HEALTH AND DEMOGRAPHIC SURVEILLANCE SYSTEM (HDSS), ZAKIGANJ, SYLHET, BANGLADESH: PROJAHNMO RURAL SITE

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Table of Contents

EXECUTIVE SUMMARY 1

- **Background** 1
- **Methods** 1
- **Quality Assurance & Data Management** 1
- **Main Findings** 1
  - ***Demographic & Household Characteristics*** *1*
  - ***Fertility*** *1*
  - ***Mortality*** *2*
  - ***Migration*** *2*
  - ***Implications*** *3*

CHAPTER 1: INTRODUCTION 4

- **1.1. Background** 4
- **1.2. Brief description of the Sylhet Projahnmo HDSS Area** 5
- **1.3. Purpose of the Projahnmo HDSS** 5

CHAPTER 2: PROJAHNMO HEALTH AND DEMOGRAPHIC SURVEILLANCE PROCEDURE 7

- **2.1. Data collection** 7
- **2.2. Quality Assurance and Data Management** 7

CHAPTER 3: DEMOGRAPHIC AND HOUSEHOLD CHARACTERISTICS 8

- **3.1. Age and Sex Distribution of the Population** 8
- **3.2. Household Demographic and Socio-Economic Characteristics** 10

CHAPTER 4: FERTILITY 12

- **4.1. Fertility rates** 12
- **4.2. Pregnancy Identification** 13
- **4.3. Pregnancy Outcomes** 14
- **4.4. Delivery of live born children** 17

CHAPTER 5: MORTALITY 20

- **5.1. Child mortality** 20
- **5.2. Mortality by different Age and Sex** 20
- **5.3. Deaths by Month** 24
- **5.4. Survival Probabilities by Age and Sex** 25

CHAPTER 6: MIGRATION 27

- **6.1. Migration by Age and Sex** 27
- **6.2. Migration by Month** 29

REFERENCE 32

ANNEX-1: IMPORTANT DEFINITIONS 33

ANNEX-2: SURVEILLANCE PROCEDURES (DETAILS) 35

APPENDIX 3: DATA COLLECTION DETAILS 36

APPENDIX 4: QUALITY ASSURANCE AND DATA MANAGEMENT (DETAILS) 37

List of Abbreviations

ANC	Antenatal Care
ASFR	Age-Specific Fertility Rate
BDHS	Bangladesh Demographic and Health Survey
CBR	Crude Birth Rate
CDR	Crude Death Rate
CHW	Community Health Worker
FWV	Family Welfare Visitor
GIS	Geographic Information System
GPS	Global Positioning System
HDSS	Health and Demographic Surveillance System
IMCI	Integrated Management of Childhood Illness
IMR	Infant Mortality Rate
IPC	Intrapartum Care
JHU	Johns Hopkins University
LMP	1st date of last menstrual period
MCH-FP	Maternal and Child Health and Family Planning
MNCH	Maternal, Newborn, and Child Health
MWRA	Married Women of Reproductive Age
NGO	Non-government Organization
NMR	Neonatal Mortality Rate
PRF	Projahnmo Research Foundation
TBA	Traditional Birth Attendant
TFR	Total Fertility Rate
UHC	Upazila Health Complex
UH&FWC	Union Health and Family Welfare Centers
U5MR	Under-five Mortality Rate
WHO	World Health Organization

Executive Summary

Background

The Health and Demographic Surveillance System (HDSS) in Zakiganj, Sylhet, Bangladesh, is operated by the Projahnmo Research Foundation (PRF) in partnership with Johns Hopkins University (JHU), together known as Projahnmo in Bangladesh. Research activities in the area began in maternal, newborn, and reproductive health through surveys and community-based surveillance. The organized Health and Demographic Surveillance System (HDSS) was established more recently, building on this platform to generate continuous, population-based information on births, deaths, pregnancies, migration, and household characteristics.

Methods

In 2023, the HDSS covered a mid-year population of 226,260 across 40,399 households. Community health workers (CHWs) conducted regular household rounds to register pregnancies, births, deaths, and migrations using standardized tools. Events were compiled at the field office and transferred to a central database for verification and analysis. Household characteristics were assessed during the first surveillance round of 2023.

Quality Assurance & Data Management

CHWs received structured training and supervised field practice. Field Research Assistants conducted routine supervision and random back-checks of key events (births, deaths, migration). Data quality assurance included completeness checks, duplicate detection, and internal consistency rules during entry and cleaning.

Main Findings

Demographic & Household Characteristics

- Mid-year population: 226,260; sex ratio at birth 97.2 males per 100 females. Age structure was young: 0–14 years = 70,355 (~one-third), 15–64 = 145,974 (64%), 65+ = 9,931 (4.4%) (Tables 3.1).
- Households: 40,399; average size 5.6; 65.3% household had ≥5 members. Access to electricity was high (98%), while reliance on biomass fuels remained widespread (97%). Drinking water came mainly from tube wells/hand pumps (78.8%); 21.2% used surface water. Only 33.2% used flush/pour-flush toilets; 66.8% relied on unhygienic facilities. Floors were predominantly natural/rudimentary (75.2%). Nearly 47% of households were in the lowest two wealth quintiles (Table 3.2).

Fertility

- Women of reproductive age (15–49): 63,589; live births: 4,825.
- General Fertility Rate (GFR) 75.7/1,000, Total Fertility Rate (TFR) 2.3, Gross Reproductive Rate (GRR) 1.1, Crude Birth Rate (CBR) 21.3/1,000 (Table 4.1).

- Fertility concentrated at 20–29 years [Age-Specific Fertility Rate (ASFR): 135.3 at 20–24; 146.8 at 25–29]; adolescent fertility is lower (34.0 at 15–19)].
- Pregnancy outcomes (Table 4.3): 5,313 pregnancies with outcomes; 89.6% ended with ≥1 live birth; 3.6% stillbirth; 6.8% abortion. Multiple births included 57 twin and 4 triplet pregnancies. (Total outcomes = 5,313 because multiple pregnancies yield more than one outcome.)
- Place/attendant (Tables 4.4.1; 4.4.2): 43.3% of births occurred at home; 30.8% in private facilities; and 21.1% in government facilities. Attendants: nurses attended 46.8%, trained traditional birth attendants (TBAs) 30.9%, family/neighbors 18.4%, and doctors 3.2% of the childbirths.
- Mode of delivery (Table 4.4.3): Caesarean section 27.2%, normal delivery 67.3%, missing 5.5% (missing concentrated in January 2023 before variable rollout). *(Interpretation note: C-section proportion is below BDHS 2022–23 national estimate ~38%, but remains well above WHO's 10–15% benchmark.)*[1, 2]

Mortality

- Total 1,456 deaths recorded; Crude Death Rate (CDR) 6.4/1,000 (male 7.2, female 5.7) (Tables 5.2.1; 5.2.2).
- Child mortality (Tables 5.1): Neonatal Mortality Rate (NMR) 37.7/1,000 live births, post-neonatal 18.4, Infant Mortality Rate (IMR) 56.2, Under Five Mortality Rate (U5MR) 63.6. Mortality was highest in the first week of life.
- Adult mortality remained low through midlife, rising steeply from 60+; 85+ death rate 119.8/1,000.
- Seasonality (Table 5.3.; Fig. 5.3): peaks in January, November, December; and lower in May–June.

Survival curves (Fig. 5.4) show the cohort's highest attrition in early life, gradual decline through adulthood, and sharp losses after 60; females retain a modest survival advantage at older ages. *(Survival probabilities are proportions of a birth cohort that are still alive at the beginning of each consecutive age interval; life expectancy is expressed in years.)*

Migration

- Annual totals (Table 6.2): In-migration 8,676; Out-migration 7,476.
- Rates per 1,000 mid-year population (Table 6.1): In 38.3, Out 33.0; higher for females (In 50.0, Out 44.7) than males (In 26.4, Out 21.0).
- Age-specific peaks at 20–24 years, especially among females (In 134.0, Out 115.6 per 1,000), likely reflecting marriage-related mobility (Fig. 6.1.1; 6.1.2).
- Monthly pattern (Fig. 6.2.1; 6.2.2): out-migration spiked in January; in-migration peaked August–December.

Implications

- Newborn and early-infancy survival: Newborn and early-infancy survival: Concentration of deaths in the first week underscores the need to strengthen antenatal care (ANC) and intrapartum care (IPC), recognition/referral for maternal–fetal complications, safe delivery and immediate newborn care, and postnatal care coverage and quality.
- Place and attendant of delivery: The high home delivery rates and reliance on Traditional Birth Attendants (TBAs) and family members indicate barriers related to access, cost, and perceived quality of care. ; Expanding equitable, high-quality institutional delivery options and midwifery/nursing outreach (including for home settings) should be prioritized.
- C-section use: At 27.2%, monitoring appropriateness, indications, and equity is warranted; reduce unnecessary procedures while safeguarding access for clinically indicated cases.
- WASH and household risks: High reliance on biomass fuel, unhygienic sanitation, and surface water suggests preventable environmental health risks affecting the maternal, newborn, and child health (MNCH) and older adults.
- Seasonal mortality: Peaks in winter months call for preparedness (e.g., respiratory infection prevention, elderly risk management, supply/oxygen readiness).
- Migration & service continuity: Female and marriage-related mobility at 20–24 has program implications for continuity of antenatal care (ANC), post-natal care (PNC), family planning, and immunization across administrative boundaries.

Chapter 1: Introduction

1.1. Background

The Health and Demographic Surveillance System in Zakiganj (HDSS, Zakiganj), of Sylhet district has been jointly developed and is maintained through a long-standing partnership between the Projahnmo Research Foundation (PRF), Bangladesh, and Johns Hopkins University (JHU), USA, hereafter referred to as Projahnmo. The site was selected in 2001 based on various health indicators, particularly those related to maternal and newborn health. At that time, Sylhet was the poorest-performing division in Bangladesh across nearly all newborn, child, and maternal health indicators. Table 1.1 illustrates the markedly higher burden of disease and adverse outcomes in Sylhet compared to national averages in 2000. This choice laid the foundation for establishing a long-term research platform in one of the country's most vulnerable regions.

Over the years, this site has hosted a number of seminal studies that developed culturally appropriate, cost-effective interventions, many of which shaped national and global maternal, newborn, and child health policies. Building on this legacy, PRF and JHU have now transitioned Zakiganj into a formal and organized health and demographic surveillance system. This transformation represents a major milestone, as it enables systematic, longitudinal monitoring of demographic dynamics, mortality, fertility, migration, and health outcomes in Sylhet—a region of both high health need and high research value.

