

Retrospective estimate of crude mortality
and the level of violence suffered by the
population of Cité Soleil, Port-au-Prince,
Haiti, between July 2022 and August 2023

FINAL REPORT

November 2023

Title Retrospective estimation of crude mortality and level of violence suffered by the population of Cité Soleil, Port-au-Prince, Haiti during the year 2022 and 2023

Study location: Cité Soleil, Port-au-Prince, Haiti

Main Investigator: Brahima Touré, MD, MPH
Intervention Epidemiology and Training Department
Epicentre
14-34 avenue Jean Jaurès, 75019 Paris, France
Tel. +33 (0)1 40 21 55 06
e-mail: brahima.toure@epicentre.msf.org

Co-investigators: Thomas Roederer, Epidemiologist, Epicentre, Paris
Sarah Chateau, MSF-OCP
Amber Alayyan, MSF-OCP
Boubacar Koronney, MSF-OCP Medical Coordinator, Port au Prince
Dr Yves Carm Colimon, Head of Monitoring and Evaluation Department DSF/MSPA

Collaborating institutions: Epicentre
Médecins Sans Frontières-OCP
Ministry of Public Health and Population - Haiti

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List of abbreviations

RECSUH	Research Ethics Committee of the State University of Haiti
FSI	Fragile States Index
GPS	Global Positioning System
95%CI	95% Confidence Interval
IHSI	Institut Haïtien de Statistique et d'Informatique
IPC	Integrated Phase Classification
MSF-ERB	Médecins Sans Frontières - Ethical Review Board
MSF-OCB	Médecins Sans Frontières - Operational Center Brussels
MSF-OCP	Médecins Sans Frontières – Operational Center Paris
IOM	International Organization for Migration
WHO	World Health Organization
NGO	Non-Governmental Organization
UN	United Nations
IDP	Internally displaced population
CMR	Crude mortality rate

Key points to remember

Survey estimating retrospective mortality, exposure to violence and use of basic and obstetric health care conducted between July 25 and August 24, 2023. The study took place during the truce negotiated between the rival groups. All group leaders were sensitized, and their agreement was obtained to conduct the survey.

- The recall period took place between July 7, 2022 and the starting day of the survey;
- Stratification of the Cité Soleil commune into 2 zones (North and South);
- Simple random sampling based on the list of GPS coordinates of all Cité Soleil dwellings;

- 1357 GPS points studied, 8,202 individuals included from 1669 households;
- **176 deaths** were reported in a little over a year;
- Cité Soleil: **Crude mortality rate = 0.63 deaths per 10,000 / day** [CI_{95%} : 0.54 - 0.73]; crude mortality rate **higher in the South zone** (0.78 deaths per 10,000 / day [CI_{95%} : 0.64 - 0.94]) than the North zone (0.47 deaths per 10,000 / day [CI_{95%} : 0.37 - 0.60]);
- **Violent deaths accounted for 40.9% of deaths.** 57.7% of deaths in the South zone;
- Residents of the South zone are highly exposed to various forms of violence: **44% of sample members have been victims of at least 1 type of violence** (against property, against people, violent death).
- **59.3% of deliveries took place at home** and 29.8% with complications
- **Self-medication by 48.1% of sick participants in the** first half of 2023
- Diarrheal diseases (and/or cholera) constantly cited as causes of non-violent death and illness.

These results show an extreme level of violence, reflected as much in mortality from violent causes as in direct exposure to violence. **Comparison with the latest DHS survey in 2016** highlights a **strong excess of mortality**, largely due to violence (5-fold increase). **The extrapolation of mortality figures for Cité Soleil** can be compared with the figures published in the media over the summer: here again, reported **mortality is vastly underestimated** (~2327 'violent' deaths for Cité Soleil alone over one year versus 2400 for all of Haiti over the first 6 months of 2023). Finally, **the survey carried out by MSF in 2007** in the same area and using very comparable tools provides a **good point of comparison: while the level of exposure of people to violence** (of all types) that we report is **slightly lower** (54% in 2007 vs. 44% in 2022-2023), **the mortality figures are nevertheless higher in our survey** (0.4/10000/d in 2007 vs. 0.63 in 2022-2023).

Background - History

History of the country

Haiti (*Ayiti* in Creole) is a Caribbean island nicknamed the "Pearl of the Antilles". It was the first French colony to gain independence in 1804, and the first independent black empire in history, with Jean-Jacques Dessalines at its head. Unfortunately, he was the first in a long line of authoritarian dictators for the country, which has had a particularly troubled history ever since: military coups, waves of violence and insecurity, natural disasters, devastating epidemics and economic crises have followed one another for decades. So much so that, since the beginning of the 21st century, Haiti has regularly been considered a "failed state"¹ (Fragile States Index of 99.7 in 2022 [1]).

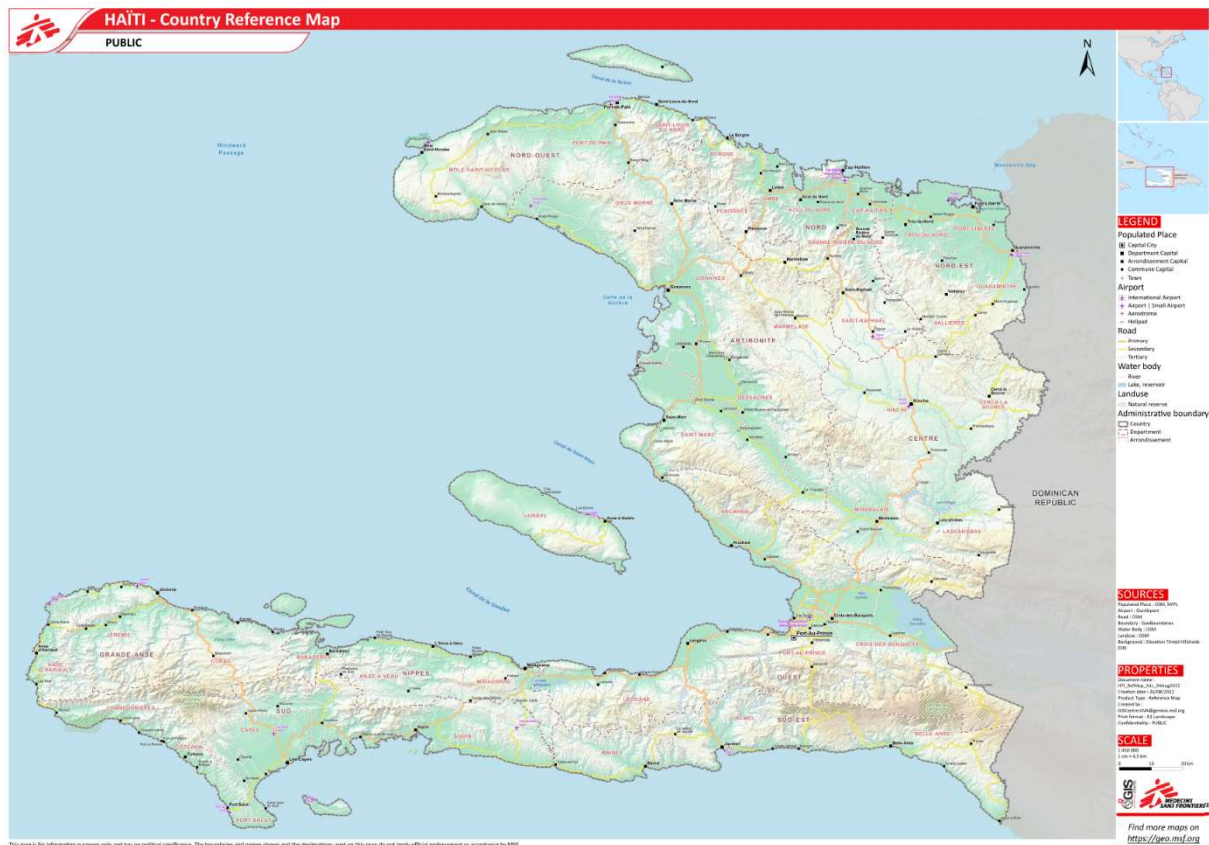


Figure 1: General map of Haiti. source MSF-OCG

Political crisis and permanent insecurity

The situation in Haiti in 2021 was marked by political crisis and ongoing insecurity, compounded by the Covid-19 pandemic, economic deterioration, the assassination of President Jovenel Moïse and a magnitude 7.2 earthquake. These events exacerbated

¹ A state is considered as failed when its sovereign government can no longer function or becomes illegitimate: public services are no longer provided, the country is no longer represented internationally, etc. The FSI score reflects the social, economic, political and military indicators corresponding to the stability required of a country.

recurrent problems in Haiti, including political instability and violence perpetrated by gangs often linked to state actors.

In 2022, gang violence and criminal activity continued to grow, with around 95 gangs fighting over the territory of Port-au-Prince, home to around 1.5 million people. These gangs seek to extend their power and take control of state functions, disrupting the daily lives of the population. They target security forces and economic assets, blocking market supplies and disrupting the operation of schools, hospitals and foreign embassies.

Demonstrations demanding the resignation of political leaders were put down by security forces, resulting in an unknown number of deaths. Insecurity has also led to major population displacements, with roughly 96,000 people displaced from various parts of Port-au-Prince to other areas. These IDPs are mainly housed in temporary reception sites.

Alongside insecurity, Haiti faces economic and food challenges. The country has long been characterized by a high cost of living, particularly for food and transport. Inflation has risen significantly, mainly due to higher fuel, transport and food costs. In addition, migrant remittances, an important source of foreign currency for the national economy, have fallen due to new banking regulations.

Growing insecurity is also disrupting markets across the country, driving up food prices. Gangs are blocking the Varreux oil terminal, leading to fuel shortages and a considerable increase in the price of gasoline. This situation is having a significant impact on economic activity and household incomes and is limiting the operation of businesses and essential services such as banks and hospitals.

All these socio-economic factors have led to the classification of most of the country in phase 3 (Crisis) according to the Food Security Index (IPC), with a forecast of phase 4 (Emergency) for Cité Soleil and surrounding neighborhoods.

This retrospective mortality and violence exposure survey aims to examine the effects of this political crisis and insecurity on the population of Port-au-Prince, Haiti.

Health situation

Haiti's healthcare system is suffering from the socio-economic crisis, with expensive access to care and public facilities lacking inputs and qualified staff. The country is exposed to natural disasters and epidemics, but poor data collection makes it difficult for humanitarian actors to intervene. Despite a low mortality rate linked to Covid-19, the country has recorded a significant number of cases, and a cholera epidemic recently raged, with over 9,000 suspected cases recorded across the country.

Cité-Soleil project

In 2011, OCP set up a trauma center in Drouillard for patients who have suffered violence, road accidents or burns.

In September 2021, MSF formalizes the merger of the Trauma and Burns activities in Tabarre and the extension of the emergency room in Drouillard.

Cholera emergency

MSF-OCP, like the 2 other sections present in Haiti, were heavily involved in the response to the cholera epidemic, which is now over.

The security situation around Cité-Soleil

The map below shows gang activity in Cité-Soleil and neighboring communes.



Figure 2 : Gang activity in Port-au-Prince. Source MSF-OCP

The city of Port-au-Prince is home to a large number of camps and shanty towns housing several thousand IDPs (see map 4).

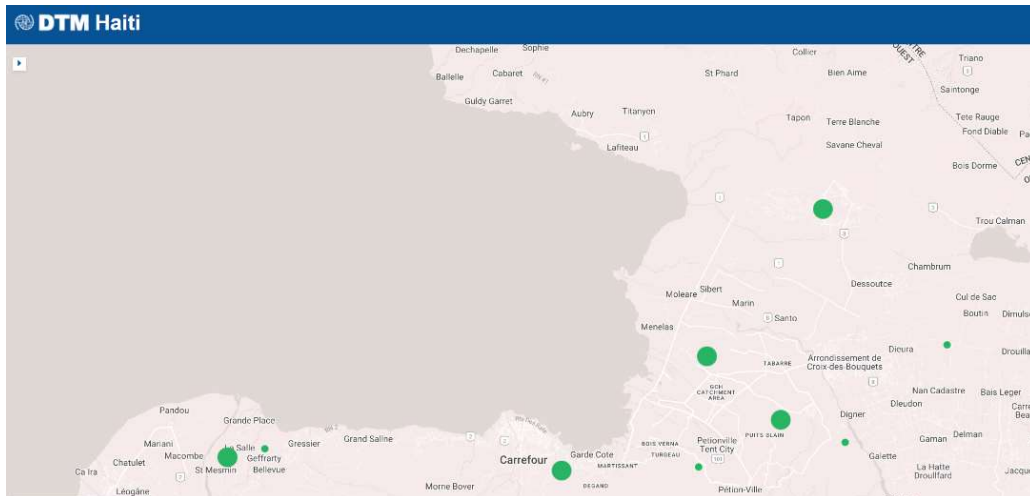


Figure 3 : IDP camps in Port-au-Prince. Sep 2022. Source OIM

Study rationale

The situation in the country is therefore particularly alarming. Although some 76 NGOs are present in Haiti, very few are actually operational in the field apart from MSF (see Figure 5).

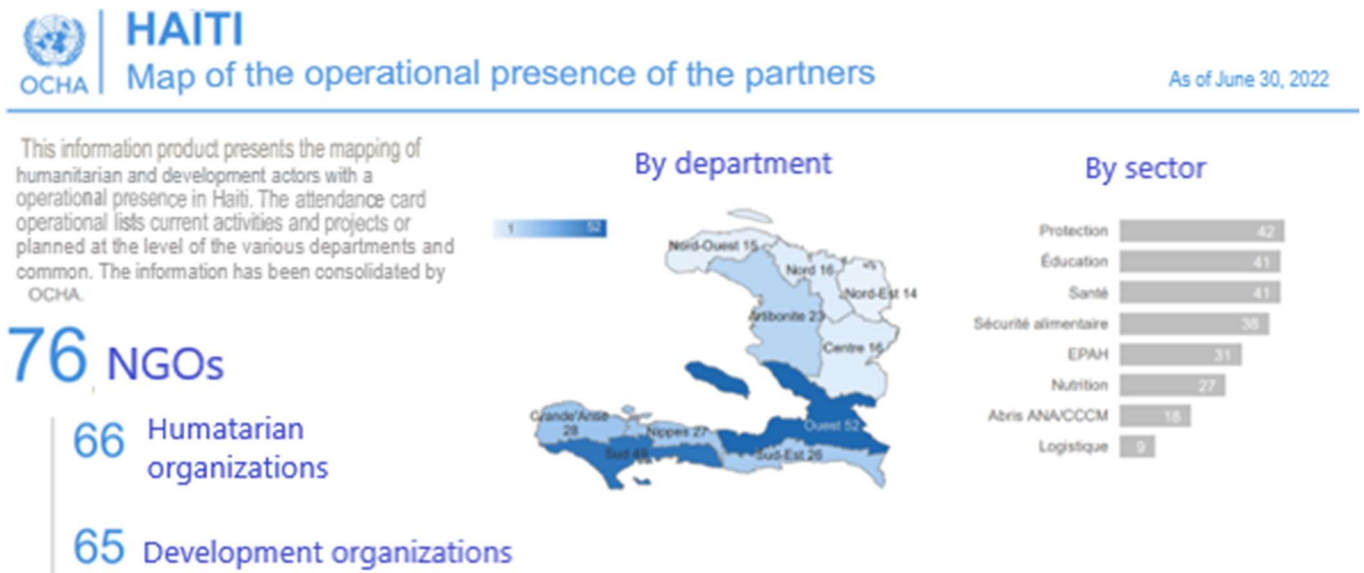


Figure 4: Presence and location of humanitarian partners. June 2022. Source OCHA

Only one article attempts to link the level of insecurity and violence to the health of the population, but this concerns a particular cohort of people being monitored for cardiovascular disease (2). Furthermore, sexual violence has received very little attention in recent years, despite the fact that several newspapers, NGO reports and United Nations offices have highlighted the increased risk to women from criminal activity and impunity (3, 4).

Given the total absence of existing data, it seemed important and interesting to document mortality and the level of violence in Port-au-Prince since the start of 2022, which have a clear impact on people's access to healthcare.

Unfortunately, since the beginning of 2023, activities at the Drouillard hospital have been largely disrupted, with long months of inactivity following extreme violence at the hospital gates and towards national staff.

To this end, a 2-stage retrospective mortality survey has been proposed: (i) among the population of Cité-Soleil, MSF-OCP's current intervention zone, to try as far as possible to enable a comparison with the results of the survey carried out in 2008 by MSF-OCB in Cité-Soleil (5) and (ii) among members of the households of MSF national staff in order to obtain an indication of mortality and exposure to violence outside Cité Soleil.

This report presents the results of the survey carried out in Cité Soleil.

Objectives

- Retrospectively estimate the mortality rate in the Cité Soleil population during the recall period.

