms of GBV such as harassment, sexual touching, and sexual exhibition, which are likely to lead to more severe GBV (Burn 2019). Thus, other types of GBV remain undocumented, especially in Sub-Saharan Africa. Most noticeably absent are examples of psychological violence (including insults, humiliation, intimidation, forfeiture of property, rights or benefits) and physical violence (including beatings, slaps, or other physical punishment) and their related-potential health, emotional and school consequences (Asaba *et al.* 2014). These types of GBV may have delayed negative impacts on girls' physical and mental health, socio-cultural status, schooling, and relationship such as poor school attendance, polyvictimization, etc. (Al Odhayani *et al.* 2013; Muriel 2018). Further research and work are needed to more deeply explore the magnitude of the burden of collecting water, the extent of each form of GBV, and the vulnerability of household water collectors (Sorenson *et al.* 2011; Sommer *et al.* 2015).

The Democratic Republic of Congo (DRC) has a school enrolment for girls of around 27% due to a number of factors, including domestic work (UNICEF (nd); EPST 2011). We hypothesise that the documented consequences of GBV for girls' mental, physical, and sexual health (Beyene *et al.* 2021; Mtasingwa & Mwaipopo 2022) can lead to adverse effects on girls' school attendance and outcomes (Psaki *et al.* 2017). Therefore, this study targeted school-going adolescent girls in the peri-urban settings of Kinshasa (PUSK), where households' access to on-site water remains a major challenge.

The insufficient number of water points combined with local overpopulation in the PUSK result in crowds and long queues at the water points. All these factors together create an environment conducive to violence whether at home, on the route, or at the water point. At home, adolescent girls may suffer from various forms of violence if they refuse to collect water, collect it late or spend too much time collecting water. At the water points, there may be quarrels and fights between women in the queues, and we also hypothesize that adolescent girls are often victims because of their age-related weakness or vulnerability.

Previous research has established that women and adolescent girls collecting water are vulnerable to several forms of GBV (House *et al.* 2014; Pommells *et al.* 2018; Castañeda Camey *et al.* 2020). However, research carried out to deeply explore the GBV experienced by girls during water collection in the context of water shortage in Sub-Saharan Africa's regions is scarce, with very little completed in the PUSK. Existing research focuses on the serious forms of sexual violence such as rape and does not address the gap of the so-called 'minor' forms of GBV. Very few studies have shown the frequency of minor GBV following their occurrence frames. Therefore, our study sought to characterize, first, the extent of water fetching and the related-GBV experienced by girls engaging in the water collection process, in order to inform decision-making and the implementation of policies to protect girls in the PUSK.

MATERIALS AND METHODS

Study area and design

Figure 1 shows the peri-urban health zones where this study was carried out. Figure 2 illustrates the 24 health areas in which data were collected. A cross-sectional study was conducted among girls aged 12–17 years old who collect water in the PUSK, a part of the city of Kinshasa. The city is divided into 35 health zones, of which 12 are peri-urban. Each of these health zones is divided into health areas which met the study criteria of being either partially or totally not connected to the water distribution network.