This report is the **first official documentation from HDSS, Zakiganj**. By establishing HDSS, Zakiganj, PRF and JHU reaffirm their shared commitment to strengthening health research infrastructure in Bangladesh and to contributing to the global network of HDSS sites that underpin evidence-based health and social policy.

Table 1.1: Key Maternal, Newborn and Child Health indicators in Sylhet and Bangladesh in 2000

Indicator	**Sylhet**	**National**
Neonatal Mortality Rate[3]	81.7	50.4
Infant Mortality Rate[3]	126.9	79.6
Under-5 Mortality Rate[3]	161.9	110.0
Total Fertility Rate[3]	4.08	3.31
Maternal Mortality Ratio [4]	471	322
Facility Delivery [3]	6.3%	7.9%
≥2 TT vaccination[3]	49.6%	63.7%
Fully vaccinated children in 12-23 month old children[3]	45.3%	60.4%

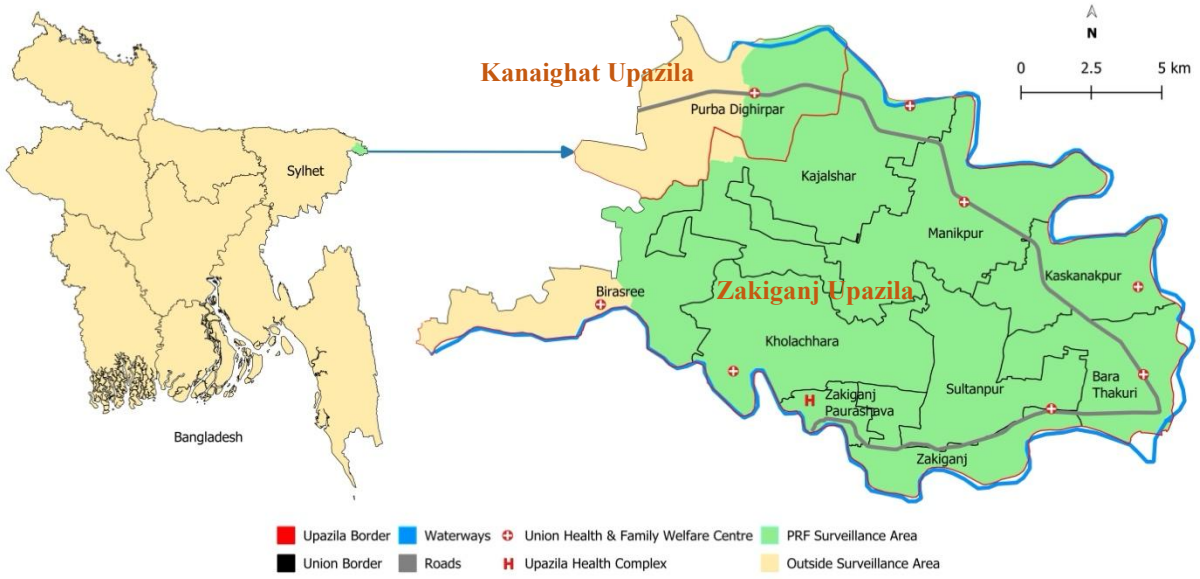

Figure 1.1: Projahnmo Study site in Sylhet, Bangladesh

1.2. Brief description of the Sylhet Projahnmo HDSS Area

HDSS Zakiganj is located in the northeastern region of Bangladesh (24.8778° N, 92.3722° E), on the north bank of the Kushiyara River. The site lies about 350 km from the capital city, Dhaka, and borders the Indian states of Assam and Meghalaya.

The surveillance area covers nine unions: Barothakuri, Birosree, Kajalshar, Kaskonakpur, Kholachara, Manikpur, Sultanpur, and Zakiganj Sadar in Zakiganj Upazila, and Purba Dighir Par in Kanaighat Upazila. Together, these unions comprise 246 villages, 11,585 baris (clusters of households sharing a courtyard), and 40,399 households. The total surveillance population is approximately 226,260 people (111,552 males and 114,708 females).

Agriculture is the primary livelihood, with most families engaged in farming. The majority of the population is Muslim (91.3%), followed by Hindu (8.7%), with a very small Christian minority (0.01%).

Health services in the HDSS Zakiganj area are provided by a mix of government, private, and non-governmental facilities. At the subdistrict headquarters, the Upazila Health Complex (UHC)—a 50-bed public hospital—together with four private hospitals provides outpatient and inpatient care. At the union level, there are nine Union Health and Family Welfare Centers (UH&FWCs) and 26 Community Clinics, ensuring primary health service coverage. Additionally, physicians from Projahnmo support the Integrated Management of Childhood Illness (IMCI) clinic at Zakiganj UHC to strengthen care for children under five.

1.3. Purpose of the Projahnmo HDSS

The purpose of the health and demographic surveillance system is to maintain a longitudinal database of households and individuals in the surveillance area, with a particular focus on married women of reproductive age (MWRA), pregnant women, and children. This platform enables Projahnmo to conduct high-quality nested epidemiological research, including both intervention trials and observational studies.

The ongoing surveillance, carried out every two months by trained community health workers (CHWs), tracks vital events, pregnancies, household movements, and other key demographic indicators. This system forms the backbone of the field site, providing essential data to support specific studies.

The key components of the Projahnmo HDSS include:

- Maintaining an updated list of all households in the surveillance area.
- Regularly updating household members and their vital status.
- Recording family relationships and linkages between household members.
- Identification and tracking of pregnancy and outcomes
- Tracking married women of reproductive age (MWRA).
- Death of household members with date of death
- Mobility and Context
- Tracking all in- and out-migration events.
- Updating GIS locations of new baris (household clusters) and households, along with periodic mapping of key landmarks.
- Collecting household socioeconomic information on a regular basis.

Chapter 2: Projahnmo Health and Demographic Surveillance Procedure

The Projahnmo HDSS in Zakiganj maintains accurate, regularly updated demographic data through systematic mapping and two-monthly household visits. The area was first mapped and enumerated in 2002, with updates in later years, and all households, baris, health facilities, and landmarks are now geo-referenced. The current surveillance system is organized into clusters managed by trained community health workers (CHWs), each responsible for routine household visits every two months. During these visits, CHWs update information on vital events, pregnancies, migration, and household changes, forming the backbone of the HDSS. All the surveillance-related definitions are described in Annex 1, and the detailed Surveillance Procedures are in Annex 2.

2.1. Data collection

Every household in the surveillance area is visited once every two months by trained community health workers (CHWs). During these visits, CHWs update information on households, members, pregnancies, births, deaths, and migrations. Since 2022, all data has been collected electronically using Android tablets designed by the Projahnmo team, replacing earlier paper-based forms. Household-level information is usually provided by a responsible adult, while married women of reproductive age (MWRA) are directly interviewed about their own pregnancies and related health matters. Household socioeconomic status is assessed at baseline and updated annually. Please see Annex -3 for details.

2.2. Quality Assurance and Data Management

Projahnmo ensures high data quality and secure management of the HDSS through a combination of training, supervision, electronic data capture, and monitoring systems. CHWs are carefully trained, supervised by field research staff, and supported by built-in tablet checks and real-time dashboards. Data are stored in a longitudinal database that records vital events, family linkages, and household changes, and are continuously updated and validated before being finalized each round.

Chapter 3: Demographic and Household Characteristics

3.1. Age and Sex Distribution of the Population

Table 3.1. illustrates the age and sex distribution of the mid-year population in the Projahnmo surveillance area. The surveillance population in 2023 was almost evenly split between males (111,547) and females (114,713), resulting in an overall sex ratio of 97.2 males for every 100 females. The child population (0–14 years) accounted for 70,355 individuals, representing nearly one-third of the total population. The adult group (15–64 years) made up the majority with 145,974 individuals (64%), while older adults (65 years and above) numbered 9,931, constituting 4.4% of the total.

In the younger age groups (<5 years), the sex ratio slightly favored males, consistent with natural birth patterns, with more boys than girls recorded. However, from adolescence through the reproductive ages (15–49 years), the sex ratio shifted in favor of females, with notable deficits in males, particularly in the 15–19 years (93.5 males per 100 females) and 45–49 years (85 males per 100 females) categories. Among the elderly, the ratio fluctuated again, with some age groups showing more males (e.g., 65–69 years, 112.3 males per 100 females), but by age 85+, females predominated (82.7 males per 100 females), reflecting women's greater longevity.

The population pyramid (Figure 3.1) displays a classic expansive shape, wide at the base and gradually narrowing with age, typical of populations with high fertility and declining survival at older ages. The wide base indicates a large proportion of children under 15 years, while the steep tapering at older ages reflects relatively low survival into later life. The pyramid is nearly symmetrical, although slight imbalances are visible: more boys at the youngest ages, and more women in many adult and elderly groups.

Overall, the age–sex structure indicates a young and growing population, with a large dependency burden from children and relatively few elderly. These findings highlight ongoing demographic challenges, particularly high demand for maternal, neonatal, child, and adolescent health services, alongside emerging needs for adult and elderly care as survival improves.

Table 3.1. Mid-year Population by age and sex and sex Ratio in 2023

Age (years)	Sex			Sex Ratio (#Male per 100 Female)
	Both Sex	Male	Female	
All Age	226260	111547	114713	97.2
<1 year	4568	2355	2213	106.4
1-4	18185	9154	9031	101.4
1	4498	2266	2232	101.5
2	4327	2189	2138	102.4
3	4584	2330	2254	103.4
4	4776	2369	2407	98.4
5-9	24057	12092	11965	101.1
10-14	23545	11807	11738	100.6

Age (years)	Sex			Sex Ratio (#Male per 100 Female)
	Both Sex	Male	Female	
Total Child	**70355**	**35408**	**34947**	
15-19	26209	12665	13544	93.5
20-24	24829	12160	12669	96.0
25-29	19091	9405	9686	97.1
30-34	16692	8097	8595	94.2
35-39	14061	6942	7119	97.5
40-44	12749	6044	6705	90.1
45-49	9750	4479	5271	85.0
50-54	10147	4908	5239	93.7
55-59	7012	3527	3485	101.2
60-64	5434	2827	2607	108.4
Total adult	**145974**	**71054**	**74920**	
65-69	3639	1925	1714	112.3
70-74	2571	1328	1243	106.8
75-79	1803	925	878	105.4
80-84	1008	495	513	96.5
85+	910	412	498	82.7
Total Old	**9931**	**5085**	**4846**	