Specific objectives

- Describe the main causes of mortality (violent causes: firearms, knives, fire, etc.; non-violent causes: illnesses, obstetrical deaths, etc.) that occurred during the recall period in Cité Soleil households;
- Describe the types of violence and morbidity that occurred in Cité Soleil households during the recall period;
- Map the commune of Cité Soleil by level of violence;
- Describe the care arrangements (traditional system, modern system, etc.) for the last episode of illness in the household during the recall period;
- Describe access to skilled health personnel for delivery of women who gave birth during the recall period.

Methods

Study diagram

A cross-sectional community survey stratified by zone (North Zone and South Zone) was carried out from July 25 to August 24, 2023 in the commune of Cité Soleil.

Population and study location

Participants were all members of households residing in Cité Soleil at the time of the survey.

For the purposes of the survey, the commune of Cité Soleil was divided into 2 zones according to its geographical and security configuration:

- the Northern zone, controlled by a single armed group, the G9, was made up of :
 - Vaudreuil, Truttier, Martial, Village des Rapatriés, Menetas, Bas Fontaine, Duviviers, Terre Noire, Blanchard, Sarthe, Macaya.
- the southern zone is controlled by rival armed groups (G9 and Gpep).
 - Blécourt, Boston, Soleil 1 and 2, Zone industrielle, Nanraquette Barrie fer, Drouillard, Cite Drouillard, Hasco, Village démocratie, Pont Rouge Warf Jeremy are controlled by the G9 group.
 - Brooklyn, Warf Soleil, Cite Fequièrè, Linto 1, 2, Cite Gerard, Ti Ayiti Bois Neuf Projet Drouillard neighborhoods controlled by the Gpep group.
 - Cite Lumière is controlled by 2 groups: G9 and Gpep.

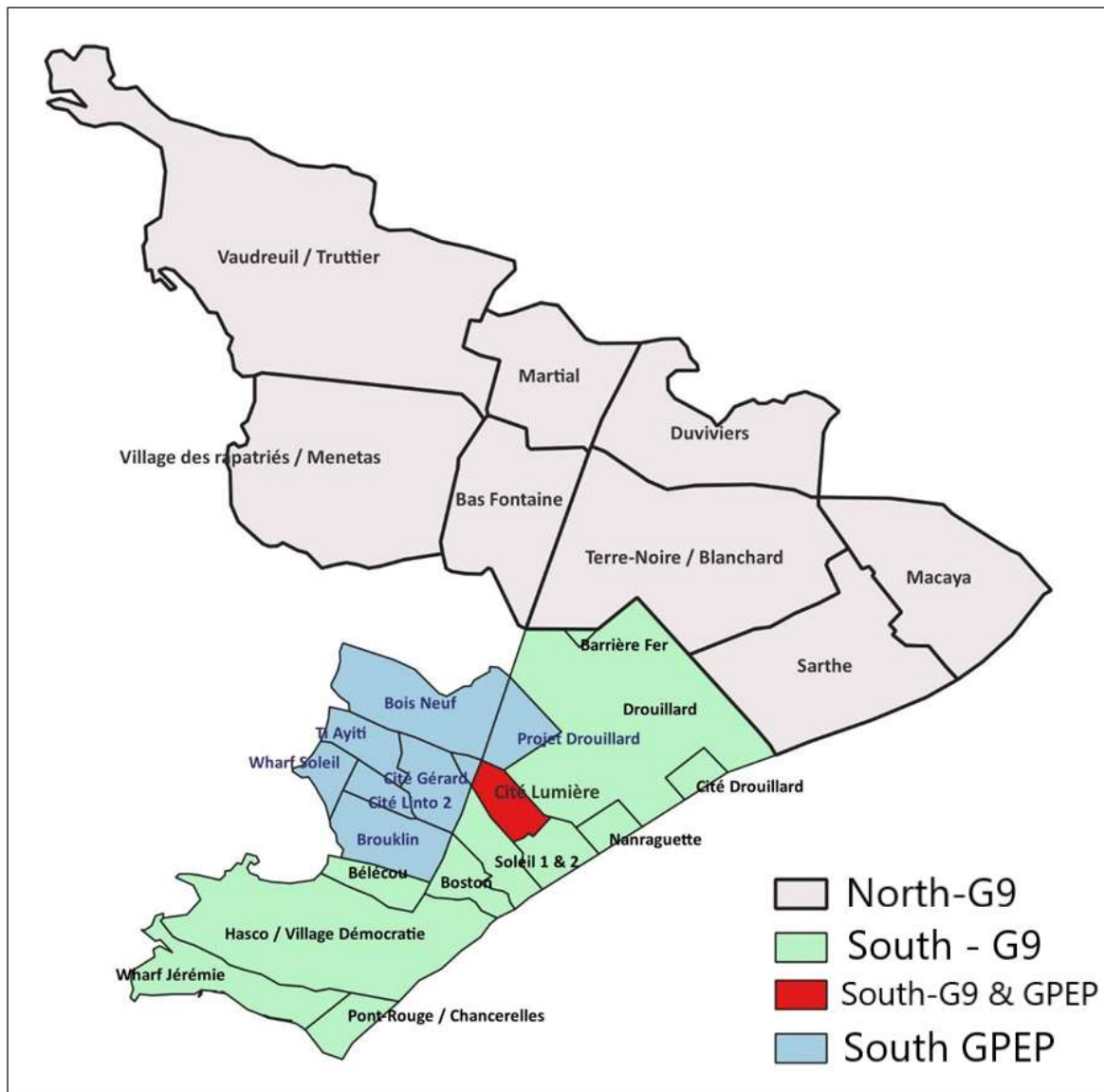


Figure 5 : Distribution of Cité Soleil neighborhoods by stratum (North zone and South zone) and by sectors controlled by the groups.

Participants

Inclusion criteria

Any adult residing in the household randomly selected for the survey and willing to participate.

Exclusion criteria

- Persons unable to carry out the investigation (under the influence of drugs/alcohol, mental illness)
- People who pose a risk to investigators.

Indicators of interest and definitions

- **Armed group:** refers to gangs and mafia groups, as well as police forces and citizen defence militias formed in recent months.
- **Recall period:** reference period for events. In our survey, it extended from July 07, 2022 to the survey start date.

The date of July 07, 2022 was chosen for the beginning of the period because it is important for the population of Cité Soleil and marks the start of very violent clashes that broke out between different armed groups. These clashes lasted for around 05 days.

- **Crude Mortality Rate:** (number of deaths reported by participants during the recall period *10000) / (population of the area considered * duration of the recall period in days)
- **Household:** members of the same family (in the broader, non-nuclear sense) sleeping and sharing daily meals under the same roof - most often in the last month.
- **Violence against property:** any attack on a person's goods or property (theft or destruction of goods, house targeted by violence, destruction or burning of the house, etc.).
- **Violence against persons:** any attack or threat to the physical integrity of a person, regardless of the perpetrator.
- **Causes of death linked to violence:** violence leading to the certain or presumed death of a person (knife, firearm, assault, etc.).
- **Causes of death considered non-violent:** causes of death unrelated to violence, such as illness, accidents, old age, etc.

Sampling strategy

Sampling consisted in randomly drawing the number of buildings corresponding to the target sample size from the list of all possible dwellings in Cité Soleil. This list of all Cité Soleil dwellings was extracted from various databases: the RapiD geospatial database (Facebook - https://rapideditor.org/rapid#background=Bing&datasets=fbRoads,msBuildings&disable_features=boundaries&map=8.87/19.0315/-72.3052) served as a starting point and was consolidated with the latest version of the Open Buildings database (Open Street Map (OSM) and Google - <https://sites.research.google/open-buildings/#download>). This polygon layer (shapefile) was then cleaned of identified places of interest (administrative buildings, schools, monuments, etc.). Finally, the centroids of each remaining polygon were generated, and formed the final sampling frame for the 1,400 GPS points required (forecasting 200.)

The list of all centroids was used as a basis for randomly selecting the 1,400 GPS points required for the survey (taking into account GPS points that may not be accessible or may not be inhabited).

Sample size

Sample sizes were calculated for the North and South zones according to the assumptions summarized in the table below.

Table 1 : Assumptions used to calculate sample size

Criteria	South zone	North zone
CMR expected	1.5/10000/day	0.5/10000/day
Confidence level of the estimator	95%	95%
Accuracy required	0.4/10000/day	0.25/10000/day
Recall period	365 days	365 days
Average household size in Port-au-Prince*.	6	6
Cluster-Effect	3	3
Percentage of non-response	10	10
Population to be sampled (theoretical)	3222	2750
Total number of households to be surveyed	597	509

The calculated sample size was 597 households for the South zone and 509 households for the North zone, giving a total of 1106 households required for the survey. A total of 1,400 GPS points were randomly selected in order to take into account points that could not be surveyed, such as GPS points that were inaccessible, GPS points located in industrial areas, GPS points located on front lines, areas that were not inhabited due to population displacement or flooding, uninhabited houses such as schools, churches, etc.

Data collected and method of collection

Data was collected through individual interviews with the head of household and household members by trained interviewers speaking the various languages commonly used in Haiti (French and Creole). Awareness-raising was carried out by Community Health Workers (CHWs) in their area of activity.

In terms of security, the various leaders of the armed groups have been informed and made aware of the objectives and benefits of the survey. The agreements of all group leaders have been obtained.

Data collection was carried out with the Kobo Collect application, using phones set up for the survey.

The questionnaire consisted of five parts for each head and household member interviewed, living on July 07, 2022 or arrived/born in the household in 2022:

- 1 general section per day and per interviewer with information on the survey location, date, number of people in the household, etc.
- 1 section on each member's demographic information: gender, age, status (living/deceased)
- 1 section on causes of death/ disappearance: date of death if deceased/ date of last news if missing, place, probable cause of death (according to the participant) :
- 1 section on the type of violence suffered in 2022 by each household member: violence against property (targeted house, theft, destruction, etc.), violence against persons (blows, threats, stabbing, handguns, sexual violence, kidnapping, etc.).
- 1 section on the care arrangements made by the household head during 2023 and on any births in 2022 and 2023, as well as the location.

The questionnaire is available in Appendix 2.

Data processing and analysis

The data collected was stored on the MSF server (<https://kobo.msf.org/>). The data was checked daily by the epidemiologist in charge of the survey, and corrected on the phones by the interviewers the following day.

Spatial analyses were based on GAM (General Additive Modelling), which links an indicator to geospatial coordinates (longitude and latitude) using non-linear interpolation (splines). The models for each indicator (deaths, violence, etc.) were developed following a process called Test/Train Cross Validation, in order to optimize the inherent parameters (number of interpolation nodes and spatial correlation matrix). Each model was estimated 5 times on 80% of the GPS points (Test) randomly selected at each iteration, then predicted 5 times on 20% of the remaining points (Train). The best model was selected on the basis of conventional evaluation criteria: mean prediction error (RMSE) and Goodness of Fit for GAM models (GCV).

The estimates produced by the optimal model selected for each indicator are then used to predict the possible value of the indicator in non-surveyed GPS points. Non-surveyed points were introduced in 2 ways:

- A list of 50,000 regularly spaced points in the space defined by Cité Soleil's boundaries (polygon). This method produces "prettier" continuous maps, but predicts values in areas that are known in advance to be uninhabited.
- The list of all possible and potential dwellings within the defined boundaries of Cité Soleil (polygon). This is the sampling frame used to draw GPS points for the survey. This method produces less legible, but more realistic maps.

Spatial analyses and maps were produced using R software (version 4.3.0) with the mgcv and leaflet packages.

Descriptive data analysis was performed using STATA software (Statacorp, LLC, version 17.0).

RESULTS

Data collection from the Cité Soleil population took place from July 25, 2023 to August 24, 2023. The recall period extended from July 07, 2022 to the day of the survey, i.e. an estimated duration of between 383 and 413 days.

This report provides a description of mortality, exposure to violence, skilled birth attendance, co-morbidities and care-seeking.

Description of the study population

Of the 1,400 randomly selected GPS points, the survey could be carried out for 1,357 GPS points, i.e. 97.0% of all points to be surveyed. However, 43 GPS points could not be surveyed, as they were either projected onto a dwelling located on the front line, or onto a ruined dwelling, or onto an abandoned dwelling, or onto an uninhabited sector located in an industrial or hospital zone

Thus, for the 1357 GPS points surveyed, 8,202 individuals belonging to 1669 households were included in the survey; 12 households (i.e. 0.7% of households) refused to take part (Table 2).

Table 2 : Distribution of households and participants by zone (North and South), Cité Soleil, July 25, 2023 to August 24, 2023

Zone	Total Household n (%)	Total Participants n (%)
North	767 (46,0%)	3 942 (48,1%)
South	902 (54,0%)	4 260 (51,9%)
Total	1 669 (100,0%)	8 202 (100,0%)

An interactive map showing the GPS points of the various households included in the survey is available via the link below (double-click).



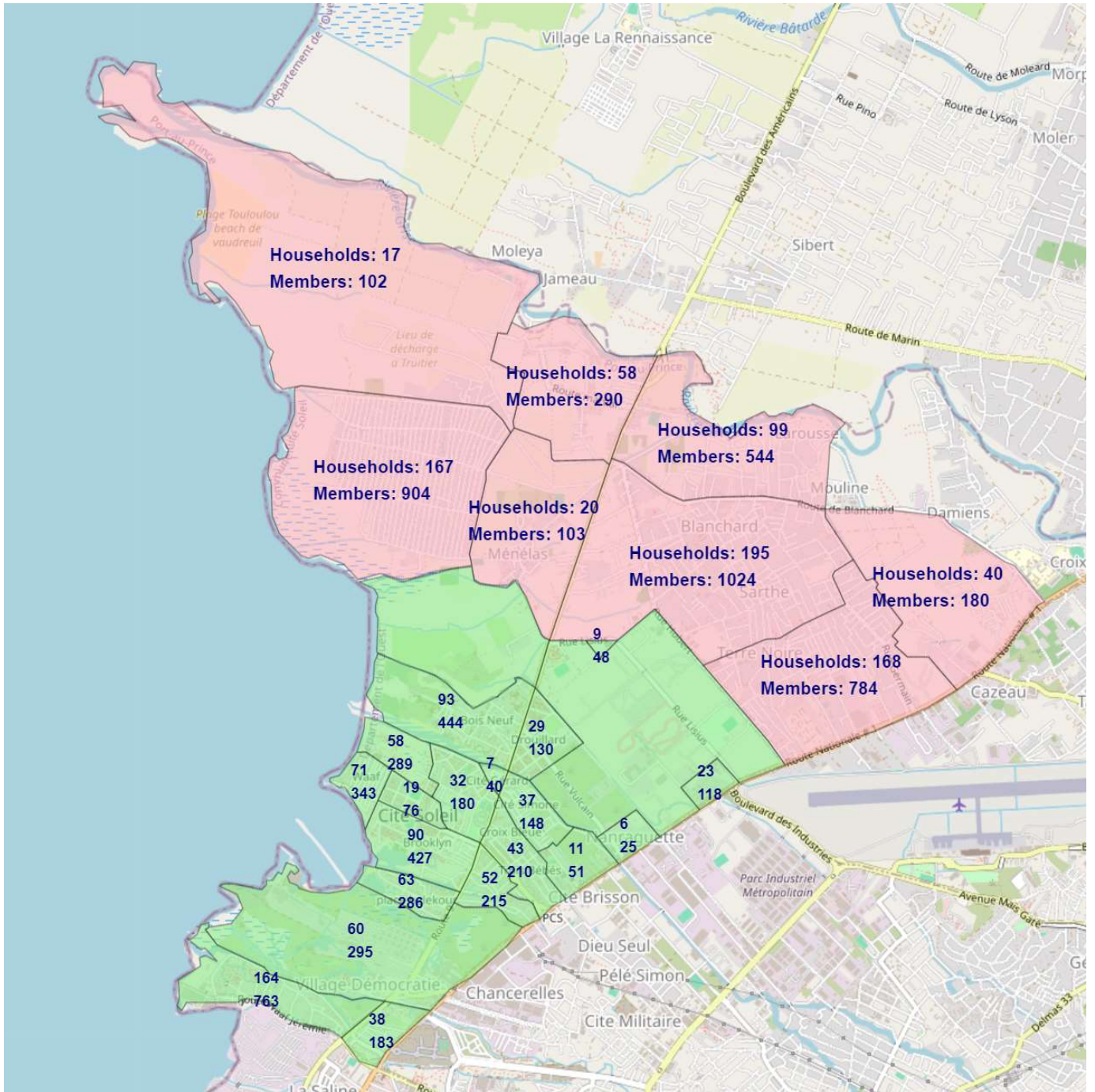


Figure 6: Distribution of households and their members by neighborhood, Cité Soleil, July 25, 2023 to August 24, 2023.