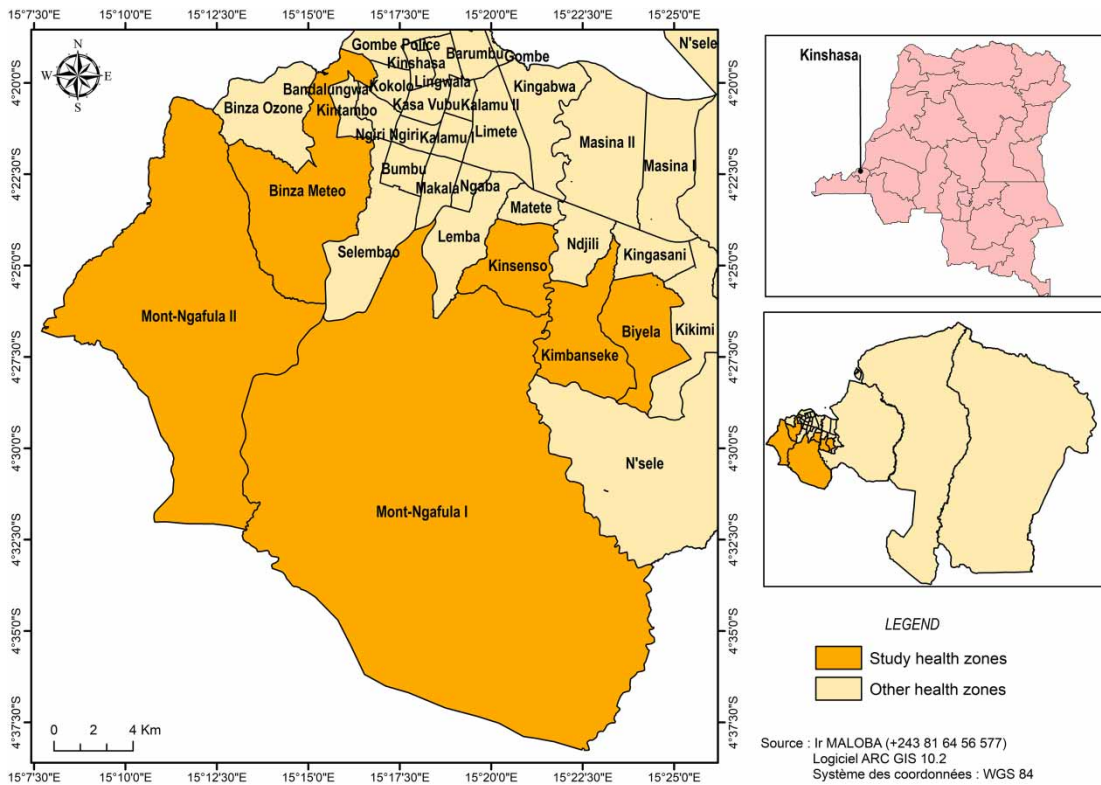


Figure 1 | Health zones in the city of Kinshasa.

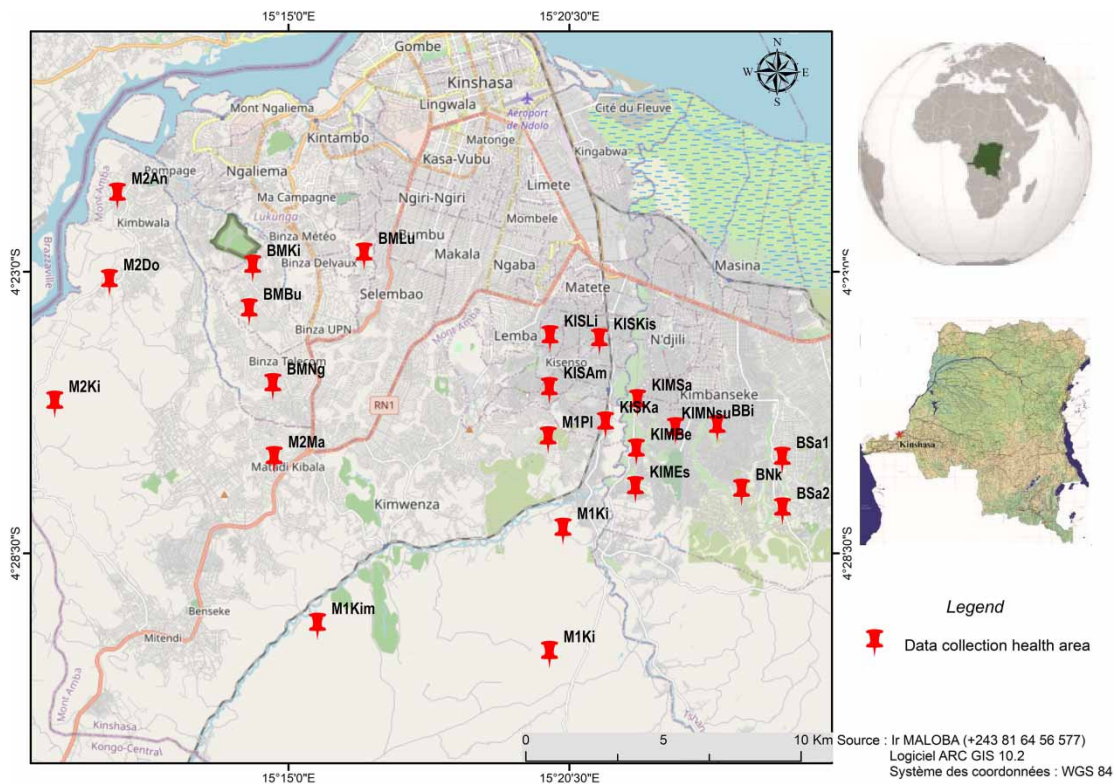


Figure 2 | Spatial location of sampled health areas in peri-urban settings of Kinshasa.