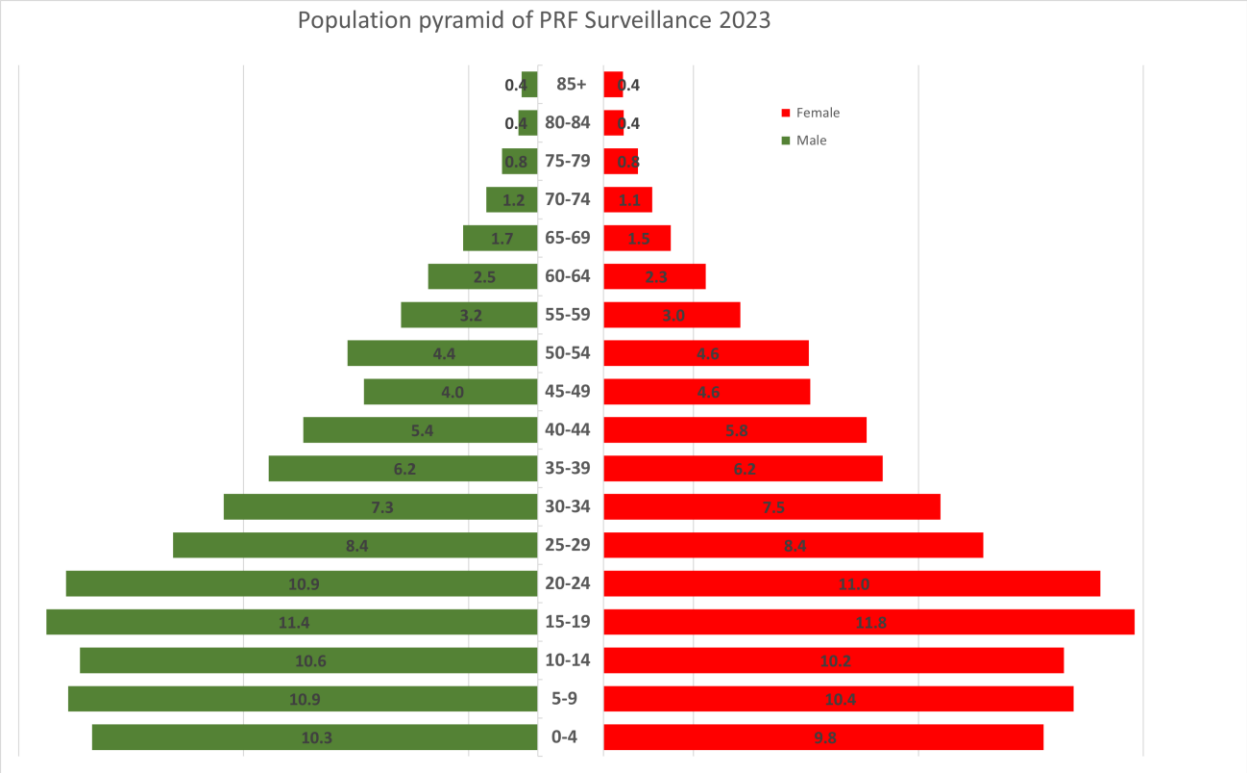

Figure 3.1: Population Pyramid of Projahnmo HDSS population

3.2. Household Demographic and Socio-Economic Characteristics

Table 3.2 illustrates the demographic profile and socio-economic characteristics of households in the surveillance area, highlighting household composition, living conditions, and wealth distribution.

In 2023, the age dependency ratio was 0.55, meaning that for every 100 working-age people, there were 55 dependents (children under 15 and adults over 64). The surveillance population was spread across 40,399 households, with an average household size of 5.6 persons. Most households were large, with 65.3% having five or more members. On average, each household included 1.01 married women of reproductive age (MWRA), 0.56 children under five, and 0.35 elderly individuals aged 60 and above, reflecting a young but gradually aging population structure.

Housing and living conditions varied. Most households (72.5%) had more than one bedroom, while about a quarter (27.5%) lived in single-room dwellings. Nearly all households (98%) had access to electricity, but 97% depended on biomass fuels (wood, coal, animal dung) for cooking, indicating heavy reliance on traditional energy sources. Drinking water mainly came from tube wells, hand pumps, boreholes, or public taps (78.8%), while about 21% relied on surface water sources, which are generally more prone to contamination. Sanitation coverage remained limited: only 33.2% of households used flush or pour-flush toilets, while 66.8% relied on unhygienic facilities.

In terms of housing materials, 75.2% of households had natural or rudimentary floors, and only 24.8% had finished floors. Roofs were predominantly made of tin, wood, or ceramic tiles (97.2%), while cement roofing was rare (2.8%). Exterior walls showed better quality, with 73.8% made of finished materials, though over a quarter (26.2%) remained natural or rudimentary.

Wealth distribution was skewed toward the lower quintiles: 47% of households were in the lowest two categories (20.2% lowest, 26.7% lower), while only 19.6% belonged to the highest quintile.

These findings indicate that most households in the surveillance area face socioeconomic constraints, with reliance on biomass fuel, limited sanitation, and modest housing conditions reflecting persistent vulnerabilities.

Table 3.2 Population and Household Characteristics

Indicator		
Demographic		
	Total Mid-year Population (N)	226,260
	Male	111,552
	Female	114,708
	Sex Ratio at Birth (men/100 women)	97.2
	Age Dependency Ratio	0.55
	Total households	40399
	Average Household size	5.6

Socio-economic status of households	<5 members	34.7%
	>=5 members	65.3%
	Average MWRA per household	1.01
	Average under-five children per household	0.56
	Average elderly populations (>60 years of age) per household	0.35
	Bedrooms in household (%)	
	One bedroom	27.5
	More than one bedroom	72.5
	Use biomass (Wood/coal/animal dung) fuel for cooking (%)	97
	Availability of electricity (%)	98
	Source of drinking water (%)	
	Tube well/hand pump/borehole/public tap (%)	78.8
	Surface water (river/dam/lake/pond) (%)	21.2
	Type of toilet facility (%)	
	Flush/pour flush toilet	33.2
	Unhygienic toilet	66.8
	Main material of the floor (%)	
	Natural or rudimentary floor	75.2
	Finished floor	24.8
	Main material of the roof (%)	
	Tin/wood/ceramic tiles	97.2
	Cement	2.8
	Main material of the exterior walls (%)	
	Natural or rudimentary walls	26.2
	Finished walls	73.8
	Wealth quintiles (%)	
	Lowest	20.2
	Lower	26.7
	Middle	13.1
	Higher	20.4
	Highest	19.6

Chapter 4: Fertility

4.1. Fertility rates

Table 4.1 shows the age-specific fertility rates and fertility indices for women aged 15–49 years in the surveillance area for 2023.

In 2023, there were 63,589 women of reproductive age (15–49 years) in the surveillance area, among whom 4,825 live births were recorded. The General Fertility Rate (GFR) was 75.9 per 1,000 women, while the Total Fertility Rate (TFR) was 2.3 children per woman, which is close to replacement level fertility. The Gross Reproductive Rate (GRR) was 1.1, and the Crude Birth Rate (CBR) was 21.3 per 1,000 population, consistent with the demographic profile of the surveillance area.

Age-specific fertility patterns show that childbearing was most concentrated in the 20–24 years (135.3 per 1,000 women) and 25–29 years (146.8 per 1,000 women) age groups, which together accounted for the majority of live births. Fertility was lower among adolescents aged 15–19 years (34.6 per 1,000 women), indicating relatively reduced teenage childbearing, though still a notable contribution. Fertility declined steadily after age 30, falling sharply by ages 40–44 (11.2 per 1,000 women) and becoming minimal at ages 45–49 (3.2 per 1,000 women).

The age-specific fertility curve in Figure 4.1 displays a bell-shaped pattern, peaking in the mid-20s and then declining with increasing age. This pattern reflects a young fertility trend, where most births occur in the first decade of reproductive life.

These findings indicate that fertility in Zakiganj is concentrated in early adulthood, with relatively low levels of adolescent childbearing and a gradual shift toward replacement-level fertility.

Table 4.1 Age-specific fertility rates (per 1,000 women) and indices 2023

Age (Years)	Total women (15-49)	# of livebirths	Rate
All Ages	63589	4825	75.9
15-19	13544	469	34.6
20-24	12669	1714	135.3
25-29	9686	1422	146.8
30-34	8595	844	98.2
35-39	7119	284	39.9
40-44	6705	75	11.2
45-49	5271	17	3.2
Total Fertility Rate	2.3		
General Fertility Rate	75.9		
Gross Reproductive Rate	1.1		
Crude Birth Rate	21.3		

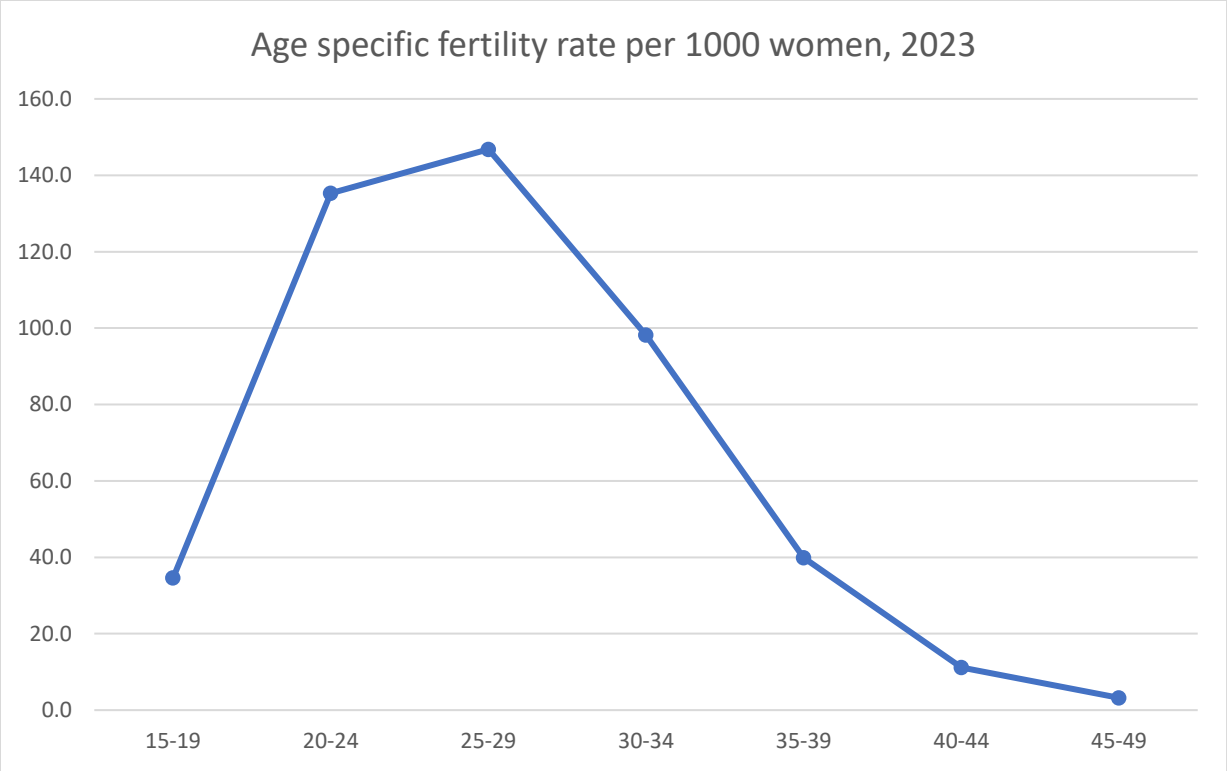

Figure 4.1: Age specific fertility rate per thousand women in 2023

4.2. Pregnancy Identification

The age-specific pregnancy identification rates presented in Table 4.2 show that pregnancy is most commonly identified among women aged 20–29 years, consistent with the biologically and socially normative childbearing ages in this setting. Women aged 20–24 had the highest identification rate at 155.6 per 1,000 women, closely followed by those aged 25–29 years (155.1). The rate declines gradually after age 30, falling to 102.3 among women aged 30–34 and 46.2 among those aged 35–39 years. Pregnancy identification among women aged 40 years and above was uncommon, dropping to 11.9 for ages 40–44 and only 2.8 for women aged 45–49. Overall, 5,522 pregnancies were identified in 2023, corresponding to an age-specific pregnancy identification rate of 86.8 per 1,000 women of reproductive age.