The median age of participants was 22 years (IIQ: [11 -37]). Children under 5 years of age accounted for 11.7% of participants, and children under 15 years of age for 32.6% (Table 3).

Females accounted for 53.7% of participants (sex ratio M/F = 0.86).

The survey population was young; in fact, the age pyramid has a flared base and a tapered apex. However, there was a marked indentation in the 5-9 age group (Figure 6).

Table 3 : Distribution of participants by age and gender (n = 8202), Cité Soleil, July 25, 2023 to August 24, 2023.

	0- 4 years	5 - 14 years	≥ 15 years	Total
Male	473 (12,4%)	842 (22,2%)	2 484 (65,4%)	3 799 (100,0%)
Female	490 (11,1%)	873 (19,8%)	3 040 (69,1%)	4 403 (100,0%)
Total	963 (11,7%)	1 715 (20,9%)	5 524 (67,4%)	8 202 (100,0%)

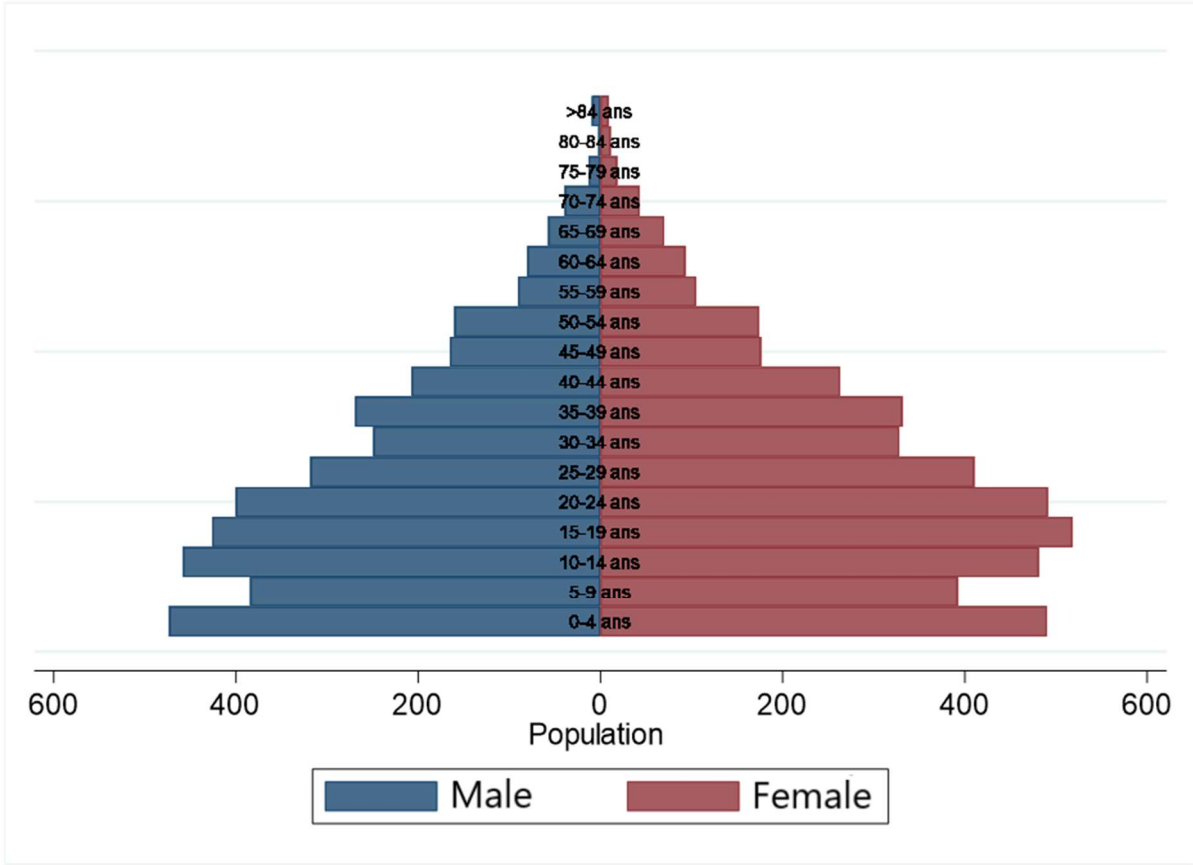


Figure 7 : Age pyramid of participants, Cité Soleil, July 25, 2023 to August 24, 2023.

Mortality

The majority of those surveyed (83.2%) were present in the household throughout the recall period. During the recall period, 192 births and 176 deaths were reported in the households surveyed (Table 4).

Table 4 : Distribution of household members by status (n = 8014), Cité Soleil, July 25, 2023 to August 24, 2023.

Event during the recall period	Frequency	Percentage (%)
Household member for the entire recall period	6 669	83,2
Joined the household during the recall period	341	4,3
Born during the recall period and present in the household	192	2,4
Born and left the household during the recall period	13	0,1
Joined then left the household during the recall period	201	2,5
Born and died during the recall period	11	0,1
Died during the recall period	165	2,1
Left the household during the recall period	422	5,3
Total	8 014	100,0

The crude mortality rate was estimated at 0.63 deaths / 10,000 people / day [IC_{95%} : 0.54 - 0.73] for the Cité Soleil commune as a whole. The specific mortality rate for children under 5 years of age was estimated at 0.86 deaths / 10,000 people / day [CI_{95%} : 0.59 - 1.26]. Among men, the mortality rate was estimated at 0.84 deaths / 10,000 people / day [CI_{95%} : 0.69 - 1.01].

Crude mortality rates were respectively estimated at 0.78 deaths / 10,000 people / day [CI_{95%} : 0.64 - 0.94] in the South zone and 0.47 deaths / 10,000 people / day [CI_{95%} : 0.37 - 0.60] in the North zone (Table 5).

Table 5 Crude and specific mortality rates, Cité Soleil, July 25, 2023 to August 24, 2023

	Number of deaths (n = 176)	Mortality rate (/ 10,000 pers / day) [IC] _{95%}
Cité Soleil	176	0,63 [0,54 - 0,73]
Age ranges		
0 - 4 years	27	0,86 [0,59 - 1,26]
≥ 5 years	149	0,60 [0,51 - 0,70]
Type		

Male	109	0,84 [0,69 - 1,01]
Female	67	0,44 [0,35 - 0,56]
North zone	65	0,47 [0,37 - 0,60]
Age ranges		
0 - 4 years	14	0,97 [0,57 - 1,64]
≥ 5 years	51	0,41 [0,31 - 0,54]
Type		
Male	32	0,51 [0,36 - 0,72]
Female	33	0,44 [0,31 - 0,62]
South zone	111	0,78 [0,64 - 0,94]
Age ranges		
0 - 4 years	13	0,77 [0,44 - 1,33]
≥ 5 years	98	0,78 [0,64 - 0,95]
Type		
Male	77	1,11 [0,91 - 1,43]
Female	34	0,45 [0,32 - 0,63]

In the North zone, the main causes of death were related to non-violent deaths (87.7%), while in the South zone, violent deaths were the main reported cause of death (57.7%) (Table 6).

Table 6 : Distribution of causes of death by zone, Cité Soleil, July 25 - August 24, 2023

	Non-violent death n (%)	Violent death n (%)	Total n (%)
NORTH	57 (87,7)	8 (12,3)	65 (100,0)
SOUTH	47 (42,3)	64 (57,7)	111 (100,0)
Total	104 (59,1)	72 (40,9)	176 (100,0)

Causes of death by Zone

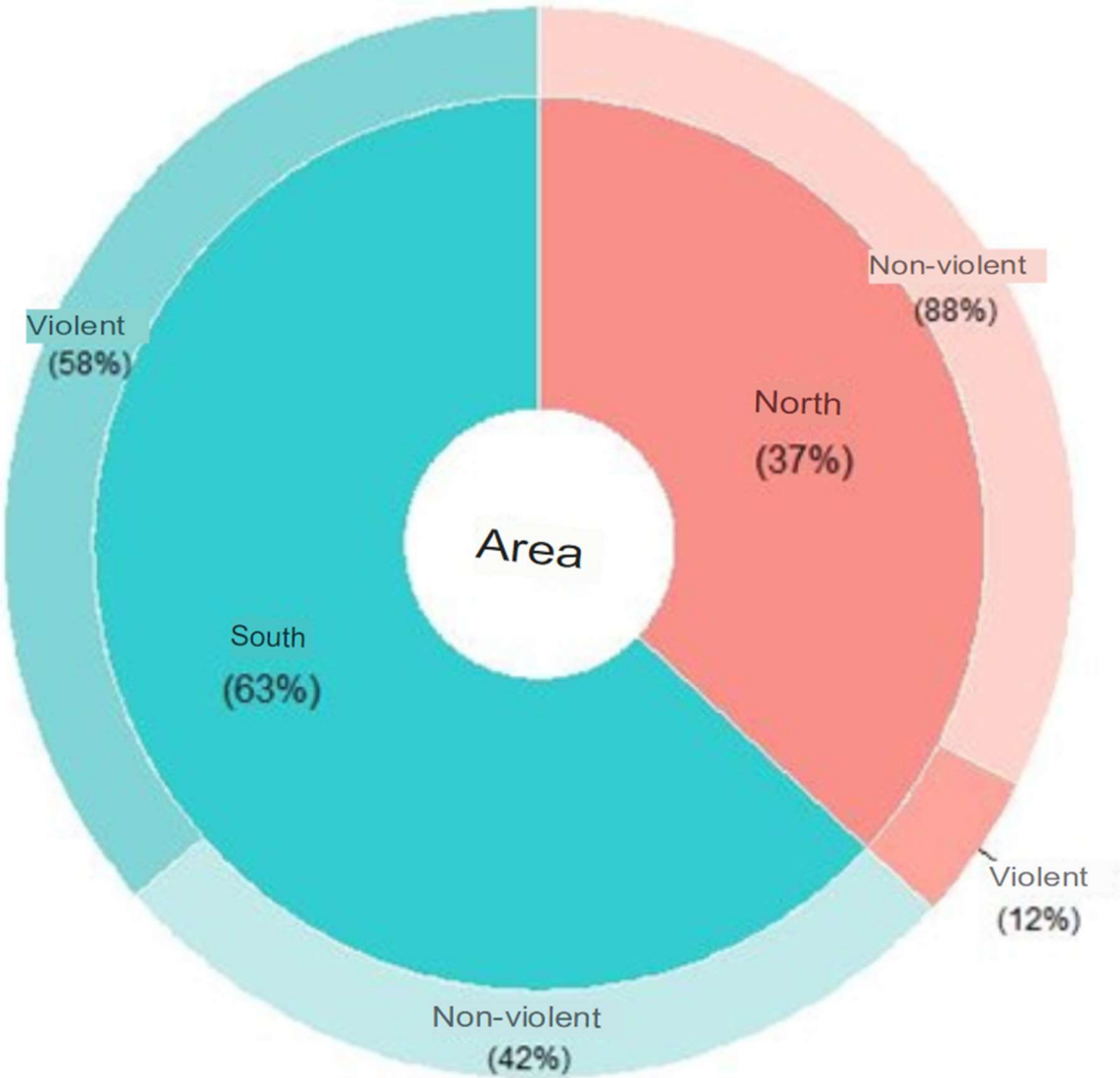


Figure 8 : Distribution of deaths by zone and by cause, Cité Soleil, July 25 - August 24, 2023

Deaths were reported every month during the recall period. July 2022 recorded the highest number of deaths (31 deaths, or 17.6%), mainly from violent causes in the South zone. The number of deaths fell in August, then increased from September to the end of 2022 (Figure 9).



Figure 9 : Monthly distribution of reported deaths by zone (North and South) and by cause of death, Cité Soleil, July 25, 2023 to August 24, 2023

In Cité Soleil, acute respiratory infections were the main cause of non-violent deaths (17.3%), followed by diarrheal diseases (13.5%) and cardiovascular diseases (12.5%).

In the South zone, diarrheal diseases (19.1%) and fever (19.1%) were the main causes of non-violent deaths reported.

In both the southern and northern zones, firearms were the main cause of death (Table 7). Deaths from violent causes occurred mainly among adults, while children were more likely to be victims of illnesses, notably diarrhea (potentially cholera) and respiratory diseases. (Table 8).

Table 7 : Causes of death reported by zone, Cité Soleil, July 25 - August 24, 2023

	North zone n (%)	South zone n (%)	Total n (%)
Non-violent causes	57 (100,0)	47 (100,0)	104 (100,0)
Acute respiratory infections	12 (21,1)	6 (12,8)	18 (17,3)
Diarrheal diseases / Cholera	5 (8,8)	9 (19,1)	14 (13,5)
Cardiovascular disease (hypertension, stroke)	6 (10,5)	7 (14,9)	13 (12,5)
Fever (isolated or with signs)	2 (3,5)	9 (19,2)	9 (10,6)
Diabetes	7 (12,3)	1 (2,1)	8 (7,7)
Cancer	4 (7,0)	1 (2,1)	5 (4,8)
Neonatal death	3 (5,3)	1 (2,1)	4 (3,9)
Prostate tumor	1 (1,8)	1 (2,1)	2 (1,9)
Stomach ulcer	2 (3,5)	0 (0,0)	2 (1,9)
Anemia	0 (0,0)	1 (2,1)	1 (1,0)
Appendicitis	1 (1,8)	0 (0,0)	1 (1,0)
Fibroma	1 (1,8)	0 (0,0)	1 (1,0)
Kidney disease	1 (1,8)	0 (0,0)	1 (1,0)
Meningitis	0 (0,0)	1 (2,1)	1 (1,0)
Abscess	0 (0,0)	1 (2,1)	1 (1,0)
Maternal death	0 (0,0)	1 (2,1)	1 (1,0)
Tuberculosis	1 (1,8)	0 (0,0)	1 (1,0)
Cause unknown	2 (3,5)	2 (4,3)	4 (3,9)
Other	9 (15,8)	6 (12,8)	15 (14,4)
Violent causes	8 (100,0)	64 (100,0)	72 (100,0)
Firearm	4 (50,0)	57 (89,0)	61 (84,7)
Accident	3 (37,5)	2 (3,1)	5 (6,9)
White weapon	0 (0,0)	2 (3,1)	2 (2,8)
Burn	0 (0,0)	1 (1,6)	1 (1,4)
Poison	0 (0,0)	1 (1,6)	1 (1,4)
No answer	1 (12,5)	1 (1,6)	2 (2,8)

Table 8 Causes of death reported by age category, Cité Soleil, July 25 - August 24, 2023

	0-1 year n (%)	1-5 years n (%)	5-15 years n (%)	15-40 years n (%)	40+ years n (%)
Non-violent causes	22	5	9	15	53
Acute respiratory infections	6 (27%)	1 (20%)	1 (11%)	1 (6.7%)	9 (17%)
Fever (isolated or with signs)	2 (9.1%)	2 (40%)	2 (22%)	12(13.4%)	3 (5.7%)
Diarrheal diseases / Cholera	6 (27%)	1 (0%)	5(55%)	1 (6.7%)	1 (1.9%)
Cardiovascular disease (hypertension, stroke)	1 (4.5%)	0 (0%)	0 (0%)	1 (6.7%)	11 (21%)
Diabetes	0 (0%)	0 (0%)	0 (0%)	2 (13%)	6 (11%)
Neonatal death	4 (18%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Other	3 (13.6%)	1 (20%)	1 (11%)	8 (53%)	23 (43.9%)
Violent causes	0	0	4	47	21
Firearm	0 (-)	0 (-)	2 (50%)	42 (89%)	17 (81%)
Accident	0 (-)	0 (-)	2 (50%)	3 (6.4%)	0 (0%)
White weapon	0 (-)	0 (-)	0 (0%)	1 (2.1%)	1 (4.8%)
Burn	0 (-)	0 (-)	0 (0%)	0 (0%)	1 (4.8%)
Poison	0 (-)	0 (-)	0 (0%)	1 (2.1%)	0 (0%)
DK/NR	0 (-)	0 (-)	0 (0%)	0 (0%)	2 (9.5%)

Exclusion of deaths from violent causes occurring at the start of the recall period between July 7, 2022 and July 16, 2022.

Violent clashes between armed groups between July 07 and July 16, 2022 resulted in numerous casualties. The analyses below present the results after excluding violent deaths during the first 10 days of the recall period.

Thus, 17 deaths from violent causes occurring in the South zone between July 07 and July 16 2022 were excluded in order to determine their influence on mortality rates (Figure 10).

The crude mortality rate and specific mortality rate for children under 5 years of age were respectively estimated at 0.56 deaths per 10,000 people/day [CI_{95%} : 0.48 - 0.66] and 0.86 deaths per 10,000 people/day [CI_{95%} : 0.59 - 1.26] in the commune of Cité Soleil. In the South zone, the crude mortality rate was estimated at 0.66 deaths per 10,000 people/day [CI_{95%} : 0.54 - 0.80] (Table 9).