Sample

We performed a random sampling using five steps to select first, six out of the 12 peri-urban Health Zones including Binza Météo, Biyela, Kimbanseke, Kisenso, Mont Ngafula I, and Mont Ngafula II. Second, the person in charge of the water sanitation and hygiene at each peri-urban health zone level helped to produce a list of health areas (HAs) of interest, meeting the study criteria. From the established list, we randomly selected four HA from each peri-urban health zone. We obtained 24 HAs drawn from the six peri-urban health zones.

Third, within each HA, a ‘community representative member’ helped to produce a list of streets from which we randomly selected five that met the criteria of containing at least 50 parcels for random selection. Fourth, at the street level, a plot survey was used to identify eligible households containing at least one girl aged 12–17 years. Fifth, in households with more than one eligible adolescent girl, a list based-random choice selected only one adolescent girl to participate in the study, preventing information bias if more than one girl was selected. The study inclusion criteria for girls’ selection consisted of being an adolescent girl aged 12–17 years, being enrolled to attend school and involved in household water collection for at least 6 months. In addition, the adolescent girls must have lived in the study area for at least 12 months, have parental authorization, and agreement to participate.

Data collection

We collected data using a semi-structured paper questionnaire; interviews were executed by young female socio-anthropologist surveyors. The questionnaire was pre-tested; data were collected between November 2018 and September 2019.

Study variables

The age of the adolescent girls, weekly frequency, daily round trips, and time of water collection, as well as the distance travelled to a water supply point were independent variables (Table 1). All of them were measured on a continuous scale and used to construct the analytical logistic regression model.

The GBV considered in this study was classified in three types: psychological violence, physical violence, and sexual violence (Henrica 2016, p4–5; Hamza 2006, p22), and were considered as ‘dependent variables’ which were binary and categorized as ‘YES’ or ‘NO’. To explore these dependent variables, questions were asked about three locations, namely household, route, and water point levels. The first questions explored GBV at home. For example, for verbal abuse, the questions were:

- At home, because of not fetching water or the fact that you fetched water late, have you experienced insults?
- On the route of fetching water, have you experienced insults?
- At the water point, have you experienced any insults?

We checked for the three forms of psychological violence as described above. If the answer was ‘YES’ to any of the questions, the second question explored temporalities as follows: When did the abuse occur on the latest occasion? According to the adolescent girls’ statements, the surveyor had to choose among three pre-stated temporalities: in the last 15 days, between 16 and the 30 days ago, and between the 31 and the 90 days ago. We did not assess periods beyond 3 months to avoid recall bias when the period to remember is longer. The third question explored the site of violence occurrence stated as follows: Where did the latest abuse occur? The response could be either at home, on the route, or at the water point. This set of questions screened for the three types of GBV in their different forms as stated below (Hamza 2006; Henrica 2016).

Table 1 | Descriptive variables of water collection

| Variables assessed (<i>n</i> = 684) | Mean (SD) | Min–Max |
|---|-----------------|----------|
| Age, years | 15.60 (1.29) | 12–17 |
| Distance travelled, metres | 951.73 (792.63) | 25–5,562 |
| Time taken to collect water, min | 188.57 (121.55) | 12–920 |
| Water collection frequency, days per week | 5.53 (1.89) | 1–7 |
| Water collection round trips per day | 4.80 (2.37) | 1–12 |

Type 1. Psychological violence. Three forms were assessed. The first form referred to verbal abuse, such as insults, humiliation, and intimidation. The second form referred to any form of forfeiture of property. The third form explored forfeiture of rights and benefits such as the right to draw water from the tap according to the time of arrival.

Type 2. Physical violence referred to beatings, strangling, slaps, spanking, twisting (hair, ears, arms, and neck), stoning, fights, and physical punishments of any kind.

Type 3. Sexual violence. They implied, first, verbal sexual harassment (sexual expressions, suggestions, comments about the body, physical appearance, or statements and questions that are invasion of privacy) and non-verbal sexual harassment (intrusive movement of the eyes or body, sexist images) as described in the literature, second, physical harassment, or sexual touching (Sivertsen *et al.* 2019) and third, exhibition of organs or body intimate parts (Collart 2019) happening to a girl in the water collection process.