Figure 4.2 shows the monthly distribution of newly identified pregnancies during 2023. The year began with relatively high pregnancy identification in January (534), followed by a small dip in February (446). A clear seasonal rise is observed in March and April, peaking in April with 575 new pregnancy identifications—the highest monthly count of the year. After April, the numbers steadily declined through the monsoon months, reaching the lowest point in July (353). From August onward, pregnancy identification remained fairly stable, with a gradual rise toward November (459) before decreasing again slightly in December (417). This seasonal pattern may reflect variations in marital timing, conception patterns, household mobility, or reporting dynamics. One point to note here is that 339 women identified as pregnant could not recall their last menstrual period, and we could not include those women in Figure 4.2.

Across both the table and the figure, the data illustrate that pregnancy identification in the surveillance area is strongly concentrated among younger adult women and exhibits notable month-to-month fluctuations, with a pronounced peak in early spring and a mid-year decline.

Table 4.2 Age-specific pregnancy identification rates (per 1,000 women) in 2023

Age (Years)	Total women (15-49)	# of Pregnancies	Rate
15-19	63589	746	55.1
20-24	13544	1971	155.6
25-29	12669	1502	155.1
30-34	9686	879	102.3
35-39	8595	329	46.2
40-44	7119	80	11.9
45-49	6705	15	2.8
Total	**63589**	**5522**	**86.8**

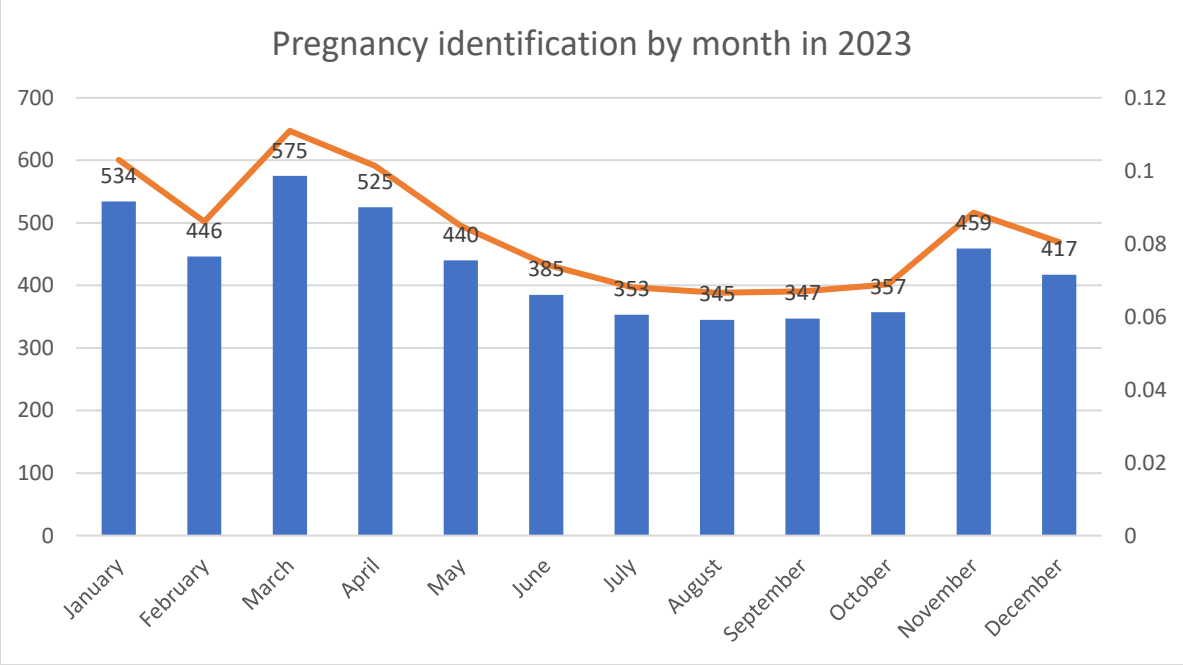

Figure 4.2: New pregnancies by calendar month in 2023
[Note: There were 339 pregnant women identified in 2023 who could not mention their 1st date of last menstrual period (LMP)]

4.3. Pregnancy Outcomes

Table 4.3 summarizes pregnancy outcomes in the surveillance area in 2023, including live births, stillbirths, abortions, and multiple pregnancies.

In 2023, a total of 5,313 pregnancies with reported outcomes were recorded. The majority, nearly nine in ten (4,763 or 89.6%), ended with at least one live birth, while 192 pregnancies (3.6%)

resulted in stillbirths and 360 (6.8%) ended in abortion. These data show that while most pregnancies concluded with live births, about one in ten ended in a loss.

Multiple pregnancies were relatively uncommon. There were 57 twin pregnancies and 4 triplet pregnancies. Among the twins, 54 ended with two live births, while one ended with two stillbirths and two ended with mixed outcomes (one live birth and one stillbirth). Triplet pregnancies were rare but showed similar variability: four resulted in three live births..

Altogether, 5,378 pregnancy outcomes were documented, consisting of 4,825 live births, 193 stillbirths, and 360 abortions. Expressed per 1,000 pregnancies, this translated to 908 live birth pregnancies, 36 stillbirth pregnancies, and 67 abortions.

These findings highlight that while the large majority of pregnancies resulted in live births, adverse outcomes—including stillbirths and abortions—remained a significant concern, underscoring the continued need for strong antenatal and maternal health services.

Note: The total number of pregnancy outcomes differs from the number of identified pregnancies because not all pregnancy outcomes reported in 2023 come from pregnancies identified that year, and multiple pregnancies (such as twins and triplets) contribute more than one outcome.

Table 4.3. Pregnancies and pregnancy outcomes

	Number of Pregnancies by type
Total Pregnancies with reported outcome	**5313**
Pregnancies that	
Ended with at least one live birth	4763
Ended with at least one stillbirth	192
Were aborted	360
Number of multiple outcome pregnancies by type	
Multiple outcome pregnancies	**61**
Twin pregnancies	57
Twin pregnancies that:	
Ended with 2 live births	54
Ended with 2 stillbirths	1
Ended with 1 livebirth and 1 stillbirth	2
Triplet pregnancies	**4**
Triplet pregnancies that:	
Ended with 3 live births	4

Ended with 1 live birth and 2 stillbirths	0
Number of pregnancy outcomes by type	
Total outcomes	**5378**
Live births	4825
Stillbirths	193
Abortions	360
Pregnancy rates by type	
Rates per thousand pregnancies:	
Live birth pregnancies	908.1
Stillbirth pregnancies	36.3
Pregnancies aborted	67.8

Live birth pregnancy: Pregnancy that ends with at least one livebirth.
Still birth pregnancy: Pregnancy that ends with at least one stillbirth.
Abortion: If a pregnancy terminates before 28 weeks of gestational age and there is no sign of life (if baby born) then it is called abortion.

Figure 4.3 presents the distribution of pregnancy outcomes—live births, stillbirths, and abortions—by calendar month in 2023.

Pregnancy outcomes in 2023 showed noticeable variation across months. January recorded the highest number of outcomes, exceeding 550, while the lowest counts were observed in May and June, both below 350. Across the year, live births consistently accounted for the vast majority of outcomes, while stillbirths and abortions—shown as smaller segments at the bottom of each bar—remained relatively stable and contributed only a modest share of the total.

The pattern suggests some seasonality, with higher numbers of pregnancy outcomes clustered in January, September, and October, compared to the mid-year months when outcomes were fewer. However, adverse outcomes such as stillbirths and abortions did not display strong seasonal variation.

These findings suggest that while the timing of total pregnancy outcomes may fluctuate seasonally, the relative proportions of live births, stillbirths, and abortions remain broadly consistent across the year.

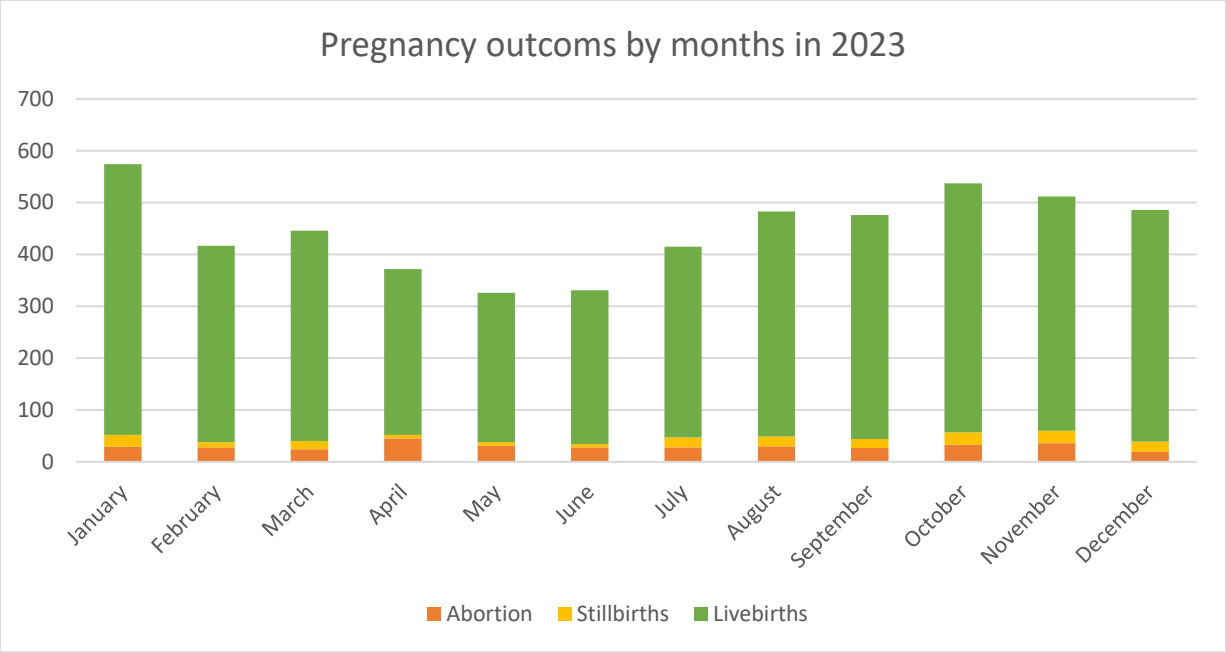

Figure 4.3 Pregnancy outcomes by calendar months in 2023

4.4. Delivery of live born children

The distribution of live births by place of delivery in 2023 indicates that home delivery remains the most common option in the surveillance area, accounting for 43.3 percent of all births. Despite ongoing efforts to promote facility-based deliveries, nearly half of women continued to give birth at home, highlighting persistent cultural preferences, access barriers, or limitations in perceived quality of care.