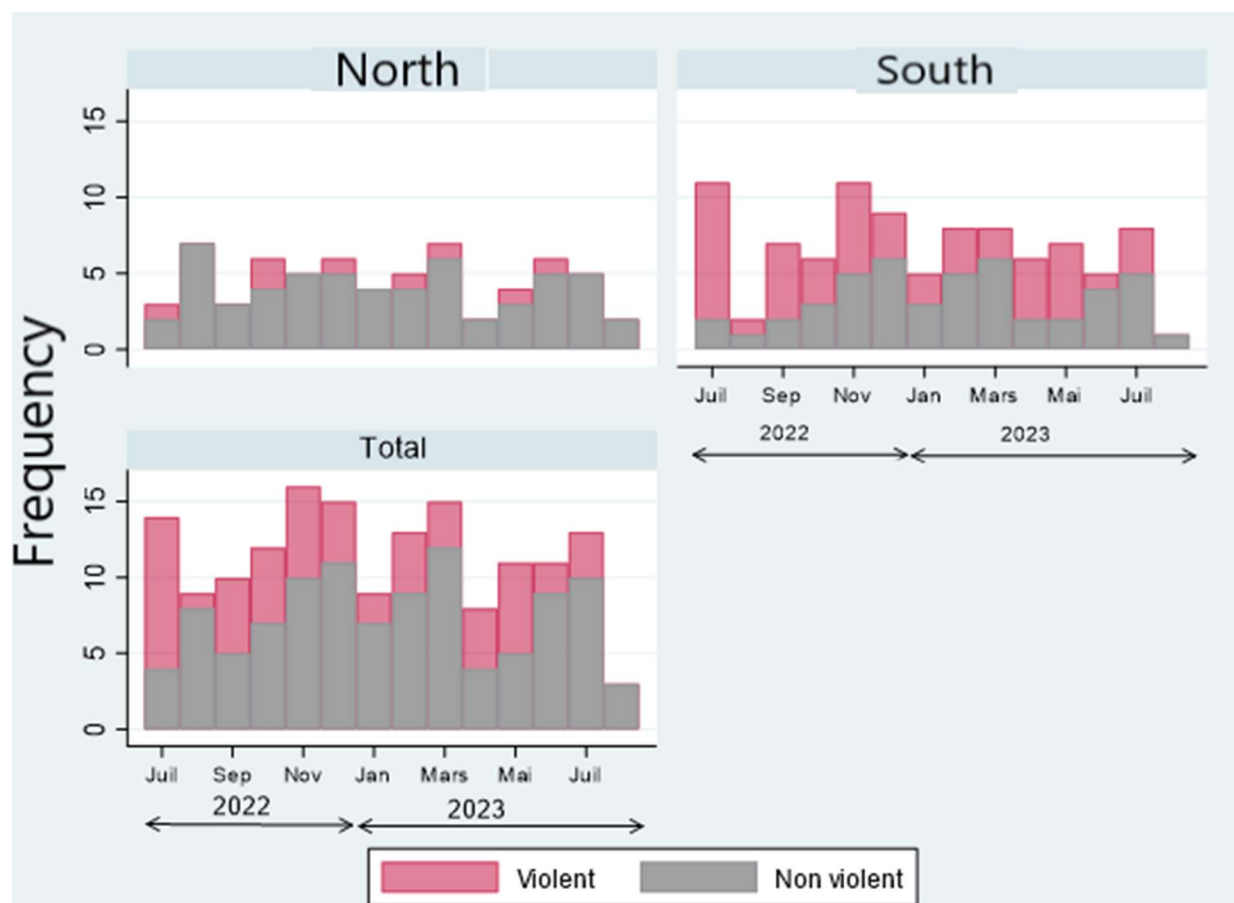


Figure 10 : Monthly breakdown of deaths by cause and area after excluding deaths related to the July 2022 confrontation, Cité Soleil, July 25, 2023 to August 24, 2023

Table 9 : Crude and specific mortality rates after excluding deaths related to the confrontation at the start of the recall period, Cité Soleil, July 25, 2023 to August 24, 2023

	Number of deaths (n = 159)	Mortality rate (/ 10,000 pers / day) [IC] _{95%}
Cité Soleil	159	0,56 [0,48 - 0,66]
Age ranges		
0 - 4 years	27	0,86 [0,59 - 1,26]
≥ 5 years	132	0,53 [0,44 - 0,63]
Type		
Male	97	0,74 [0,61 - 0,91]
Female	62	0,41 [0,32 - 0,53]
Geographical area		
North zone	65	0,47 [0,37 - 0,60]
South zone	94	0,66 [0,54 - 0,80]

Extrapolation of the number of deaths of Cité Soleil and Haiti

Population data for the country and Cité Soleil were extracted from the WHO Americas website (<https://opendata.paho.org/en>).

Table 10 : Summary of data on deaths, missing persons and abductions in relation to the population of Cité Soleil, Cité Soleil, July 25, 2023 to August 24, 2023

	Population 2022	Number of households	Total women	Total men	Total minors (<18a)	Total adults (≥18a)
Total countries	10911819	2571738	5503354	5408465	4615039	6296780
Cité Soleil	265072	59297	135185	129887	120380	144692
<i>RMS 2023</i>	<i>8202</i>	<i>1669</i>	<i>4403</i>	<i>3799</i>	<i>3226</i>	<i>4976</i>
deaths	176		67	109	41	135
of which violent deaths	72		16	56	5	67
missing	17		2	15	2	15
kidnappings	2		1	1	2	0

Our survey sampling (spatially complete random sampling of all inhabited buildings) and its power ensure good representativeness and allow direct extrapolation of results by proportionality.

Applying the mortality rates (overall and violent) over the entire recall period to the population figures for Cité Soleil, we extrapolate that 5688 deaths may have occurred over the past year (IC95: 4875 - 6586), of which 2327 were due to violent causes (IC95%: 1994-2694). The number of missing persons and kidnappings would be 550 and 65 respectively.

Comparison of mortality data with the most recent DHS survey (EMMUS-VI - 2016)

Mortality data for children (<5 years and 5-15 years old)

Infant mortality data (0-5 years) from the 2016 DHS survey (7) are collected from the birth register and cross-referenced with death data from health centers. Results are expressed as rates per 1000 live births over the last 5 years. In addition, the results of the 2016 DHS survey provide data for the whole country, but unfortunately do not go down to the lower level (Province or Commune). For all these reasons, comparison with the results of the present survey is therefore limited.

Table 11 : Comparison of infant and child mortality rates (<5 years) by gender between the 2016 DHS survey and the RMS 2023, Cité Soleil, July 25, 2023 to August 24, 2023

DHS survey 2016			RMS Cité Soleil 2023	
0-5 years	N deaths over 5 years	1-year rate (/1000)	N deaths over 1 year	1-year rate (/1000)
Girl	77/1000	15	13/C490	26
Boy	89/1000	18	14/473	30
Total	81/1000	16	27/963	28

Taking into account the above-mentioned limitations, infant mortality seems to have increased between 2016 and 2023.

Mortality data for children between the ages of 5 and 15 are completely absent from the DHS 2016 report, thereby preventing any comparison.

Mortality data for adults

The following data have been extracted from the final report of the 2016 DHS survey (7). As before, mortality data was not collected in the same way between the two surveys, and imprecise gymnastics are required to express the 2 rates in the same unit.

Table 12 : Comparison of the distribution of deaths by sex and age category between the 2016 DHS survey and the RMS 2023, Cité Soleil, July 25, 2023 to August 24, 2023

DHS survey 2016				RMS Cité Soleil 2023		
Age	N Deaths	Number-Years	Rates (/1000)	N Deaths	Number-Years	Rate (/1000)
Women						
15-19	44	30776	1,42	3	520	5,77
20-24	95	35662	2,66	8	506	15,81
25-29	107	33027	3,25	1	383	2,61
30-34	109	27567	3,95	4	330	12,12
35-39	119	20170	5,91	3	321	9,35
40-44	81	12586	6,47	1	229	4,37
45-49	56	7554	7,43	4	181	22,10
Set	611	167341	3,76	24	2470	9,72
Men				M		
15-19	55	30640	1,80	4	449	8,91
20-24	112	35806	3,13	13	384	33,85
25-29	125	33205	3,76	7	304	23,03
30-34	147	27233	5,41	5	265	18,87
35-39	125	19403	6,44	14	265	52,83
40-44	110	12620	8,68	7	171	40,94
45-49	71	7289	9,70	12	161	74,53
Set	744	166195	4,66	62	1999	31,02
Total	1355	333536	4,06	86	4469	19,24

In red, excess mortality by a factor of at least 3

As with children, data from the 2016 DHS is only available for the whole country. However, it is possible to compare mortality rates (all causes) from the survey with those obtained by sex and age category in 2016. Mortality in 2023 is almost 5 times higher than in 2016. However,

caution is advised, as the Cité Soleil commune is certainly not representative of the whole country.

Excess mortality is most marked among men, and in the 20-24, 35-39 and especially 45-49 age categories.

Violence

Violence against property (1,669 households)

For the majority of households interviewed in the commune of Cité Soleil, the security situation in 2023 is identical to that in 2022 (34.7% of households), or has even worsened in 2023 (34.9% of households) compared to 2022.

However, 29.4% of households felt that the security situation in 2023 had improved compared to 2022. Of all households surveyed (1,669 households), 286 (17.1%) said they had experienced violence affecting their property, mainly property theft (37.1%), followed by shooting at the house (28.5%) and property destruction (19.3%) (Table 13).

The majority of property-related violence was reported in July 2022, mainly in the South zone (Figure 11).

Table 13 Distribution of participants according to perceived level of security and violence to property, Cité Soleil, July 25, 2023 to August 24, 2023

	Frequency	Percentage (%)
Security situation (n = 1669)		
Much worse than in 2022	582	34,9
Identical, as in 2022	579	34,7
Better than 2022	491	29,4
No answer	17	1,0
Total	1 669	100,0
Targets of violence (n = 1669)		
Yes	286	17,1
No	1 378	82,6
No answer	5	0,3
Total	1 669	100,0
Types of violence suffered* (n = 286)		
Theft of goods	142	37,1
Shooting at the house	109	28,5

Destruction of goods	74	19,3
Destruction of homes	57	14,9
Other	1	0,2
Total	383	100,0

* Multiple answers possible

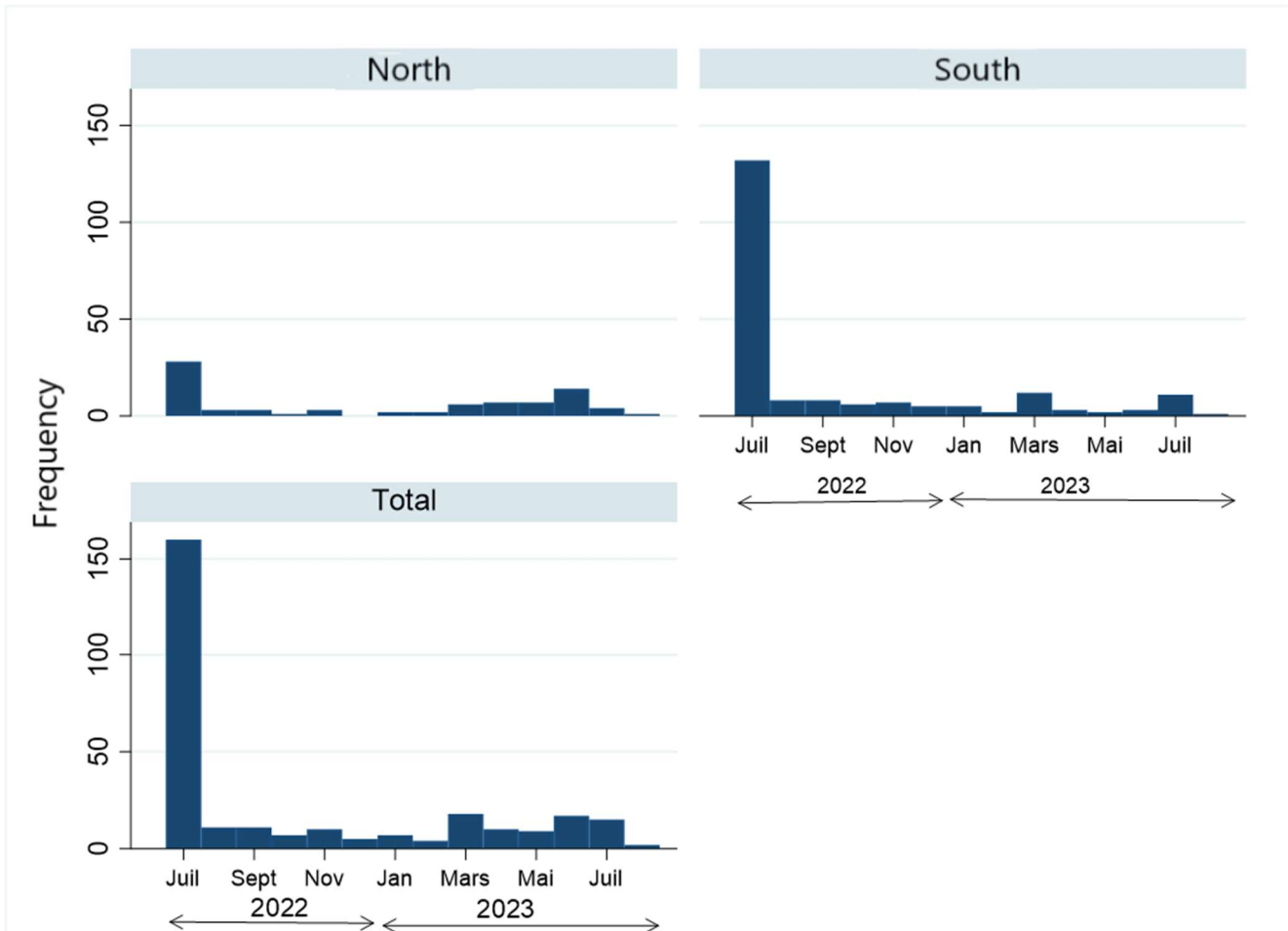


Figure 11 : Monthly breakdown of reported violence against material goods in households by zone, Cité Soleil, July 25, 2023 to August 24, 2023

Violence against persons (n=458)

Among all household members included in the survey, personal violence was reported by 458 participants (5.6%), and 1,189 participants (14.5%) reported having witnessed personal violence. Physical violence (26.5%) was the main form of violence reported, followed by verbal violence (25.4%) and violence with firearms (19.0%); 49 cases of sexual violence (8.8%) were reported (Table 14).

Table 14 : Distribution of participants by type of violence, Cité Soleil, July 25, 2023 to August 24, 2023

	Frequency	Percentage (%)
Types of violence suffered* (n = 458)		
Physical violence (physical aggression ...)	148	26,5
Verbal abuse	142	25,4
Gun violence	106	19,0
Robbery	67	12,0
Sexual violence	49	8,8
Harassment	13	2,3
Kidnapping	9	1,6
Stabbing violence	6	1,1
Burn	6	1,1
Other	13	2,3
Total	559	100,0
Witness to violence* (n = 1189)		
Gun violence	965	54,3
Physical violence	386	21,7
Verbal abuse	173	9,7
Robbery	64	3,6
Burn	63	3,5
Stabbing violence	53	3,0
Sexual violence	41	2,3
Kidnapping	17	1,0
Harassment	10	0,6
Electrocution	1	0,1
Other	5	0,3
Total	1778	100,0

* Multiple answers possible

Violence was reported every month, with a peak observed in July 2022, followed by a stable level of violence between August 2022 and February 2023. An increase in violence reported in March and April 2023 (Figure 12).

Physical violence and violence with firearms were the main types of violence experienced by participants living in the South zone, while in the North zone, verbal violence, physical violence and hold-ups were the main types of violence experienced (Figure 13).