At any location (household, route, water point), different types of GBV including psychological violence, physical violence, and sexual were explored separately from each other. If at least one form of violence occurred, this implies for this study that the whole type of GBV is positive. Within different types of GBV, each form of violence was separately screened at the household level, on the route, and at the water, point to obtain the frequencies displayed in Table 2. The distribution of GBV at different sites was assessed in percentages, which were compared using the Chi-square test for homogeneity (Campbell 2007).

Data analysis

Data from the study were recorded on Epidata software version 3.1 and transferred to SPSS version 26 for analysis. The normality of the quantitative variables was verified by the Kolmogorov–Smirnov and Shapiro–Wilk tests.

The categorical variables generated proportions that were compared with the Fisher–Irwin χ^2 test (Collart, 2019). The association between the dependent variable and the independent variables was checked with multivariate logistic regression with a 95% confidence interval. A p -value < 0.05 was considered statistically significant for both tests.

Table 2 | Types and forms of gender-based violence by sites of occurrence

| Types and forms of gender-based violence ($n = 684$) | Sites of GBV occurrence | | | | χ^2 | p -value |
|--|-------------------------|--------------------|---------------------|--------------------|---------------|--------------------|
| | Household (%) | Route (%) | Water point (%) | Overall (%) | | |
| Psychological | 496 (72.50)* | 240 (35.10) | 578 (84.50)* | 653 (95.50) | 29.19 | < 0.0001 |
| Insults & humiliation | 480 (0.20)* | 207 (30.30) | 351 (51.30)* | 581 (84.90) | 51.20 | <0.0001 |
| Deprivation of rights | 175 (25.60)* | 40 (5.80) | 516 (75.40)* | 264 (82.50) | 339.06 | <0.0001 |
| Confiscation of property | 124 (18.0)* | 51 (7.50) | 129 (18.80)* | 222 (32.50) | 0.11 | 0.7387 |
| Physical | 216 (31.60)* | 49 (7.20) | 152 (22.20)* | 30 (44.90) | 15.36 | < 0.0001 |
| Slaps | 99 (14.50) | 9 (1.30) | 71 (10.30)* | 169 (24.70) | 5.55 | 0.0185 |
| Fights | 2 (0.30) | 31 (4.50)* | 119 (17.40)* | 13 (20.00) | 58.32 | <0.0001 |
| Twisting limbs | 70 (10.20) | 5 (0.70) | 2 (0.30) | 75 (11.00) | | |
| Punishments | 69 (10.10) | 3(0.40) | 0 (0.00) | 68 (10.20) | | |
| Spankings | 55 (8.00) | 2 (0.30) | 5 (0.40) | 64 (9.40) | | |
| Hittings | 6 (0.90) | 5 (0.70) | 34 (4.90) | 37 (5.40) | | |
| Strangling | 6 (0.90) | 6 (0.90) | 28 (4.10) | 31 (4.50) | | |
| Stonings | 12 (1.70) | 6 (0.90) | 11 (1.60) | 23 (3.40) | | |
| Injuries | 4 (0.60) | 3 (0.40) | 13 (1.90) | 19 (2.80) | | |
| Sexual | 128 (18.70) | 653 (95.50) | 438 (64.00)* | 664 (97.10) | 209.98 | < 0.0001 |
| Harassments | 103 (15.10) | 643 (94.00) | 643 (53.80)* | 657 (96.10) | 286.34 | < 0.0001 |
| Sexual touchings | 26 (3.80) | 142 (20.80) | 2 (10.50)* | 19 (28.80) | 27.47 | <0.0001 |
| Exhibitionism | 30 (4.40) | 53 (7.70) | 5 (11.00)* | 131 (19.20) | 43.91 | 0.036 |

*Proportions that were compared to provide statistical significance at $p < 0.05$. These statistics show the homogeneity of GBV according to each site compared to others.

RESULTS

Sociodemographic and water collection descriptive characteristics

Table 1 summarizes the variables taken into account to characterize water accessibility in PUSK.

More than half (57%) of adolescent girls interviewed were between 16 and 17 years old with a mean age of 15.6 years (Table 1). In total, 68% of them travel at least 500 m with a mean distance of 952 meters to reach the water point. Data analysis showed that 98% girls invested more than 30 min in fetching water with a mean time of 189 min. 68% draw water at least 5 days a week and more than half (56%) perform an average of five daily round trips between the household and the water point.