Among facility-based deliveries, private facilities played the largest role, contributing 31.2 percent of all live births. This high utilization reflects the strong presence and accessibility of private clinics, hospitals, and nursing homes in the region, as well as women's preference for perceived better responsiveness and individualized attention in private settings. Public sector facilities collectively accounted for 21.1 percent of deliveries. Within the public system, Upazila Health Complexes handled the majority (11.1 percent), followed by Health and Family Welfare Centers (7.1 percent), while District Hospitals accounted for only 2.9 percent of births. The relatively low use of district-level facilities may reflect their greater distance, higher patient load, or logistical challenges for women seeking care.

A small proportion of births (4.5 percent) occurred in locations categorized as "Other," which may include community clinics, temporary birthing centers, or deliveries that occurred while en route to a health facility.

Overall, the data show that while nearly 57 percent of births occurred in health facilities, there remains substantial reliance on home delivery, and the private sector plays a disproportionately large role compared to the public system. This pattern underscores the need to strengthen public maternity services, address barriers to facility access, and continue promoting safe delivery practices across the surveillance area.

Table 4.4.1 Percent distribution of pregnancies that ended with live birth by place of delivery in 2023

Place of Delivery	Number	Percent
Home	2088	43.3
Public Health facilities	1017	21.1
Health and Family Welfare Center	343	7.1
Upazila Health Complex	534	11.1
District Hospital	140	2.9
Private Facilities* (Clinic/Hospital/Nursing home)	1503	31.2
Others	217	4.5

**Note: Private facilities include both for-profit and non-profit facilities*

Table 4.4.2 shows the distribution of live births in 2023 by birth attendants.

In 2023, deliveries in the surveillance area were attended by a range of individuals, reflecting the mix of traditional practices and health system involvement. Nearly half of all births (46.8%) were attended by nurses, making them the most common attendants. Trained traditional birth attendants (TBAs) played a substantial role, assisting at 30.9% of deliveries. Family members and neighbors were reported as attendants in 18.4% of cases, showing continued reliance on informal support during childbirth.

In contrast, qualified doctors were present at only 3.2% of deliveries, underscoring the limited availability or use of physician-led care. A very small proportion (0.7%) were attended by others not included in the main categories, and one birth was reported with no attendant present.

This distribution indicates that although skilled providers such as nurses were the leading attendants, a significant proportion of deliveries still occurred under the care of traditional or informal attendants. In the surveillance area, trained nurses also assist with home deliveries, which may help explain their large share.

These findings highlight the reliance on nurses and TBAs in childbirth care, while the low presence of doctors points to ongoing gaps in access to higher-level medical services during delivery.

Table 4.4.2 Percent distribution of pregnancies that ended with live birth by birth attendant in 2023

Birth Attendant	Number	Percent
Relatives/Neighbor	886	18.4
Trained TBA	1489	30.9
Nurse	2258	46.8
Qualified Doctor	156	3.2
Others	35	0.7
None	1	0.0

Table 4.4.3 shows the distribution of live births in 2023 by mode of delivery, distinguishing between normal deliveries and caesarean sections.

In 2023, most pregnancies that ended with a live birth in the surveillance area were delivered normally, making up 67.3% of reported cases. Caesarean sections accounted for 27.2%, meaning that more than one in four births involved surgical intervention. An additional 5.5% of cases were recorded as missing, reflecting the fact that data collection on this variable was only introduced into the surveillance system beginning in February 2023. The missing cases are therefore concentrated among births that occurred in January 2023, prior to full implementation of the variable.

These findings show that while the majority of births were normal deliveries, caesarean sections already account for more than one-quarter of deliveries in Zakiganj. This proportion is lower than the national figure reported in BDHS 2022–23 (38%), but remains nearly double the World Health Organization's recommended upper threshold of 10–15%, underscoring the widespread use of surgical delivery in this setting.[1, 2]

Table 4.4.3 Percent distribution of pregnancies that ended with live birth by place of delivery in 2023

Mode of delivery	Number	Percent
Normal	3,246	67.3
C-section	1,313	27.2
Don't know	266	5.5

Chapter 5: Mortality

5.1. Child mortality

Child mortality patterns are presented in Table 5.1. The neonatal mortality rate (first 28 days) was 37.7 per 1,000 live births, while mortality among young infants (0–59 days) was 44.8 per 1,000 live births. By one year of age, the infant mortality rate reached 56.2 per 1,000 live births, and mortality among children aged 1–4 years was 7.5 per 1,000 live births. Overall, the under-five mortality rate was 63.6 per 1,000 live births. Across all age groups, boys consistently experienced higher mortality than girls, underscoring persistent gender differences in survival.

These findings emphasize that preventing deaths in the newborn and early infancy period remains the most urgent challenge for improving child survival in Zakiganj.

Table 5.1 Child mortality

Demographic Indicator	Number			Rate per 1000 Live birth		
	Total	Male	Female	Total	Male	Female
Births (Live birth)	4,825	2,491	2,334			
Neonatal Death (<28 Days)	182	110	72	37.7	44.2	30.8
Young Infant Death (0-59 Day)	216	131	85	44.8	52.6	36.4
Infant Death (<1 year)	271	161	110	56.2	64.6	47.1
Post-infant Death (1-4 Years)	36	20	16	7.5	8.0	6.9
Under-five Deaths (5 years)	307	181	126	63.6	72.7	54.0

5.2. Mortality by different Age and Sex

Table 5.2.1 presents the number, percent distribution, and cumulative distribution of deaths in 2023 by age and sex.

In 2023, a total of 1,456 deaths were reported in the surveillance area, with more among males (804) than females (652). Mortality was highly concentrated in the earliest stages of life, with 271 deaths (19%) occurring in infancy, including 182 neonatal deaths, more than half of which occurred within the first week of life. By the fifth birthday, 307 deaths had occurred, representing just over one-fifth of all deaths.

At older ages, the burden of mortality shifted toward the elderly, particularly from age 60 onward, when deaths rose steeply and together accounted for the majority of all recorded deaths. Sex differences followed expected patterns: male deaths predominated in childhood, whereas in older ages—especially beyond 70 years—female deaths were more frequent, reflecting women's greater longevity.

Table 5.2.1 Number of deaths, percent distribution, and cumulative percent distribution of deaths by age and sex in 2023

AGE (YEARS)	BOTH SEXES			MALE			FEMALE		
	Number	%	Cumulative %	Number	%	Cumulative %	Number	%	Cumulative %
All ages	1456	100.0		804	100.0		652	100.0	
<1 year	271			161			110		
<7 days	152	10.4	10.4	92	11.4	11.4	60	9.2	9.2
7-28 days	30	2.1	12.5	18	2.2	13.7	12	1.8	11.0
<28 days	182			110			72		
29-59 days	34	2.3	14.8	21	2.6	16.3	13	2.0	13.0
2-5 months	42	2.9	17.7	23	2.9	19.2	19	2.9	16.0
6-11 months	13	0.9	18.6	7	0.9	20.0	6	0.9	16.9
1-4 years	36			20			16		
1 year	14	1.0	19.6	8	1.0	21.0	6	0.9	17.8
2 years	11	0.8	20.3	6	0.7	21.8	5	0.8	18.6
3 years	7	0.5	20.8	5	0.6	22.4	2	0.3	18.9
4 years	4	0.3	21.1	1	0.1	22.5	3	0.5	19.3
<5 years	307			181			126		
5-9	10	0.7	21.8	4	0.5	23.0	6	0.9	20.2
10-14	10	0.7	22.5	5	0.6	23.6	5	0.8	21.0
15-19	23	1.6	24.0	10	1.2	24.9	13	2.0	23.0
20-24	30	2.1	26.1	12	1.5	26.4	18	2.8	25.8
25-29	15	1.0	27.1	8	1.0	27.4	7	1.1	26.8
30-34	33	2.3	29.4	16	2.0	29.4	17	2.6	29.4
35-39	45	3.1	32.5	23	2.9	32.2	22	3.4	32.8
40-44	45	3.1	35.6	23	2.9	35.1	22	3.4	36.2
45-49	49	3.4	38.9	28	3.5	38.6	21	3.2	39.4
50-54	100	6.9	45.8	61	7.6	46.1	39	6.0	45.4
55-59	88	6.0	51.9	51	6.3	52.5	37	5.7	51.1
60-64	143	9.8	61.7	79	9.8	62.3	64	9.8	60.9
65-69	131	9.0	70.7	78	9.7	72.0	53	8.1	69.0
70-74	138	9.5	80.2	77	9.6	81.6	61	9.4	78.4
75-79	104	7.1	87.3	56	7.0	88.6	48	7.4	85.7
80-84	76	5.2	92.5	46	5.7	94.3	30	4.6	90.3
85+	109	7.5	100.0	46	5.7	100.0	63	9.7	100.0

Table 5.2.2 presents age- and sex-specific death rates per 1,000 population in 2023, highlighting neonatal, infant, and under-five mortality alongside broader mortality trends across the life course.

The crude death rate (CDR) for the surveillance population in 2023 was 6.4 per 1,000 population, with males experiencing a higher rate (7.2) than females (5.7).