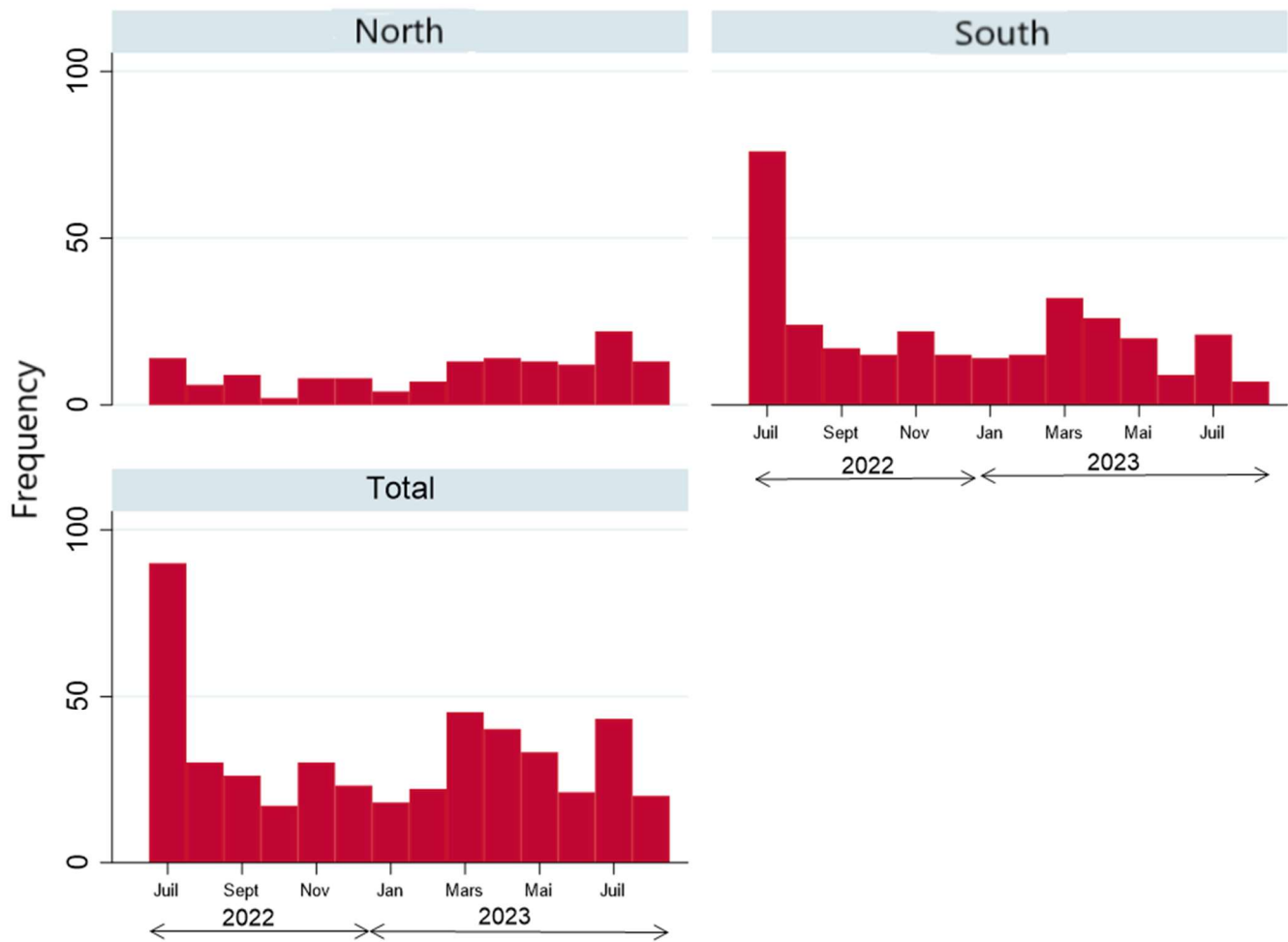


Figure 12 : Monthly breakdown of violence by area reported by participants, Cité Soleil, July 25, 2023 to August 24, 2023

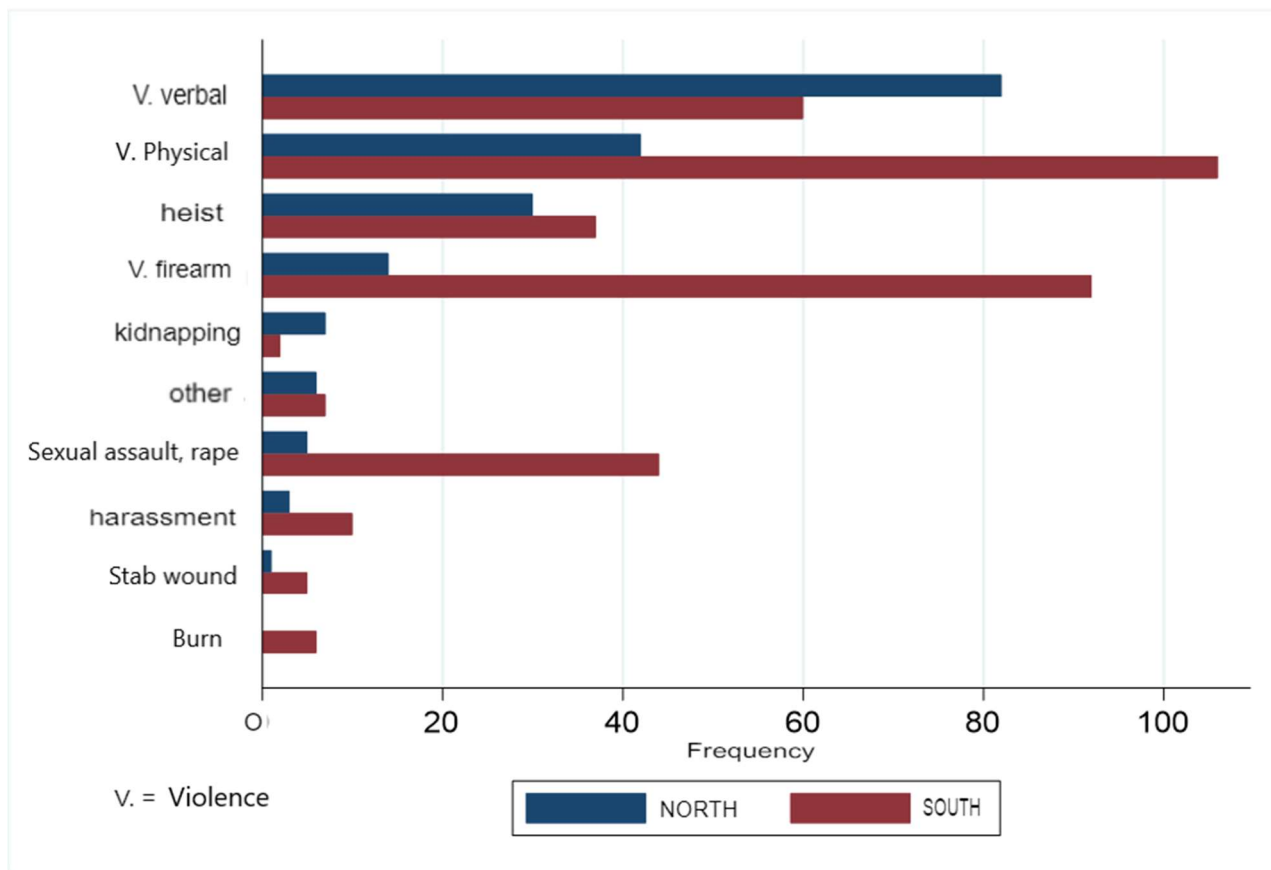


Figure 13 : Breakdown of types of violence suffered by people by area, Cité Soleil, July 25, 2023 to August 24, 2023

In the commune of Cité Soleil as a whole, 44.4% of households reported having been exposed to at least one type of violence. Violence is more marked in the South zone (56.7%) than in the North zone (30.0%) (Table 15).

Table 15 : Distribution of households by area according to whether the household has experienced at least one type of violence, Cité Soleil, July 25, 2023 to August 24, 2023

	NORTH n (%)	SUD n (%)	Total n (%)
No type of violence	537 (70,0%)	391 (43,3%)	928 (55,6%)
At least 1 type of violence	230 (30,0%)	511 (56,7%)	741 (44,4%)
Total	767 (100,0%)	902 (100,0%)	1669 (100,0%)

Spatial analysis of deaths and exposure to violence

Maps by neighborhood are available in the appendix. It should be borne in mind that the survey was not intended to compare neighborhoods with one another, as some neighborhoods were represented by only a handful of households. The maps proposed below are valid, and result from a spatial statistical methodology appropriate to our sampling strategy.

Control Grid

The map linked below (double-click to open) combines the various indicators in our sample, after modeling and prediction for points on a grid of 50,000 regularly spaced points in Cité Soleil. The indicators are: the proportion of deaths, the proportion of deaths due to violence, the proportion of violent deaths, the proportion of people who are victims of violence, the proportion of people who witness violence and, finally, an indicator combining deaths due to violence, victims of violence against property and victims of violence against the person. Zoom in, click on neighborhoods and select indicators 1 by 1.



List of all possible dwellings

The linked map below (double-click to open) combines the same indicators in our sample, after modeling and prediction for all possible homes in Cité Soleil (initial sampling frame). Zoom in, click on neighborhoods and select indicators 1 by 1.



Spatial analyses show that mortality and exposure to violence are highly concentrated in the South Zone, around the Port in the neighborhoods of Wharf Soleil, Cité Linto 1 and 2, Brooklyn, Ti Ayiti, Boston and Cité Lumière. A second "hotbed of violence" is located in the North Zone, in the Martial district.

Access to health care

Access to obstetric care

In the course of the survey, 275 deliveries were reported in the period from the beginning of 2022 to the day of the survey among all 2,395 women of childbearing age enumerated. The median age of the women who gave birth was 28 years [IIQ: 23 - 35].

Of these reported deliveries, 233 women (84.7%) said they had attended antenatal consultations, and 156 women said they had a pregnancy health record. Among women who had ANC (233 women), 69.5% had consultations in the first trimester, 92.2% in the 2^{ème}

trimester and 90.1% in the 3^{ème} trimester (Table 16). These figures are slightly lower than those reported in the 2016 DHS survey (90% of women had at least one ANC, the majority in the first 2 trimesters [7]).

More than half of all deliveries (59.3%) took place at home. Among the 233 women who attended antenatal clinics, 54.1% of deliveries also took place at home, the majority of which were assisted by a matron (35%) or skilled medical personnel (39%). Again, these results are comparable to those reported by the 2016 DHS survey (60% home births and half assisted by matrons [7]).

Insecurity (41%) and financial difficulties (29%) were the main reasons given by participants who were unable to have a prenatal consultation. (Table 17). These results differ significantly from the 2016 DHS survey, in which 73% of mothers stated that financial difficulties were the main reason for not attending an ANC (7).

Table 16 : Antenatal consultations (ANC) and place of delivery for women who gave birth from January 2022, Cité Soleil, July 25, 2023 to August 24, 2023

	Frequency	Percentage (%)
Pregnancy follow-up		
ANC performed during pregnancy (n = 275)	233	84,7
ANC at 1 ^{er} trimester (n = 233)	162	69,5
ANC in 2 ^{ème} trimester (n = 233)	215	92,2
ANC at 3 ^{ème} trimester (n = 233)	210	90,1
Vaccination during pregnancy (n = 233)	183	78,5
Biological tests during ANC (n = 233)	215	92,3
Ultrasound during ANC (n = 233)	163	70,0
Place of delivery (n = 275)		
House	163	59,3
Public maternity hospital	50	18,2
Faith-based health center	25	9,1
Private clinic	24	8,7
Humanitarian health center	10	3,6
On the way to the Health Center	2	0,7
Other	1	0,4
Assistance during delivery by qualified personnel * (n = 275)		
Health professional (doctor, nurse)	150	39,7
Matron	132	34,9
Parents / alone	96	25,4
Pregnancy outcome (n = 275)		
Favourable with no complications	178	64,7
Favorable but with complications	82	29,8
Neonatal death	14	5,1
Maternal death	1	0,4

* Multiple answers possible

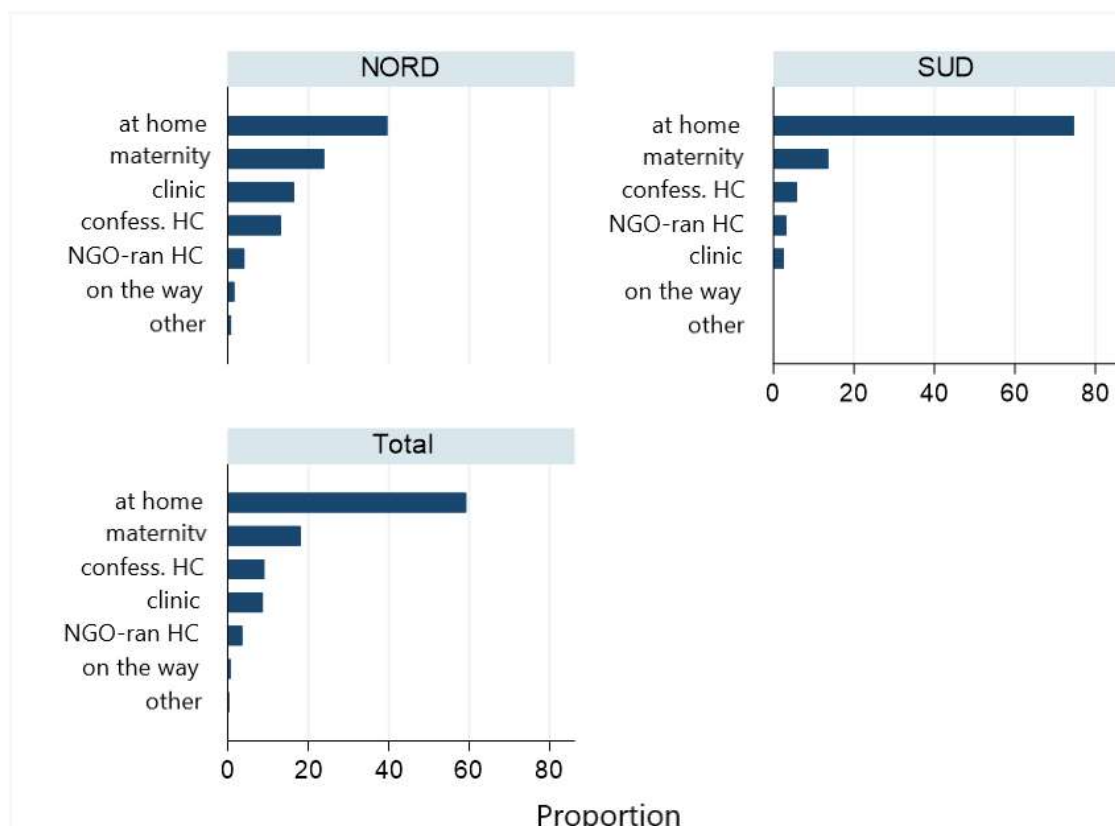


Figure 14 : Distribution of women by place of delivery and zone, Cité Soleil, July 25, 2023 to August 24, 2023

Table 17 : Distribution of women according to the reported reasons for not having a prenatal consultation, Cité Soleil, July 25, 2023 to August 24, 2023

Reasons* (n = 42)	Frequency	Percentage (%)
Insecurity	20	40,8
Financial difficulties	14	28,6
Busy / Lack of time	6	12,2
Traditional care	4	8,2
Remote HC	1	2,0
Other	4	8,2
Total	49	100,0

* Multiple answers possible

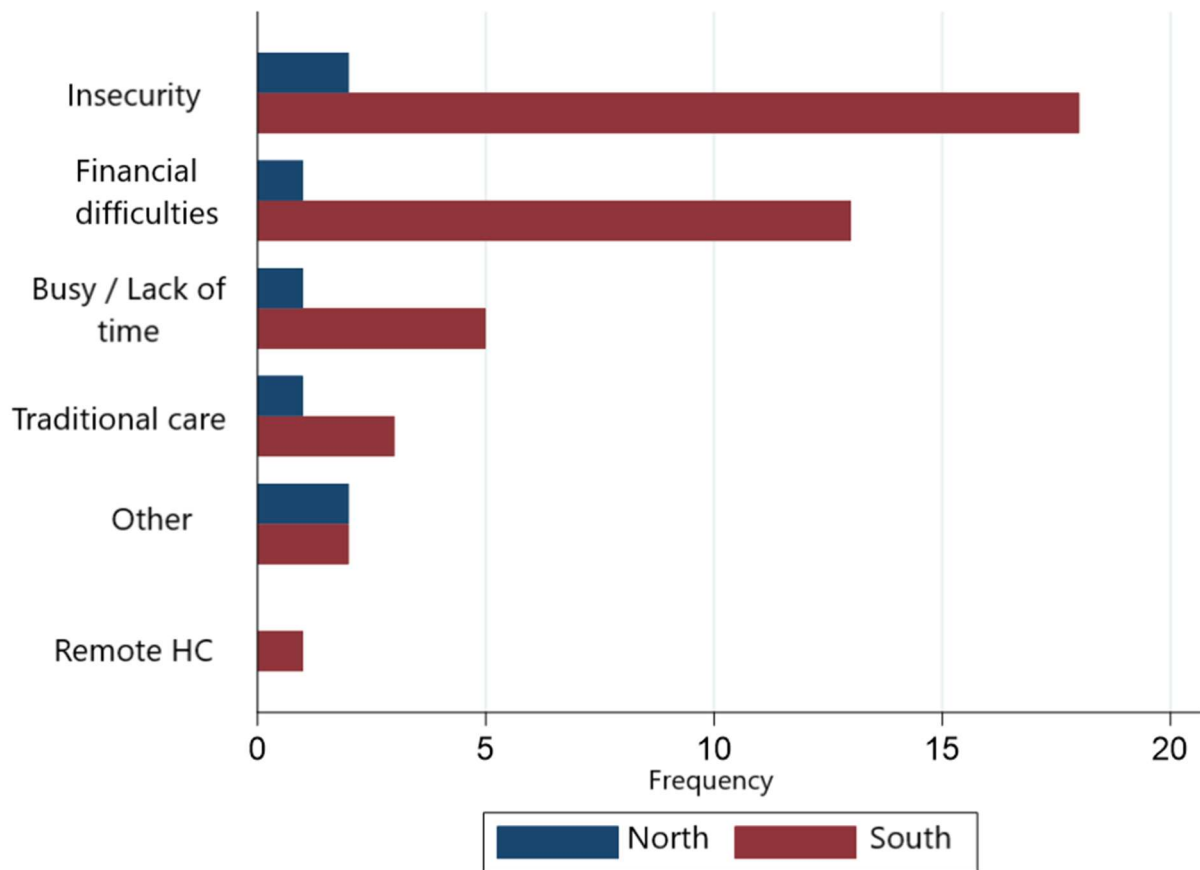


Figure 15 : Distribution of women who gave birth according to the reasons given for not

Spatial analysis of obstetric care

Control Grid

The map linked below (double-click to open) combines the various indicators related to obstetric care, at the level of a control grid. Zoom in, click on neighborhoods and select indicators 1 by 1.