Figure 3 shows that of the 684 adolescent girls interviewed, 683 (99.9%) experienced at least one form of GBV in the previous 3 months. Of the 99.9% of adolescent girls who reported having experienced GBV, 84.5% had experienced GBV in the last 15 days prior to the survey.

Table 2 shows the sites and prevalence of related-GBV experienced by adolescent girls fetching water in the PUSK.

The results in Table 2 indicate that 95.5% of adolescent girls reported experiencing at least one form of psychological violence. The forms most experienced were insults, intimidation, and humiliation. With a percentage of 84.5%, insults, intimidations, and humiliations were significantly higher at home (70.2%) than the 51.3% at water points ($p < 0.001$).

Secondly, 44.9% of adolescent girls experienced physical violence and these were more often experienced at home than elsewhere ($p < 0.001$). An overall percentage of 24.7% of slaps was declared of which 14.5% occurred at home, and 10.3% at the water point ($p < 0.001$).

The second most common reported physical violence was fighting in 20% of cases, and 17.4% of adolescent girls experienced fights at the water supply point. This was more prevalent than 4.5% of adolescent girls who experienced fights en route ($p < 0.001$).

Thirdly, 97.1% of adolescent girls reported experiencing at least one form of sexual violence. With a prevalence of 96.1%, harassment was the most prevalent form of sexual violence. In total, 94% of respondents experienced sexual harassment en route, and this occurrence was significantly more frequent in comparison to other sites, as 53.8% were sexually harassed at the water point ($p < 0.001$). In the last 15 days preceding the survey, 59.6% of adolescent girls experienced sexual harassment, with an average of 5.78 ± 4.00 episodes per person.

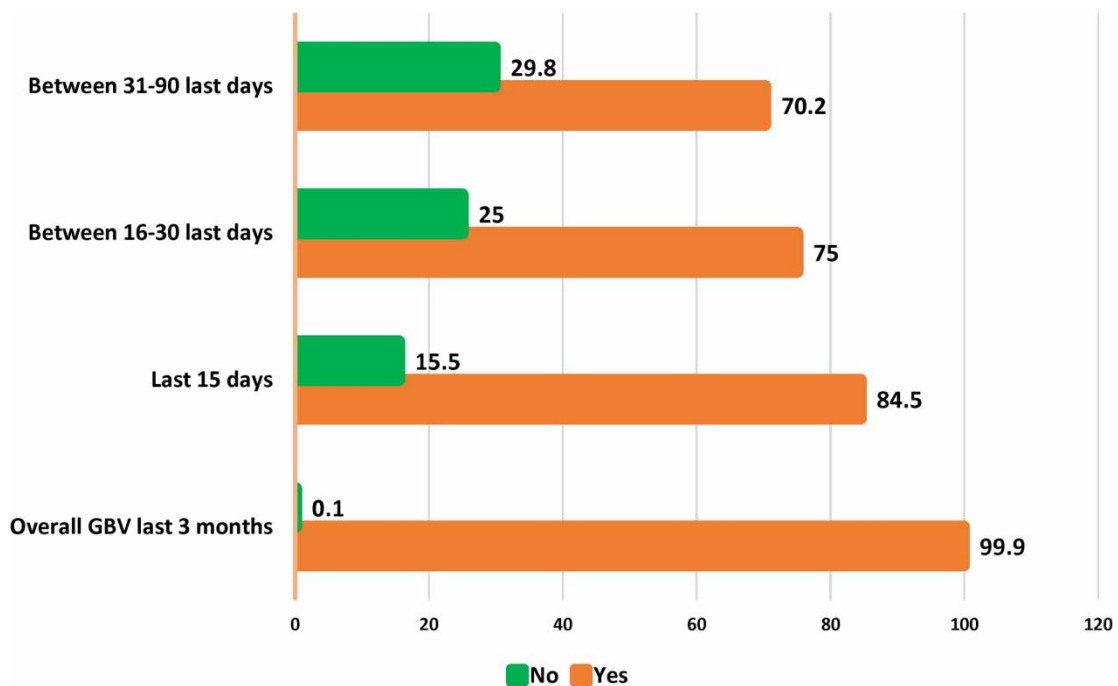


Figure 3 | Temporality of GBV types in the last 3 months prior to the study.