Mortality was highly concentrated in early childhood. The neonatal mortality rate was 37.7 per 1,000 live births, with males at 44.2 and females at 30.8. Within the neonatal period, the risk was greatest in the first week of life, with deaths under 7 days accounting for 31.5 per 1,000 live births. The post-neonatal mortality rate was 18.4 per 1,000 live births (20.4 among males, 16.3 among females). In total, the infant mortality rate reached 56.2 per 1,000 live births, with a pronounced sex differential (64.6 among males vs. 47.1 among females). By age five, the cumulative under-five mortality rate was 63.6 per 1,000 live births, again higher for males (72.7) than females (54.0).

Beyond early childhood, mortality rates were low through adolescence and young adulthood, generally ranging between 0.3 and 2 per 1,000 population up to age 39. Rates then rose gradually, reaching 5 per 1,000 at ages 45–49, 12.5 per 1,000 at ages 55–59, and climbing sharply at older ages. Mortality reached 36 per 1,000 at ages 65–69, 53.7 at 70–74, 75.4 at 80–84, and peaked at 119.8 per 1,000 among those aged 85 years and older.

The sex pattern observed at older ages mirrored that of early childhood, with males showing higher mortality rates up to age 79. However, from 85 years and above, females recorded a higher death rate (126.5 per 1,000) compared to males (111.7 per 1,000), reflecting the larger number of women surviving to advanced ages and their increased vulnerability at these stages.

These findings demonstrate the double burden of mortality in Zakiganj (Figure 5.2.1): very high risks in the neonatal and infant periods, followed by low mortality through much of adulthood, and then steeply rising rates in old age.

Table 5.2.2 Death rates by age, sex (per 1,000 population) in 2023

AGE (YEARS)	BOTH SEXES	MALE	FEMALE
All ages (CDR)	**6.4**	**7.2**	**5.7**
<7 days*	31.5	36.9	25.7
7-28 days*	6.2	7.2	5.1
Neonatal Mortality Rate (NMR)*	**37.7**	**44.16**	**30.84**
29-59 days*	7	8.4	5.6
2-5 months*	8.7	9.2	8.1
6-11 months*	2.7	2.8	2.6
Post neonatal mortality rate*	**18.4**	**20.4**	**16.3**
Infant Mortality Rate (IMR)*	**56.2**	**64.6**	**47.1**
1-4 years	2	2.2	1.8

AGE (YEARS)	BOTH SEXES	MALE	FEMALE
1 year	3.1	3.5	2.7
2 years	2.5	2.7	2.3
3 years	1.5	2.2	0.9
4 years	0.8	0.4	1.3
0-4 years	13.5	15.8	11.2
Under five child mortality rate*	**63.6**	**72.7**	**54.0**
5-9	0.4	0.3	0.5
10-14	0.4	0.4	0.4
15-19	0.9	0.8	1
20-24	1.2	1	1.4
25-29	0.8	0.9	0.7
30-34	2	2	2
35-39	3.2	3.3	3.1
40-44	3.5	3.8	3.3
45-49	5	6.3	4
50-54	9.9	12.4	7.4
55-59	12.5	14.5	10.6
60-64	26.3	27.9	24.5
65-69	36	40.5	30.9
70-74	53.7	58	49.1
75-79	57.7	60.5	54.7
80-84	75.4	92.9	58.5
85+	119.8	111.7	126.5
* Rate per 1000 livebirths			

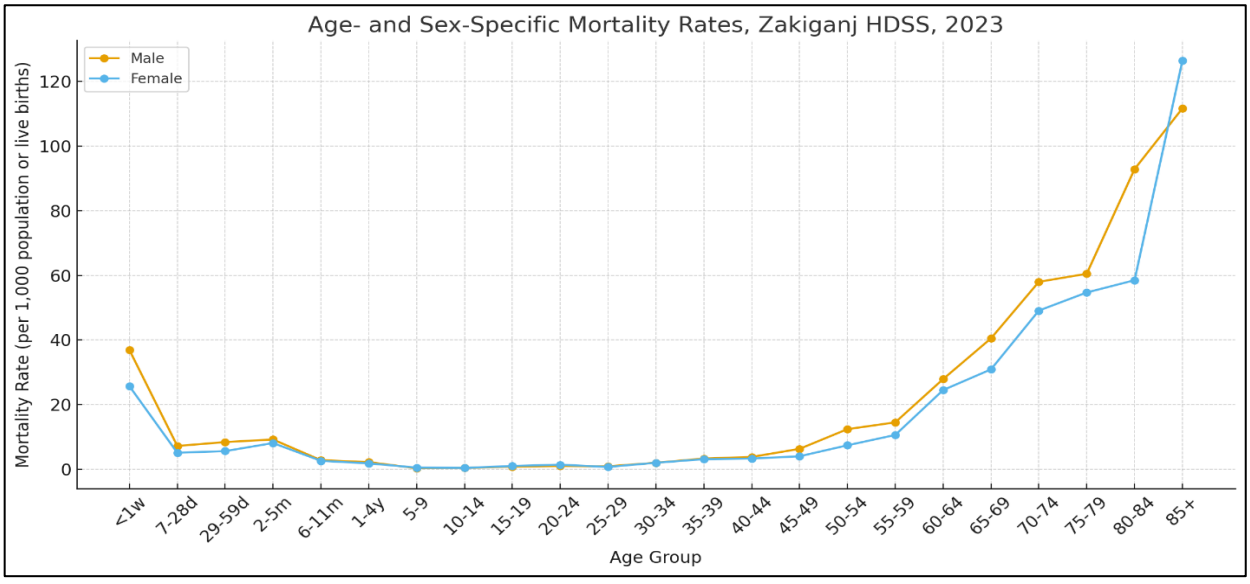

Figure 5.2.1 Age- and Sex specific Mortality Rates in 2023

5.3. Deaths by Month

A total of 1,456 deaths were reported during 2023, distributed unevenly across months and age groups (Table 5.3). Mortality was highest at the beginning and end of the year, with January alone contributing to 198 deaths, followed by elevated counts in November (141), December (136), and February (149). In contrast, May (90 deaths) and June (97 deaths) recorded the lowest numbers, showing a mid-year dip.

Among children under five, there were 307 deaths, with the largest monthly totals in January (43) and November (40). Within this age group, newborns under one month consistently represented the largest share, underscoring their persistent vulnerability. Deaths among adults aged 5–64 years totaled 586 across the year and showed a relatively steady monthly distribution. Older adults aged 65 years and above accounted for 563 deaths, with peaks again in January and December, which may suggest seasonal influences such as colder weather or infectious disease surges.

The bar chart in Figure 5.3 illustrates these patterns, showing mortality concentrated at the extremes of age—early childhood and older adulthood—with seasonal fluctuations most evident in the winter months.

These findings indicate that mortality in Zakiganj followed a seasonal pattern in 2023, with peaks at the start and end of the year, reinforcing the need to monitor and address preventable seasonal health risks.

Table 5.3 Deaths by month and age, 2023

Month	Age at death						
	Under 1 Month	1-11 Month	1-4 years	Under-Five Deaths	5-64 years death	65 and above years death	All Ages
January	18	16	9	43	78	77	198
February	14	7	2	23	47	79	149
March	6	7	2	15	49	47	111
April	11	5	2	18	48	47	113
May	11	3	2	16	48	26	90
June	11	5	1	17	40	40	97
July	14	4	3	21	36	40	97
August	18	3	2	23	43	38	104
September	23	8	4	35	49	41	125
October	15	7	4	26	38	31	95
November	26	10	4	40	61	40	141
December	17	12	1	30	49	57	136
Total	184	87	36	307	586	563	1456

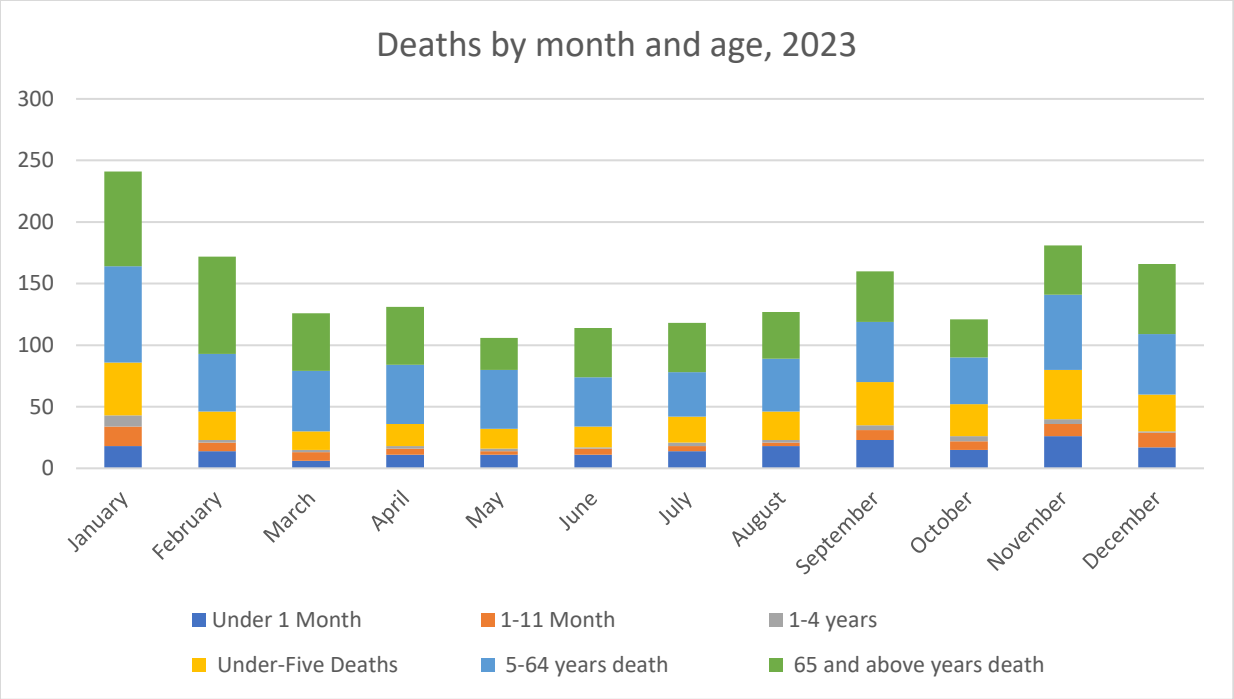

Figure 5.3 Deaths by calendar months in 2023

5.4. Survival Probabilities by Age and Sex

Figure 3.6 presents the probability of survival from birth to successive ages by sex in 2023. The curve shows the proportion of the birth cohort that survived to each age, providing a cohort perspective on mortality risks across the life course.

At birth, survival probabilities appear below 70 years for both sexes, reflecting the high concentration of deaths in the neonatal and infant periods. By age five, the probability of survival rises slightly to about 72–74 years because those who survive the riskiest early years face much lower mortality risks in later childhood. After age five, the curve declines steadily as deaths accumulate across childhood, adulthood, and old age.