List of possible homes

The linked map below (double-click to open) combines the various indicators related to obstetric care for possible homes only (initial sampling frame). Zoom in, click on neighborhoods and select indicators 1 by 1.



Spatial analyses mainly reveal that women living in the South Zone had fewer prenatal consultations and more home births than in the North, particularly in neighborhoods heavily affected by violence. Problems of access to obstetric care are therefore more evident in the South Zone.

Basic health care

In the first half of 2023, 2,410 participants reported having been ill. Migraine and headaches were the main symptoms reported by participants, followed by gastric ulcers (11.9%) and diarrheal diseases (8.8%). Dermatoses, anemia and sexually transmitted infections accounted for 4.5%, 3.2% and 3.1% respectively.

Of the participants who had been ill, 1,970 claimed to have sought treatment for their illness. Self-medication (modern and/or traditional) represented the main recourse to care (48.1%), followed by consultation in a humanitarian health center (20.9%) (Table 18). These results are completely different from those reported by the 2016 DHS survey, since 80% of disease cases were treated in a health facility (7).

Financial difficulties (62.1%) were the main reason given by participants who did not seek care in a health center, followed by self-medication (12.3%) (Table 19). These results are comparable to those of the DHS survey, since 58% of the reasons given concerned financial difficulties, 16% self-medication (or recourse to traditional medicine) and 12% distance (7).

Table 18 : Distribution of participants by illness and type of care, Cité Soleil, July 25, 2023 to August 24, 2023

	Frequency	Percentage (%)
Illness during the recall period (n = 7190)	2410	33,5
No answer	14	0,2
Seeking Care for the disease (n = 2410)	1970	81,7
No answer	2	0,1
Type of care during illness* (n = 1970)	2799	100,0
Self-medication (modern and traditional medicine)	1341	48,1

Humanitarian HC consultation	584	20,9
Private clinic consultation	525	18,8
Consultation at the denominational HC	182	6,5
Public HC consultation	120	4,3
Traditional medicine	26	0,9
Pharmacy consultation	15	0,5
Don't know	4	0,1
Other	2	0,1
Top 10 diseases * (n = 2410)	2332	100,0
Migraine / headaches	1113	47,7
Gastric ulcer	277	11,9
Diarrheal diseases / cholera	205	8,8
Cardiovascular diseases	181	7,8
Respiratory diseases	150	6,4
Dermatosis	105	4,5
Mental illnesses	83	3,6
Anemia	76	3,2
Sexually transmitted infections	73	3,1
Diabetes	69	3,0

Table 19 : Reasons given by participants for not seeking care at a health center, Cité Soleil, July 25, 2023 to August 24, 2023

	Frequency	Percentage
Financial difficulties in paying for care	639	54,7
Self-medication	144	12,3
Less sick (illness was not serious)	139	11,9
Financial difficulties in paying for transport	87	7,4
Too busy / no time	56	4,8
Insecurity	37	3,2
Transportation problems	22	1,9
Remote HC	12	1,0
Closed HC	7	0,6
Dysfunctional HC	4	0,3
No drugs at HC	2	0,2

Refused care	2	0,2
Other	18	1,5
Total	1169	100,0

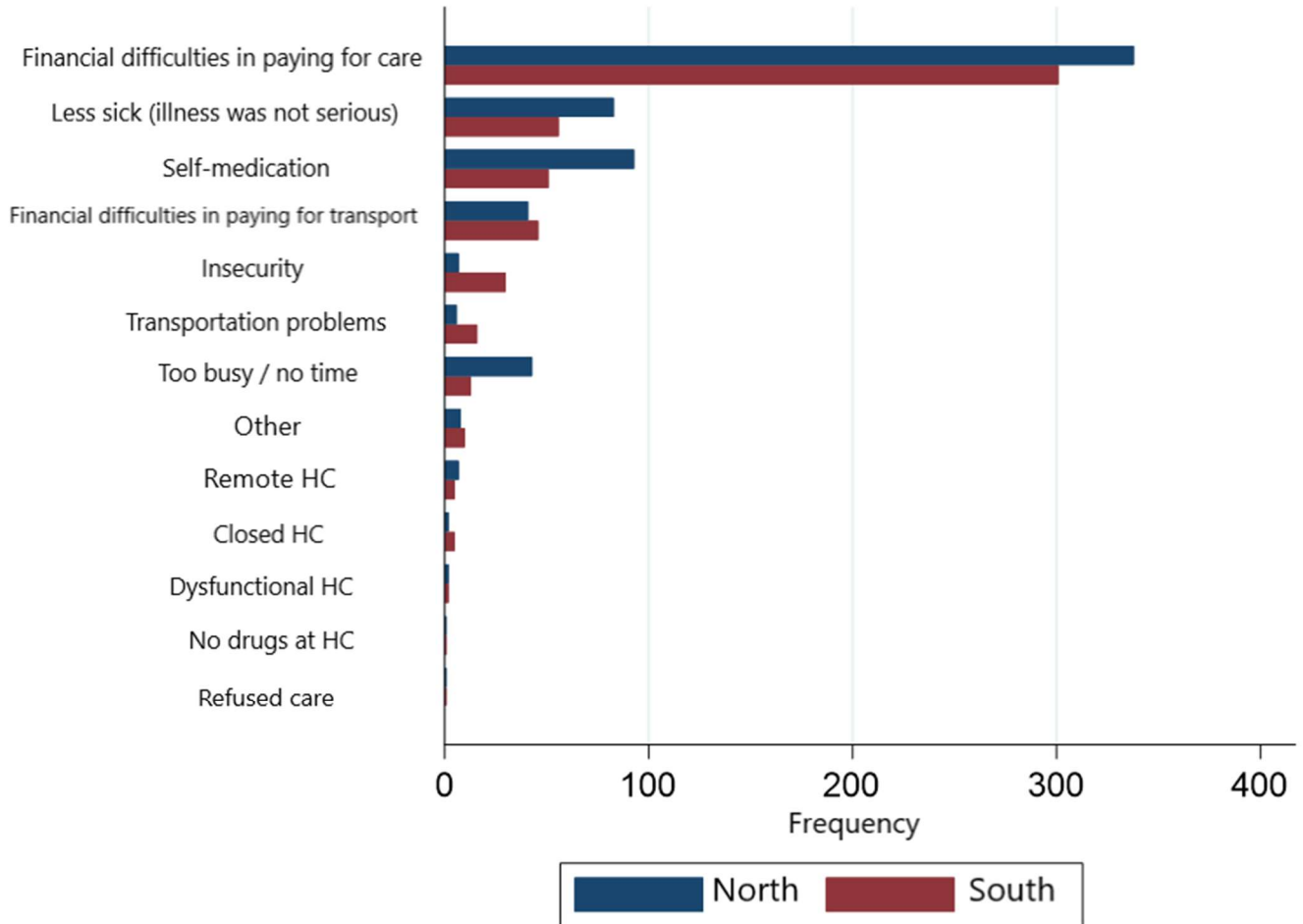


Figure 16 : Reasons given by participants by zone for not seeking care at a health center, Cité

Spatial analysis of primary care

Control grid

The map linked below (double-click to open) combines the various indicators related to primary care seeking, at the level of a control grid. Zoom in, click on neighborhoods and select indicators 1 by 1.



List of possible dwellings

The map linked below (double-click to open) combines the various indicators related to primary care seeking, but this time only for possible homes (initial sampling frame). Zoom in, click on neighborhoods and select indicators 1 by 1.



Spatial analyses once again reveal the disparities between the North and South Zones: while the search for care is comparable, people in the North Zone consult medical facilities much more often than those in the South, and this as much for financial reasons as for those linked to money or safety.

Discussion

The survey to estimate retrospective mortality and violence suffered was finally carried out in the commune of Cité Soleil from July 25 to August 24, 2023, in a relatively calm security context during a period of truce between the various belligerent armed groups. In fact, a truce negotiated between the armed groups had been in effect for several weeks prior to and up to the end of the survey. As a result of the truce, clashes between the various armed groups were brought to a halt. In order to guarantee the safety of the investigators and the success of the survey, a large part of the preparatory phase was devoted to MSF's sensitization of the community, community authorities and armed group leaders. All group leaders were informed and sensitized about the survey in their areas, and their agreement was obtained. As a result, the survey was carried out without any security incidents throughout the Cité Soleil commune. The survey was well received in the community, and the teams were able to access 97.0% of the randomly selected GPS points to visit, enabling the inclusion of 8,202 participants living in 1,669 households. Only 0.7% of households refused to participate in the survey.

The population included was young, with people aged under 5 and under 15 representing 11.7% and 32.6% respectively of the total number of participants. The characteristic age pyramid, however, shows a decrease in the number of participants aged between 5 and 9. The data from the present survey is similar to the data from the Mortality, Morbidity and Service Utilization Survey (EMMUS-VI) conducted in 2016 - 2017 in Haiti. The decrease in the number of participants aged 5 to 9 can be explained by a generational shift observable on the age pyramid of the data collected in 2016 - 2017. Indeed, the EMMUS-VI survey data showed a decrease in the number of children aged under 5 compared to children aged 5 to 9.

During the recall period, 176 deaths were reported in the households surveyed: overall, the crude mortality rate estimated during the recall period for the Cité Soleil population as a whole was 0.63 deaths / 10,000 people / day [0.54 - 0.73], and the specific mortality rate for children aged under 5 was 0.86 deaths / 10,000 people / day [0.59 - 1.26]. Overall, for the Cité Soleil commune as a whole, the crude mortality rate estimated during the survey was high, with a marked disparity between the North and South zones. The crude mortality rate is higher in the South zone than in the North zone. Specific mortality rates among children aged under 5 are high and similar in Cité Soleil commune and in the North and South zones. Children were mostly victims of disease, while adults suffered as much from disease as from extreme violence. The estimated mortality rate among male participants was particularly high in the commune of Cité Soleil, especially in the South zone, where the mortality rate was estimated at 1.11 deaths per 10,000 people/day [CI_{95%} : 0.91 - 1.43].

The mortality rate is higher in the South zone than in the North zone, particularly among the male population. Excess mortality in the South zone is mainly due to deaths from violent causes, reported in every month of the recall period. Indeed, the survey results show a high proportion of deaths from violent causes, representing 40.9% of deaths reported in the whole of Cité Soleil and more than half of deaths reported in the South zone (57.7%). Conversely, in

the North zone, deaths from violent causes accounted for 12.3%. Deaths from violent causes were mainly firearm-related (50.0% of violent deaths in the North zone and 89.0% of violent deaths in the South zone). The northern zone, controlled by one armed group (G9), is less confronted with clashes between rival groups, unlike the southern zone, controlled by different groups (G9 and GPep) and the scene of frequent clashes until the truce, responsible for many deaths and injuries among members of armed groups and the civilian population. Deaths were reported in every month of the recall period, with high mortality from violent causes in the South zone in connection with clashes between armed groups in early July 2022.

The security situation in Haiti deteriorated significantly in late 2022 and early 2023. According to the UN Human Rights Office, conflicts between the various armed groups over the extension of their territory have increased sharply, becoming more frequent and more violent: thus, 2,439 deaths, 902 wounded and 951 kidnappings were recorded in Haiti from the beginning of 2023 to August 15, 2023². The results of this survey show that these figures are certainly underestimated, which is not surprising since they are based on media monitoring (press and social networks), whereas the present survey is intended to be representative of Cité Soleil. Furthermore, a comparison of the mortality results with those of the last EMMUS-VI survey carried out in Haiti (2016), in a period that was certainly 'calmer', shows a clear over-mortality in Cité Soleil, most likely due to interpersonal violence.

The mortality rates estimated during the present survey in the commune of Cité Soleil are higher than the mortality rates estimated during the survey conducted in 2023 among MSF national staff and also higher than the mortality rates of the survey conducted in 2008 in the commune of Cité Soleil (Crude mortality rate = 0.4 deaths / 10,000 people / day [0.4 - 0.5] and specific mortality rate = 0.5 deaths / 10,000 people / day [0.3 - 0.7]) [8] (Summary in Appendix 3).

The estimated crude mortality rate in the North zone is similar to the rate estimated in Cité Soleil in 2008, while the estimated rate in the South zone is higher, representing almost double the rate estimated in 2008. Deaths from violent causes have also risen sharply in Cité Soleil compared with 2008. In fact, deaths from violent causes accounted for 29.2% of deaths in 2008, compared with 40.9% of deaths in 2023 in Cité Soleil and 57.7% of deaths in the South zone.

In the commune of Cité Soleil, the intensity and proximity of the conflicts with the MSF hospital in Drouillard forced the closure and temporary suspension of the hospital's activities in the first half of 2023, and the postponement of the community mortality survey initially planned for the beginning of the year.

July 2022 was a particularly violent month. The exclusion of deaths linked to the clashes in July 2022 has very little impact on mortality estimates, however, leading to a slight decrease

² Office of The High Commissioner for Human Rights, Press briefing notes: Haiti: organized gang violence leads to deaths and injuries, August 18, 2023. <https://www.ohchr.org/fr/press-briefing-notes/2023/08/haiti-deaths-and-injuries-amid-gang-violence>

in mortality rates, which nevertheless remain high and higher than the mortality rates estimated for MSF staff and the mortality rates estimated in 2008.

If mortality was the main objective of our survey and already reflects the extreme violence experienced by the population of Cité Soleil between 2022 and 2023, the results of exposure to violence are even more striking.

More than 2/3 (69.6%) of participants felt that the current security situation is identical to that of 2022, or even that the situation has worsened in comparison to 2022. In the neighborhoods, violence is systemic, and the conflict between armed groups is to the detriment of the civilian population, who are often the victims and trapped in these clashes. In addition to the consequences of conflict between armed groups, the population is also the victim of all forms of violence perpetrated by members of armed groups. Physical violence, verbal violence and violence with firearms were the main types of violence reported, as was the violence reported during the 2008 survey. Sexual violence accounted for 8.8% of reported violence and may be underestimated. Overall, almost half of all members have experienced some form of violence (44%). This proportion is comparable to that reported in the 2008 MSF survey.

The northern zone, controlled by a single armed group, is less prone to clashes. However, the population is exposed to violence committed by members of armed groups. Verbal violence such as intimidation, threats and physical violence were the main forms of violence reported. Conversely, in the southern zone, controlled by various rival armed groups, physical violence, violence with firearms and verbal violence were the main types of violence reported. Sexual violence was mostly reported in the southern zone, unlike in the northern zone. Sexual violence was mainly reported in neighborhoods such as Brooklyn, Cité Linto 2, Cité Gérard and Ti Ayiti. In these neighborhoods, almost the entire population has experienced some form of violence (from 66% to 90%).

The deterioration of the security environment and the current political crisis are responsible for the collapse of the health system and the reduction in the supply of health care (lack of inputs, shortage of health personnel, closure of health centers, etc.) in Haiti, particularly in the commune of Cité Soleil. This situation has led to the closure of a number of health centers. For example, during the first quarter of 2023, clashes between armed groups on the outskirts of MSF's Drouillard hospital led to the closure of the hospital on two occasions, and to the stoppage of activities and closure of the hospital, thus depriving beneficiaries of the care offered by MSF. The MSF-OCP hospital in Tabarre also had to close for several weeks in the summer of 2023. The situation of insecurity in Haiti is having a negative impact on the supply of healthcare and the use of basic healthcare services.