Table 3 | Factors associated with psychological, physical, and sexual violence experienced using logistic regression

| Factors assessed | Psychological violence | | Physical violence | | Sexual violence | |
|------------------------------------|------------------------|---------------|-----------------------|---------------|---------------------|---------------|
| | AOR (95% IC) | p-value | AOR (95% IC) | p-value | AOR (95% IC) | p-value |
| Age | 1.153 (1.002–1.326) | 0.046* | 0.802 (0.631–1.019) | 0.072 | 1.343 (1.139–1.583) | 0.000* |
| Days of water fetching last 7 days | 1.342 (0.998–0.999) | 0.015* | 1.579 (1.218–2.046) | 0.001* | 1.389 (1.083–1.782) | 0.010* |
| Number of trips per day | 0.734 (0.538–0.884) | 0.003* | 0.659 (0.513 – 0.847) | 0.001* | 0.724 (0.568–0.923) | 0.009* |
| Distance (metres) | 1.124 (0.996–0.999) | 0.024* | 1.000 (0.999–1.000) | 0.095 | 0.999 (0.997–0.999) | 0.021* |
| Times (min) | 0.929 (0.881–0.980) | 0.121 | 1.019 (0.988–1.051) | 0.239 | 0.929 (0.881–0.980) | 0.007* |

The bolded values highlight the statistical significant associations between the factors and the dependent variables.

Association between study variables with the psychological, physical, and sexual violence

For adolescent girls involved in water collection, each additional year of age increases their likelihood of experiencing GBV by 15.3% for psychological violence [Adjusted Odds Ratio (AOR) = 1.153 (1.002–1.326)] and by 34.3% for sexual violence, [AOR = 1.343 (1.139–1.583)] (Table 3). Also, the increase of distance beyond 500 m increases the risk of experiencing psychological violence by 12.4% [AOR = 1.124 (0.998–0.999)]. Each additional day out of seven days of water collection in a week presents an additional risk of experiencing psychological violence by 34.2% [AOR = 1.342 (0.998–0.999)], by 57.9% for physical violence [AOR = 1.579 (1.218–2.046)] and by 38.9% for sexual violence [AOR = 1.389 (1.083–1.782)].

However, reducing number of trips per day decreases the risk of experiencing GBV by 26.6% for psychological violence [AOR = 0.734 (0.538–0.884)], by 34% for physical violence [AOR = 0.659 (0.513 – 0.847)], and by 27.6% for sexual violence [AOR = 0.724 (0.513–0.847)]. Reducing the time for water collection decreases the risk of experiencing sexual violence by 7% [AOR = 0.929 (0.881–0.980)].

Gender-based violence witnessed by school-going adolescent girls

In relation to water collection activities, our findings indicate that in the 15 days prior to our interviews, at least 7 out of 10 adolescent girls reported witnessing scenes of GBV perpetrated on other peers. First, they witnessed psychological violence (mainly insults, intimidation, humiliation as well as deprivation of rights and benefits) at the water point. On average, the respondents witnessed 3.21 ± 2.87 episodes of other adolescent girls experiencing psychological violence in the last 15 days.

Secondly, they witnessed physical violence (mostly fights) at water points. On this topic, the adolescent girls we surveyed reported witnessing an average of 3.64 ± 3.34 girls experiencing fighting. The adolescent girls reported having witnessed an average of 4.06 ± 3.05 other adolescent girls being sexually harassed or touched during the last 15 days preceding our survey.

DISCUSSION

The extent of gender-based violence

We found that almost all adolescent girls surveyed were required to fetch water from community water points for household use, and that more than nine out of ten adolescent girls experienced multiple forms of GBV. These results highlight the extent of GBV among adolescent girls fetching water and correlate with the experience of adolescent girls in South Africa who also experience violence while fetching water (Jayaweera *et al.* 2022).

The high prevalence of GBV in Kinshasa involves several forms of GBV affecting the lives of adolescent girls over a period covering the last 3 months compared to the percentage of 17.1% reported from the South African study. Our results reflect not only the intersection of several forms of GBV, but factors like the distances they walk, time devoted to water collection, age, and involvement in water collection.