From about age 40 onward, survival declines more sharply, with the steepest drops after age 60. By age 85 and above, survival probabilities fall to just over 10% for females and slightly higher for males, reflecting the limited proportion of the cohort reaching advanced ages.

Sex differences follow expected demographic patterns: males show higher mortality in early life and again through much of adulthood, while females retain a modest survival advantage into older ages.

These findings highlight the double challenge in Zakiganj: reducing deaths in early childhood, when risks are highest, and addressing the growing health needs of older adults as more people survive into advanced ages.

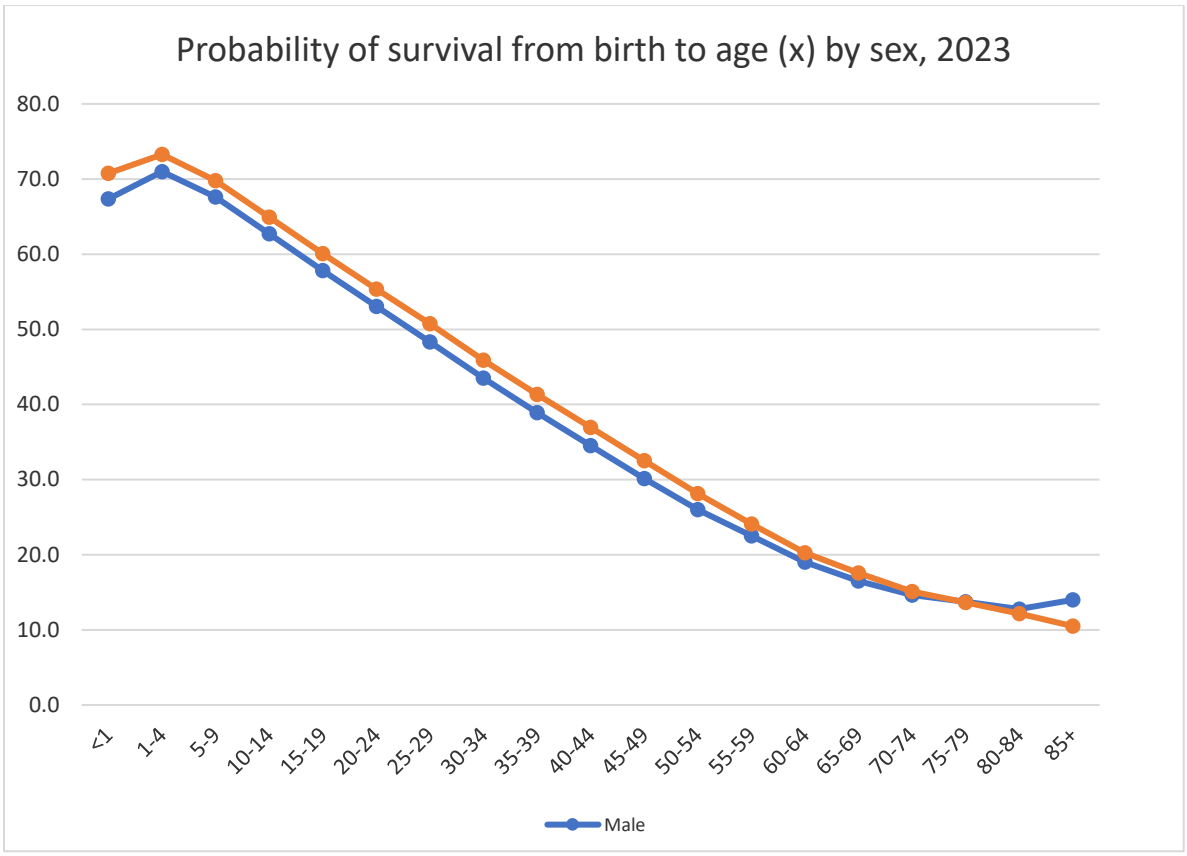

Figure 5.4 Probability of Survival from birth to age (x) by sex in 2023

Chapter 6: Migration

6.1. Migration by Age and Sex

Table 6.1 presents age- and sex-specific migration rates (per 1,000 population) in 2023, distinguishing between in-migration and out-migration.

Overall in-migration (38.3 per 1,000 population) slightly exceeded out-migration (33.0 per 1,000), indicating a modest net population gain. Female in-migration was consistently higher than male in-migration across almost all reproductive and older age groups, while male rates were generally lower except at a few isolated ages.

Among males, in-migration began very low in early childhood but rose notably through adolescence and early adulthood, with peaks occurring between 30 and 44 years. Out-migration for males remained lower than in-migration at most ages, though it showed a modest rise in adolescence and early adulthood. The male migration curve in Figure 6.1.1 reflects these patterns, with in-migration exceeding out-migration for most age groups and showing a pronounced mid-adult peak.

Female migration patterns showed a much more pronounced peak in young adulthood. In-migration rose sharply at ages 15–19 and reached its highest level at ages 20–24 (134.0 per 1,000), followed closely by high out-migration at the same age (115.6). This strong early adulthood rise in both directions is reflected clearly in Figure 6.1.2 and is characteristic of marriage-related mobility, which is the dominant driver of female migration in many rural areas. After age 30, female migration rates decreased substantially but remained slightly higher than male rates at most older ages, particularly 60–64 and 80–84 years, suggesting ongoing household or caregiving-related movements.

These findings show that migration in Zakiganj is strongly age- and sex-selective, with particularly high movement among young women in their reproductive years, reflecting patterns of marriage- and family-related mobility.

Table 6.1 Age and sex-specific migration rates (per 1,000 population) by direction in 2023 (Mid-year population)

Age (Years)	Both Sexes		Male		Female	
	In	Out	In	Out	In	Out
All Ages	38.3	33.0	26.4	21.0	50.0	44.7
0-4	0.4	25.1	0.5	26.5	0.3	23.7
5-9	37.2	22.7	36.6	22.7	37.8	22.6
10-14	29.1	23.5	29.1	21.7	29.0	25.4
15-19	54.8	49.3	20.8	18.9	86.5	77.6
20-24	82.0	68.1	27.7	18.7	134.0	115.6
25-29	52.0	45.9	31.8	22.3	71.5	68.9

Age (Years)	Both Sexes		Male		Female	
	In	Out	In	Out	In	Out
30-34	38.1	34.3	33.8	27.3	42.1	41.0
35-39	32.0	30.4	35.1	25.6	28.9	35.0
40-44	38.9	21.2	42.5	20.4	35.6	21.9
45-49	24.1	17.0	25.0	18.3	23.3	15.9
50-54	25.5	16.1	24.9	14.9	26.2	17.2
55-59	19.7	16.0	20.7	13.0	18.7	18.9
60-64	36.6	16.9	29.0	15.2	44.9	18.8
65-69	26.7	15.1	23.4	15.1	30.3	15.2
70-74	18.7	13.6	15.8	12.8	21.7	14.5
75-79	12.8	17.2	11.9	11.9	13.7	22.8
80-84	24.8	9.9	12.1	10.1	37.0	9.7
85+	22.0	11.0	9.7	7.3	32.1	14.1