Against this backdrop, the majority of women who had given birth (84.7%) said they had attended antenatal clinics to monitor their pregnancies. However, more than half of all deliveries (59.3% for all women and 54.5% for those who had attended antenatal clinics) took place at home. Compared to the proportion of prenatal consultations carried out for pregnancy monitoring, the number of home births assisted solely by matrons is high,

especially in the South zone, where they accounted for 74.7% of all births. However, these results are not so far removed from those reported by the 2016 DHS survey. A more in-depth analysis of obstetric care data will be available shortly in a dedicated additional note.

In addition, among participants who had been ill, migraine/headache, gastric ulcer and diarrheal diseases were the main symptoms and illnesses reported: self-medication was the type of care most reported by participants (48.1%), followed by consultation in a humanitarian health center offering free health care. Self-medication and the use of traditional medicine were frequent, accounting for almost half the types of care used by participants. Here again, while the results are not very different from those of the 2016 DHS survey with regard to consultations in health facilities and self-medication, the reasons for not consulting are much more impacted by insecurity in our survey.

The low availability of health care, financial difficulties, insecurity and accessibility problems could explain the level of health center attendance observed during illness and childbirth. Diarrhoeal diseases (and cholera) were consistently reported during the survey. In fact, they accounted for 8.8% of illnesses reported by participants in the first half of 2023, and 13.5% of causes of non-violent death. The southern zone, located downstream, faces serious problems of flooding, sanitation and access to drinking water. The first cases of cholera were discovered in the southern zone.

The results obtained in this survey may have been influenced by various biases, notably memory bias due to the long recall period (between 383 and 413 days). The long recall period may have led to an underestimation of deaths, imprecision of events and dates of occurrence. The fact that the survey was conducted in the community, in gang-controlled neighborhoods, could also have influenced the survey data, leading to an underestimation of events for fear of reprisals after the MSF teams had left. This is the case for violence suffered by individuals. Sexual violence and intra-family violence could also be underestimated, as they are highly sensitive and difficult to discuss with a stranger during a short interview. Indeed, the 2016 DHS survey reports that nearly a third of women have suffered domestic violence (all types: physical, sexual, psychological) in the past year, and that the husband/partner is the perpetrator in 95% of cases.

Finally, while violence perpetrated by gangs is certainly preponderant, we must not overlook the violence committed in return by police forces, but also, and increasingly so in recent months, by the self-defense militias that some residents have formed to defend their neighborhoods ("Bwa Kalé" movement,³⁴). For this reason, we prefer to use the term "armed groups".

Conclusion/Recommendations

³ <https://www.rfi.fr/fr/am%C3%A9riques/20230505-mouvement-bwa-kal%C3%A9-en-ha%C3%Afti-les-autorit%C3%A9s-ont-exacerb%C3%A9-la-col%C3%A8re-de-la-population>

⁴ <https://www.lapresse.ca/international/caraibes/2023-06-06/crise-en-haiti/meme-les-bandits-ont-commence-a-avoir-peur.php>
[Retrospective estimate of crude mortality and the level of violence suffered by the population of Cité-Soleil Port-au-Prince, Haiti, 2022-2023](#)

The increase in violence observed in late 2022 and early 2023 led to the initial postponement of the Cité Soleil retrospective mortality survey for security reasons. The survey was finally carried out in July and August 2023, thanks to a truce negotiated between Cité Soleil's armed groups.

Estimated mortality rates for the commune of Cité Soleil, and particularly in the southern zone of Cité Soleil, are high and higher than the rates estimated in 2008 and the rates estimated for the survey conducted among MSF staff in 2023.

Deaths from violent causes were high, particularly in the southern zone, where the various armed groups regularly clash.

The impressive level of violence reported here is already a strong argument for denouncing the insecurity in which the population of Cité Soleil in particular, and Port-au-Prince in general, finds itself.

Recommendations

- Improving the protection of existing health structures to make them functional/accessible
- Increased/improved healthcare services for Cité Soleil's population, especially the most vulnerable.
- Extension of MSF's medical activities to the South zone ;
- Opening of a women's health service including a care center for survivors of sexual violence (open 24/7, confidentiality protection, referral system).
- Opening of a mental health care service for victims or witnesses of extreme violence
- Enhanced surveillance of diseases with epidemic potential (diarrheal diseases, cholera, measles, etc.) in the Cité Soleil commune, particularly in the southern zone, which is constantly flooded;
- Improving and reinforcing access to drinking water for the population;
- Raising public awareness of hygiene and sanitation;
- Deeper exploration of the reasons for self-medication
- A plea for improved public safety
- Advocacy with other NGOs to strengthen care activities in Port-au-Prince and Haiti in general
- Need to collect further quantitative data to confirm/confirm results: across Port-au-Prince and other parts of the country
- Possibility of supplementing this quantitative survey with qualitative work, through interviews with key people in the community, in order to illustrate the population's feelings.

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6. Haiti: gang warfare paralyzes the fight against cholera. <https://www.courrierinternational.com/long-format/reportage-haiti-la-guerre-des-gangs-paralyse-la-lutte-contre-le-cholera>
7. Mortality, Morbidity and Utilization of Services Survey (EMMUS-VI) (2016). <https://www.dhsprogram.com/pubs/pdf/FR326/FR326.pdf>
8. Médecins Sans Frontières (MSF), Retrospective estimate of crude mortality and level of violence suffered during the year 2022 by MSF staff and their families, Haiti, June 2023.

Appendices

Appendix 1: Questionnaire



Retrospective mortality survey Cité-Soleil, Port-au-Prince, 2023

N° team ___ Date ___ / 01 / 2023 Camp/Quartier _____ N° Point GPS _____ N° Foyer ___ Oral consent obtained

How many people were in your household on January 1st, 2022 (including children <5 years old)? ___

For EACH person in the household on January 1st, 2022 and for EACH birth/arrival since (parents, brother/sister, etc.), fill in a line.

	Demographics				Death / Disappearance					
	<i>New persons since 1st January 2022</i>	<i>Gender</i>	<i>Age</i>	<i>Habitual residence</i>	<i>Present?</i>	<i>If not, why not?</i>	<i>Date</i>	<i>Location</i>	<i>Cause death</i>	<i>If violent death, what type?</i>
Person	B= Birth A= Arrival	Date	1=M 2=F in years or months if <1 year	1=Same as survey 2=Other neighborhood/city (specify)	currently 0=No 1=Yes	1= Death 2= Missing 3= Removed 4= Left PàP 6= Other	Date	1=House 2=Street 3=Hospital 9=DK/NA	1= Violence 2=Cholera 3=Other illness 4=Accident 9=DK/NA	1= Beaten 2= White weapon 3= By bullet/shell 4= Fire 5= DK/NA 6= Other (specify)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Retrospective estimate of crude mortality and the level of violence suffered by the population of Cité-Soleil Port-au-Prince, Haiti, during the year 2022

	Violence suffered					
	<i>Experienced violence in 2022?</i>	<i>Respondent</i>	<i>Month</i>	<i>Type of violence</i>	<i>Well-known author</i>	<i>Location</i>
Person	0=No 1=Yes 9=DKN If more than once, ask for the most 'serious'.	1=Participant 2=Victim	<i>in 2022</i>	1=Rape/Cas of Jacques ⁵ 2=Strokes/hits 3=Gunshot wound 4=Stab wounds 5=Kidnapping 6=Prison (violence) 7=Sexual abuse 8=Threats 9=Burns 10=Drowning 10=Other (specify) 11=DK	0=No 1=Yes 9=DK	1=In the house 2=In the neighborhood 3=Outside the neighborhood 8=Other (specify) 9=DK
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

⁵ A case of Jacques is sexual violence/rape on a prostitute, considered less serious in Haiti than a 'normal' rape and therefore likely to be under-reported. In our survey, they will be classified like the others

Has your home or property been targeted by violence since January 1st 2022?

- 1 Yes
- 0 No
- 9 DK/NA

If yes, what type of violence :

- 1 Theft of goods
- 2 Destruction of property
- 3 House targeted by shootings
- 4 House destroyed/burnt down
- 5 Other : _____
- 9 DK/NA

In terms of security and violence in Port-au-Prince, you'd say it's :

- 1 Much worse than before 2022
- 2 As before
- 3 Better than before, it gets better
- 9 DK/NA

When you're sick or in need of care, where do you look for help these days :

- 1 Health Center
- 2 Hospital
- 3 Traditional
- 4 I'm not looking for care
- 5 Other (please specify): _____

9 DK/NA

Did your wife (or one of your daughters if of age) give birth during the year 2022? Y / N

If yes, where did she give birth to her baby?

1 At home

2 At the nearest health facility

3 In the maternity hospital of (specify) : _____

4 Other (please specify) : _____

9 DK/NA

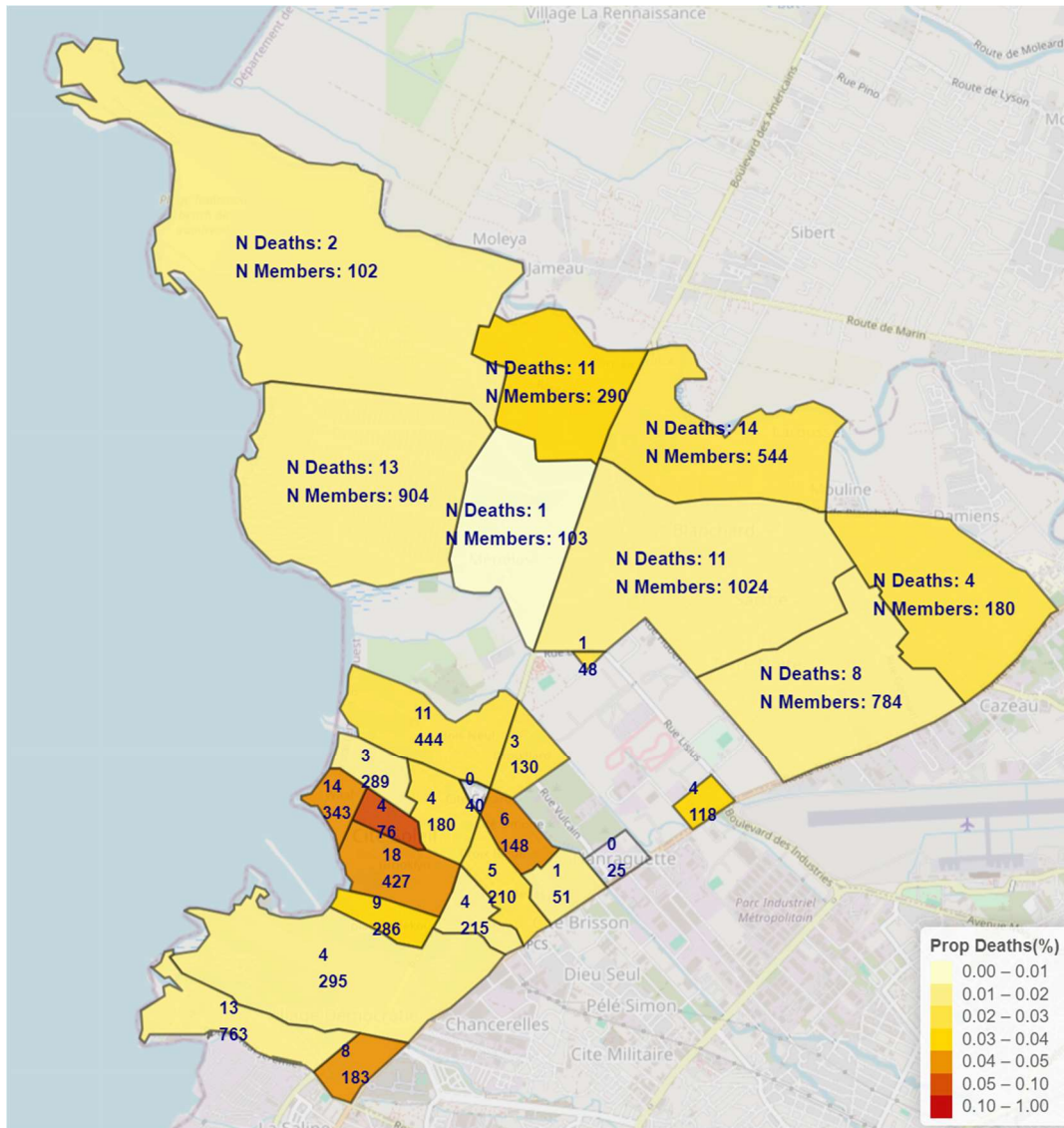


Figure 18: Mortality rate by neighborhood, Cité Soleil, July 25, 2023 to August 24, 2023

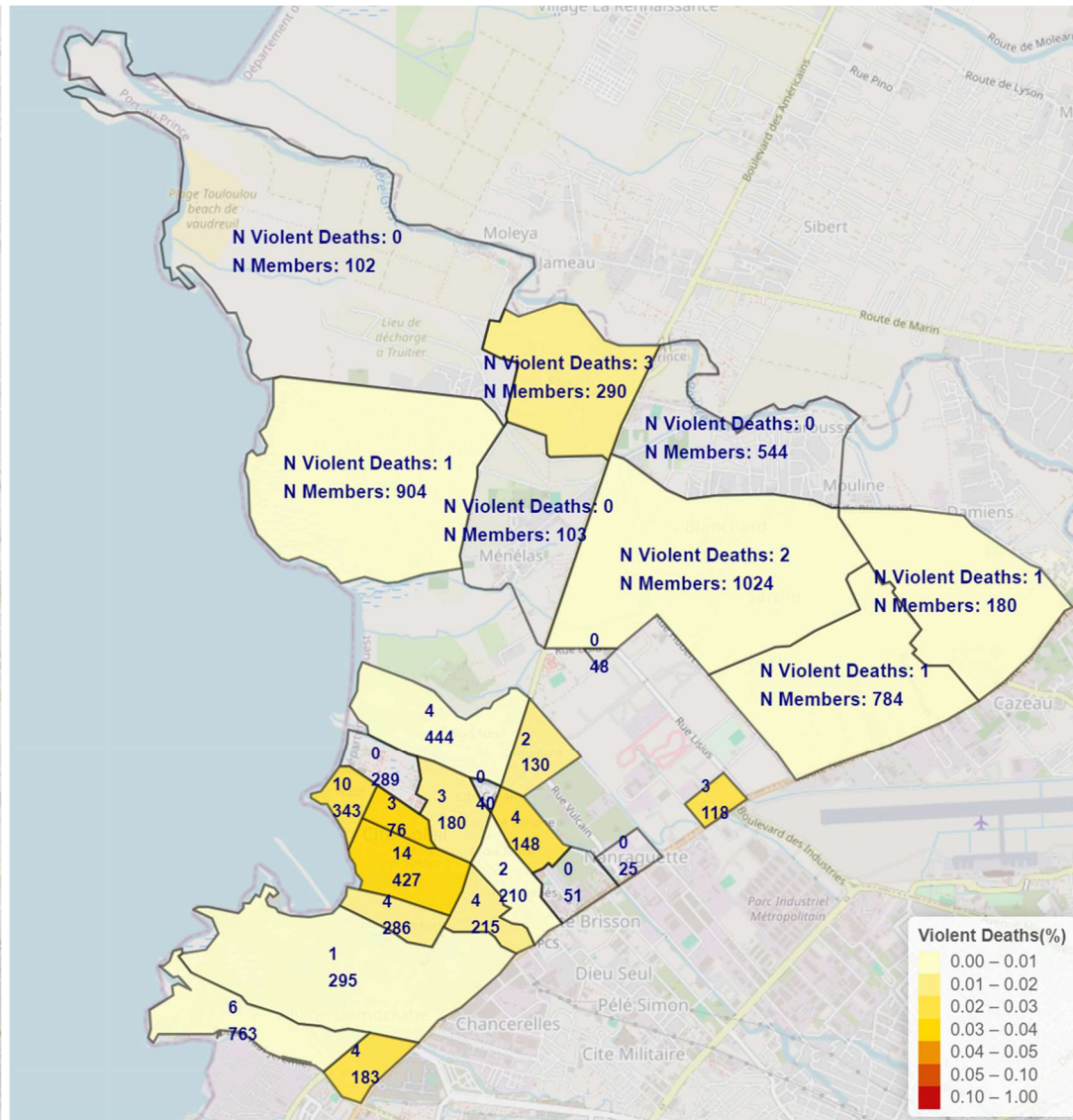


Figure 17: Proportion of violent deaths in mortality by neighborhood, Cité Soleil, July 25, 2023 to August 24, 2023