The prevalence of GBV is supported by other studies stating that poor access to water and water collection activities favour the occurrence of GVB and increase the vulnerability of water collectors like adolescent girls (Finkelhor *et al.* 2009; Pommells *et al.* 2018; Castañeda Camey *et al.* 2020). In countries such as Uganda and Nigeria, studies have also reported adolescent girls experiencing GBV during the water collection process (Al Odhayani *et al.* 2013; Asaba *et al.* 2014; Ayoade *et al.* 2015).

Forms and sites of occurrence of gender-based violence

This study has revealed a high prevalence of GBV with more than nine out of ten adolescent girls having already experienced at least one form of psychological violence (Table 2). Analysis showed a predominance of deprivation of benefits and rights at the water point, followed by insults, intimidation, and humiliations at the home. Most of the psychological violence occurred over the last 15 days. At the water point, the weekly involvement and the age of the adolescent girls were both factors associated with psychological violence, results which are similar to those found through a meta-analysis using a systematic review of literature (Lee & Kim 2023). However, the reduction of the number of daily round trips and the distance walked were found to decrease the level of psychological violence among adolescent girls. This may be explained by a decrease in the daily time spent queuing for water by adolescent girls. Where the number of water points is insufficient, or the yield is low, social tensions rise when people are in the queue waiting for a long time for their turn to draw water. This is consistent with studies mentioning psychological violence which mostly occurs at the water point following long periods of waiting in the queue (Thompson *et al.* 2011; House *et al.* 2014).

Nearly half of the adolescent girls interviewed have already experienced at least one form of physical violence, and the physical violence was more prevalent at home (slaps, punishment, and battery). At the household level this appears as a parental discipline measure against adolescent girls failing to fetch water, taking too long, not getting enough water, or spilling it. However, at water points, fights and slaps were the physical violence forms most often reported whereas alarming proportions of physical violence were documented elsewhere (Finkelhor *et al.* 2009).

Similar results of physical violence were reported, showing the breadth of physical violence affecting adolescent girls, particularly when they failed to fetch water or have been late returning with water (Sommer *et al.* 2015). The physical violence has also been reported en route to the water point when girls must travel long distances that expose them to assailants (Pommells *et al.* 2018; ELiana *et al.* 2019). However, in the context of PUSK, our study did not show a statistical association between the physical violence among adolescent girls and the distance travelled (Table 3).

The study established that the weekly number of days of water collection was a factor in increasing the occurrence of physical violence on adolescent girls. Our analysis has also shown that the decrease in daily round trips performed by adolescent girls appeared as a mitigating factor against physical violence. Even if in our study increased distance travelled to the water point is not associated with physical violence, our data indicates that increased daily and weekly frequency of fetching water increased the opportunities for violence to occur. In effect, additional trips increase the overall distance travelled and we assume this offers more opportunities for a perpetrator to commit violence against adolescent girls engaged in water collection. During interviews, most adolescent girls reported that the physical violence occurring on the water route often resulted from quarrels starting at the water point. Thus, en route, adolescent girls used to transform insults and quarrels starting at the water points into fights between peers. Such statements support the fact documented elsewhere that crossing long routes makes girls more insecure and exposes them to GBV including physical violence between women and girls (Thompson *et al.* 2011; Sommer *et al.* 2015).

Our research has reported a high incidence of sexual violence occurring in various locations with adolescent girls fetching water. Our results, which corroborate findings from previous studies in Sub-Saharan Africa, show that sexual violence against adolescent girls collecting water is very common and disturbing (Asaba *et al.* 2014; Ayoade *et al.* 2015; IRC 2017, 2019; Pommells *et al.* 2018). Similar studies have shown insufficient water services forcing adolescent girls to walk long distances to reach water points. Thus, travelling long distances put girls at a high risk of several forms of sexual violence (McIlwaine 2013; Castañeda Camey *et al.* 2020).

In addition, we reported a significant association between sexual harassment with the adolescent girls' age and the increase of the weekly involvement in water collection. From an intersectional perspective, this is consistent with other studies showing that adolescent age was associated with weekly involvement, distance and time were contributing factors to sexual violence occurrence (Castañeda Camey *et al.* 2020). Our results show that reducing daily round trips, distance, and time are all protective factors. Several results from studies in other contexts also documented these factors to increase the likelihood for adolescent girls to be sexually harassed in the pursuit of water (Sommer *et al.* 2015; Castañeda Camey *et al.* 2020).