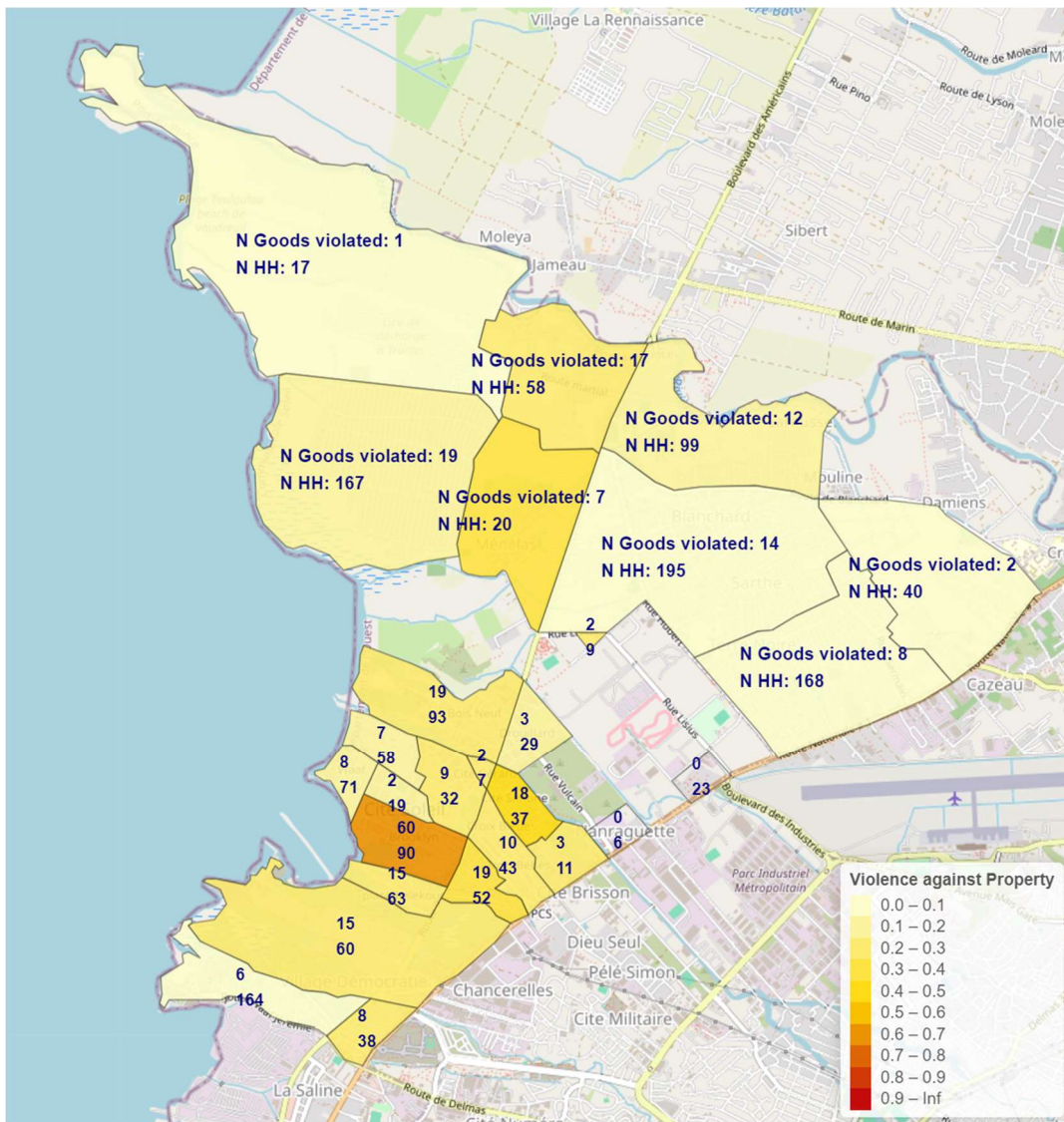


Figure 20: Proportion of households subjected to property violence by neighbourhood

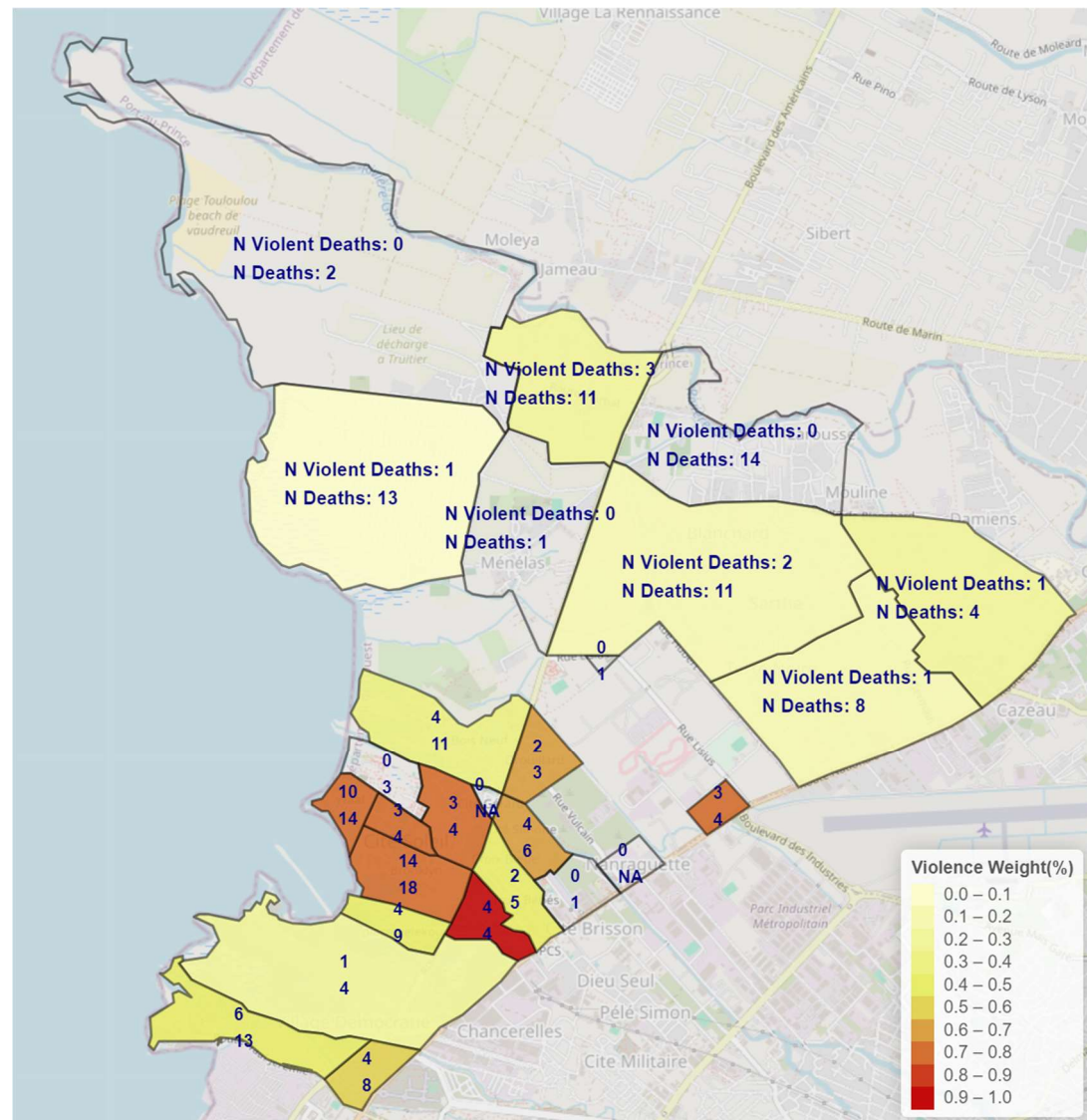


Figure 19: Proportion of abused members by neighborhood, Cité Soleil, July 25, 2023 to August 24, 2023

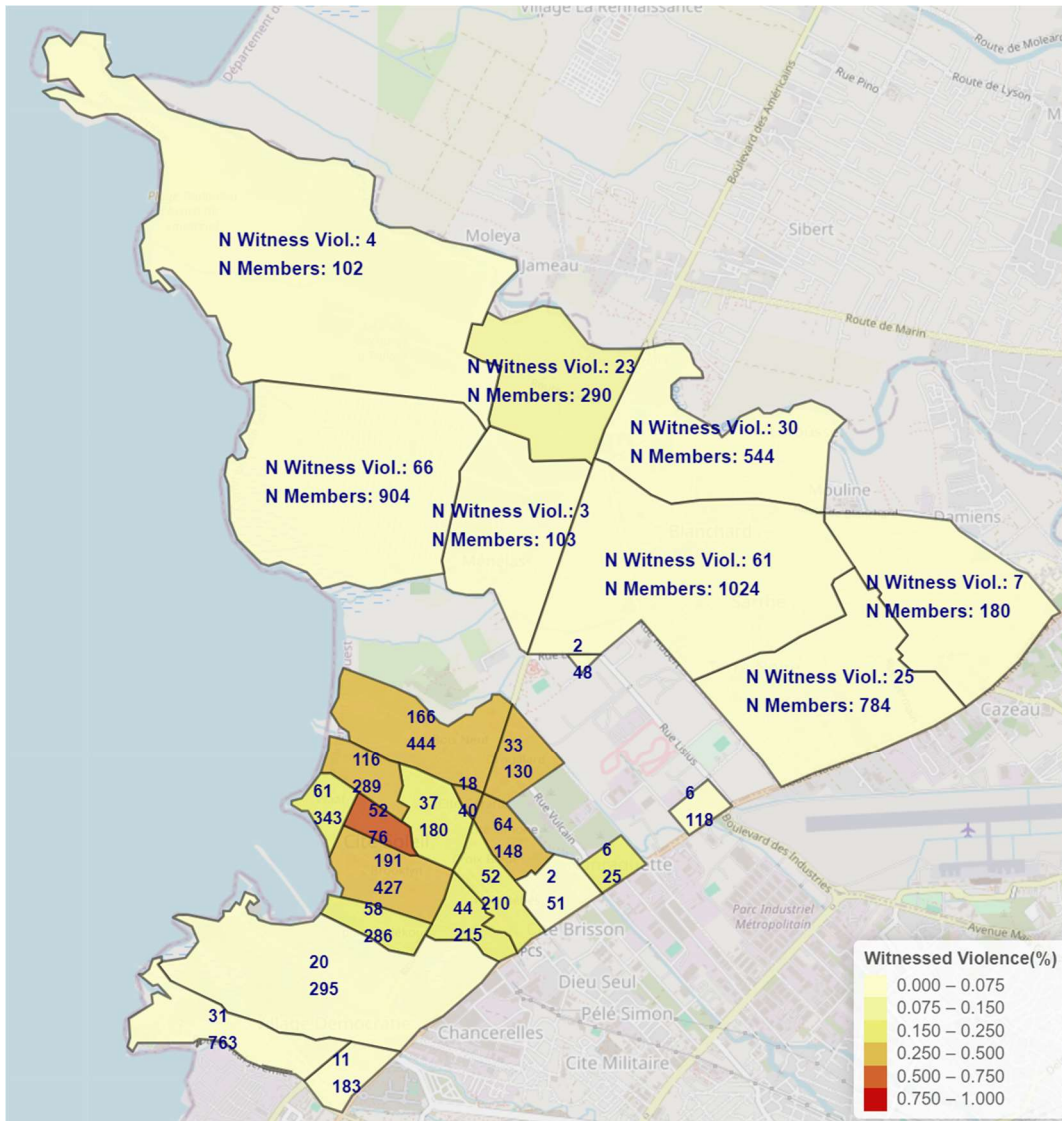


Figure 21: Proportion of members witnessing violence by neighborhood, Cité Soleil, July 25, 2023 to August 24, 2023

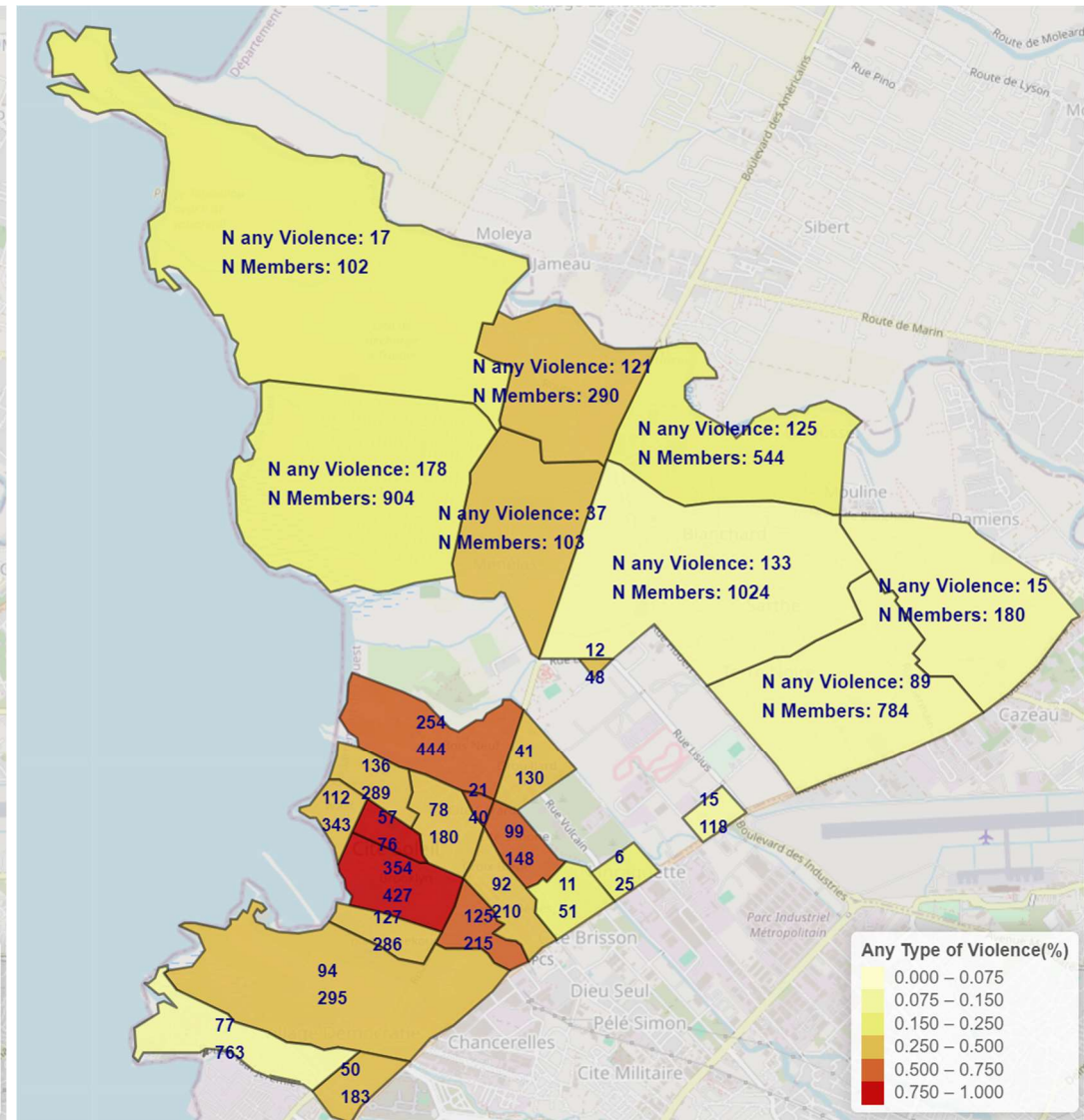


Figure 22. Proportion of households having experienced violence (all types: property, physical, witness, etc.), by neighborhood, Cité Soleil, July 25, 2023 to August 24, 2023

Appendix 3. Comparison with the MSF-OCB mortality survey in Cité Soleil in 2008

RMS MSF-OCB 2008						RMS MSF OCP 2023					
	Nb	Deaths					Nb	Deaths			
0-1	262	19				0-1a	361	22			
2-4a	406	2				1-5a	753	5			
5-14a	1209	4				5-15a	1734	13			
15-39	2085	51				15-40a	3727	62			
>40	801	44				40+ years	1627	74			
Total	4763	120				Total	8202	176			
CMR	0,4/10000					CMR	0,63/10000				
ICMR	0,5/10000					ICMR	0,86/10000				
Violent deaths	35	29,20%				72	40,1				
>5a	34	35,4				72	48,3				
H	24	68,6				56	77,8				
	Violence Property	Nb HH		Violence	No. of people (except dead)	Violence Property	Nb HH		Violence	No. of people (except dead)	
Targeted house	255					109					
Theft of goods	188					142					
House destroyed	38					57					
Destroyed assets	35					74					

Retrospective estimate of crude mortality and the level of violence suffered by the population of Cité-Soleil
Port-au-Prince, Haiti, 2022-2023

Other	6						1					
Total	450	945		239	4643		286	1669		458	8202	
			M	125					M	125		
			W	114					W	114		
All violence	Property Alone	298	31,5				Property Alone					
	Goods and people	152	16				Goods and people					
	People only	64	6,7				People only					
	Property or Person	514	54,2				Property or Person		741	44,3		



Epicentre

14-34 av Jean Jaurès, 75019 Paris, France
Association law 1901

+33(0)1 40 21 55 55

epimail@epicentre.msf.org
www.epicentre.msf.org