Unexpectedly, our study has revealed that psychological violence and physical violence occurring at home for failing to collect water were predisposing factors for adolescent girls to experience sexual violence. Indeed, the psychological and physical violence occurring at home often drove the psychologically and physically abused adolescent girls out of the house. This temporary removal explained in part why they were victims of sexual harassment or sexual touching at the plot level. We

suggest a qualitative study to deeply explore and better explain this unusual phenomenon that seems to be a consequence of psychological violence and physical abuse linked to water collection occurring at home.

The temporality of gender-based violence

Our study found that more than 8 out of 10 cases of GBV were recent, experienced in the 15 days before our survey (Figure 3). This large proportion reflects the extent and the topicality of the problem of GBV among adolescent girls fetching water in PUSK. The reported scale of GBV seems high, especially in the 15 days preceding our survey.

This may be due to the fact that adolescent girls are most likely to remember and report the most recent incidents of GBV. We suppose that the more time accumulates, the more adolescent girls could forget certain facts. Therefore, recall bias may explain the trend of reduced GBV occurrences over time as shown in Figure 3. This contrasts somewhat with the literature which indicates that the dynamic nature of events such as recall memory and trends may arise as challenges that can influence evaluating GBV (McAlpine *et al.* 2020). Data from our research demonstrated that although recall bias may have affected the responses of under-aged girls, the importance of the problem remains high in PUSK.

Indeed, up to 3 months later where recall bias could influence decreased reporting, 7 girls out of 10 experienced either one form of GBV in the past. Our result corroborates the high rates of GBV experience documented among adolescent girls during the water collection process in other contexts (Etienne *et al.* 2002; Zengenene & Susanti 2019; Moawad *et al.* 2021).

Anecdotal evidence indicates that in the context of extreme poverty, sexual violence is growing exponentially in PUSK. This may mean that some of the adolescent girls who responded were recalling incidents of sexual violence that were not all related to water collection. There are unfortunately no previous studies of GBV during water collection that would enable us to compare the present incidence of GBV to past trends, indicating that a qualitative study may be helpful to deeply explore this issue.

Limitations

This study has several limitations, first, the study relied on adolescents reporting subjective information about lived experiences, which requires their capacity to reflect on and articulate violent events accurately and reliably. This is challenging for many people and may have influenced how they responded in the study. Second, during the pre-test of the questionnaire, due to fear of reprisals, most adolescent girls were reluctant to report violence they had experienced from their parents and siblings when they were interviewed close to their parents. To overcome this obstacle during data collection, we opted to obtain authorization to perform interviews away from their parents and siblings. Third, the questionnaire relies on self-reported data from adolescent persons, and as such, recall bias is expected regarding questions exploring up to the last past 12 months. However, as serious and impactful incidents, occasions of GBV are likely to be clearly remembered by most people. Fourth, we performed a cross-sectional study which limits ability to draw causal inferences from the data. Hence, the outcomes of the study were possibly affected by non-considered factors potentially associated with or mediating GBV such as socio-cultural and other personal factors.

CONCLUSIONS

This study found that almost the entire group surveyed travel an average of 952 meters to collect water each day. Psychological violence was highest at water points, physical violence was highest within households and sexual violence was most prevalent on the water route. The adolescent girls' age, weekly involvement in water collection, and distance were found to be the factors associated with GBV.

Policies promoting the at-home provision of water will mitigate predictors of GBV occurrences that are related to fetching water and may reduce the risk of its progression to more severe forms. In addition, deconstructing the discriminatory social norms that assign girls to collecting water, combined with awareness-raising activities targeting parents, siblings, and neighbours taken as abusers, would improve community knowledge. Also, mobilizing community stakeholders, parents, and guardians to protect and secure girls during the water collection process would contribute to reducing the incidence of GBV.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Ethics Research Committee of the Kinshasa School of Public Health under the number ESP/CE/230/2018. Written informed consent was obtained from each parent authorizing their daughters to participate. Moreover, each adolescent girl gave her non-coercive consent for participation. The confidentiality of the information provided by the respondents was guaranteed to the study participants.

Therefore, all methods were performed in accordance with the relevant guidelines and regulations in Ethics Approval and Consent to participate.

AUTHORS' CONTRIBUTIONS

J.-M.N.M. and G.M.K. designed the study and supervised the data collection process, and J.-M.N.M. performed data analysis and drafted the article. J.-A.G., G.M.K., C.B.S., and J.N.K. revised the entire article process while J.-A.G. revised the English version of this article.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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