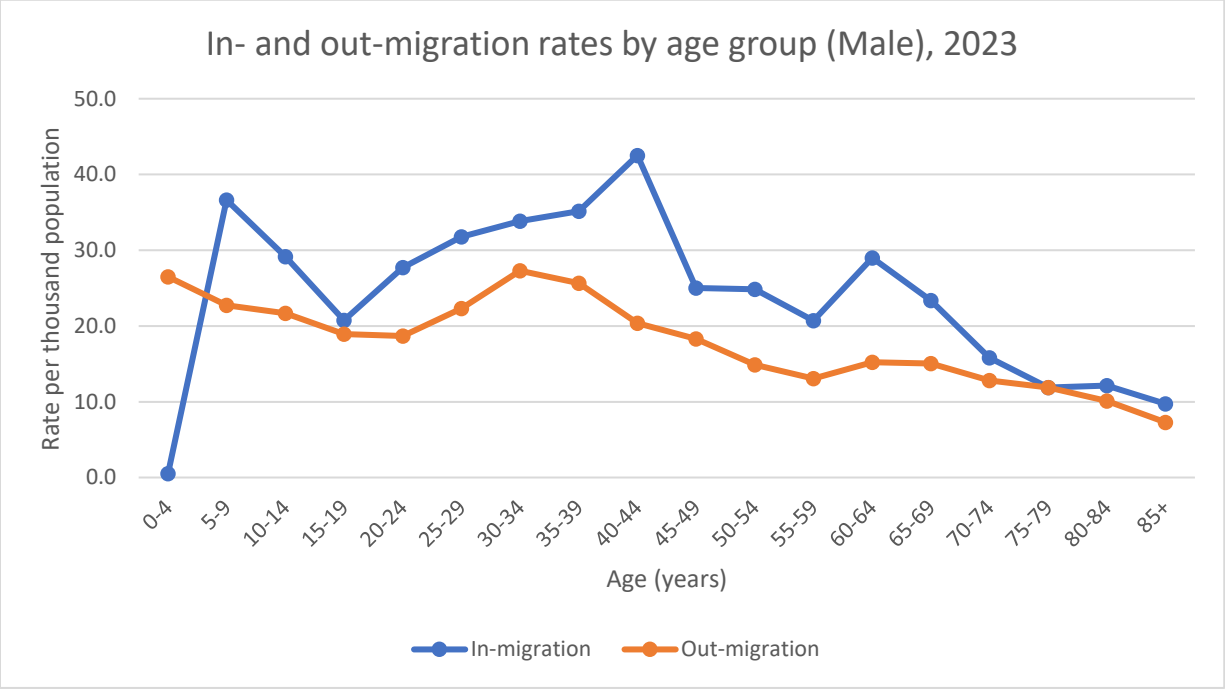

Figure 6.1.1: In- and out-migration rates by age group for males in 2023

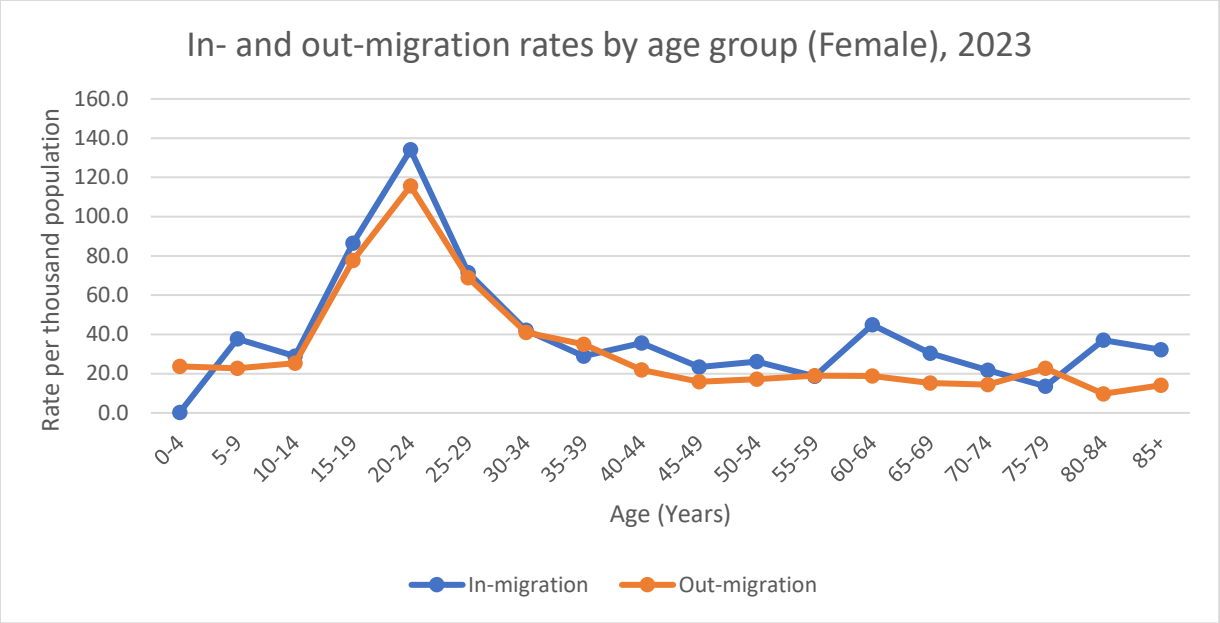

Figure 6.1.2 In- and out-migration rates by age group for females in 2023

6.2. Migration by Month

Table 6.2 presents the number of in- and out-migrations in 2023, disaggregated by sex and month. The migration data for 2023 show that 8,676 people moved into the surveillance area, while 7,476 people moved out, resulting in a net population gain over the year. Female migration dominated in both directions: 5,733 female in-migrations compared with 2,943 male in-migrations, and 5,132 female out-migrations compared with 2,344 among males. This pattern reinforces the broader finding that women experience higher overall mobility, especially during early and mid-adulthood.

Seasonal variation in migration is clearly visible. January stands out as the peak month for out-migration, with 2,531 departures, of which more than 60 percent were females. This sharp surge suggests a strong seasonal driver, likely linked to marriage transfers, household restructuring after the new year, or the end of school or work cycles. In contrast, in-migration during January was relatively low at 263, creating the largest monthly net loss.

In-migration increased steadily through the year and reached its highest levels between August and October. The largest inflows occurred in August (420), September (420), and October (411), with females consistently contributing the majority. Out-migration during these months was comparatively modest, creating a net influx of population. Mid-year months such as May (214 in-migrations) and June (153 in-migrations) showed the lowest inflow, coinciding with moderate levels of out-migration.

The male-specific trends in Figure 6.2.1 show a pronounced January spike in out-migration, when nearly 1,000 men left the area, far exceeding male in-migration. Male in-migration rose later in the year, peaking in September and October. Female trends in Figure 6.2.2 display an even stronger pattern: January saw more than 1,500 female departures, while in-migration reached its highest

levels during August to October. Female mobility was consistently higher throughout the year, both in inflow and outflow.

Taken together, Table 6.2 and the figures demonstrate that migration in this population is shaped by both seasonality and gender-specific life events. Female migration peaks strongly around marriageable ages and at the start of the year, while male migration is more consistent but shows notable increases in later months.

Table 6.2 Number of in- and out-migrations by sex and month in 2023

Month	In-Migration			Out-Migration		
	Both Sexes	Male	Female	Both Sexes	Male	Female
All Months	8676	2943	5733	7476	2344	5132
January	263	132	349	2531	963	1568
February	291	174	404	469	134	335
March	250	138	373	479	118	361
April	342	136	451	385	112	273
May	214	77	259	446	139	307
June	153	103	226	513	160	353
July	223	111	282	453	83	370
August	420	369	685	426	119	307
September	420	401	723	558	179	379
October	411	436	681	487	126	361
November	382	478	682	394	116	278
December	357	388	618	335	95	240

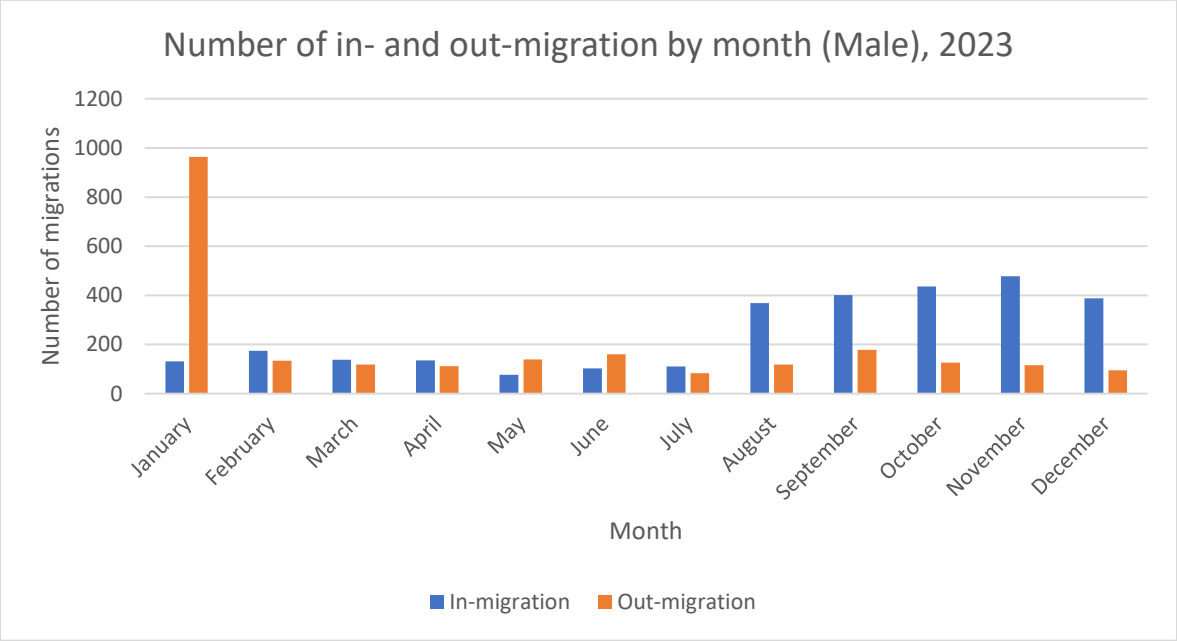

Figure 6.2.1 Number of in- and out-migration by month for males in 2023

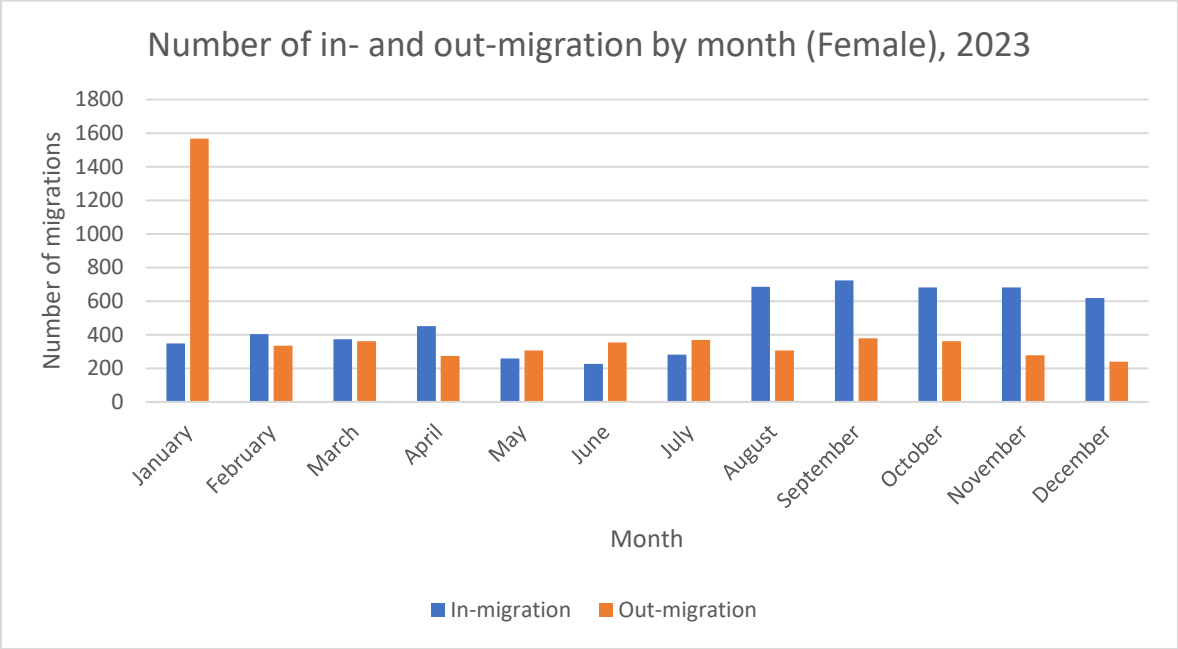

Figure 6.2.2 Number of in- and out-migration by month for females in 2023

Reference

1. *Bangladesh Demographic and Health Survey 2022 - Key Indicators Report*. 2023, National Institute of Population Research and Training Medical Education and Family Welfare Division Ministry of Health and Family Welfare, Dhaka, Bangladesh; The DHS Program, ICF, Rockville, Maryland, USA.
2. World Health Organization, *Monitoring emergency obstetric care: a handbook. Geneva: WHO Press.* 2009.
3. National Institute of Population Research and Training (NIPORT), M.a.A.M., and ORC Macro (ORCM): Dhaka, Bangladesh and Calverton, Maryland [USA], *Bangladesh Demographic and Health Survey 1999-2000.* 2001.
4. National Institute of Population Research and Training (NIPORT), O.M., Johns Hopkins University and ICDDR,B., *Bangladesh Maternal Health Services and Maternal Mortality Survey 2001.* 2003.

Annex-1: Important definitions

Division, District and sub-District: Bangladesh is divided into eight major administrative regions known as division and each division is further administratively divided into a number of districts. Total number of districts in Bangladesh is 64 with an average population size ~2,500,000.
Each district in Bangladesh is further divided into a number of sub-districts with an average population size of 251,000. The Projahnmo surveillance site is located in two sub-districts in Sylhet district with a population size of ~503,114.

Union: A union is the smallest administrative unit in Bangladesh with an average population size of 35,000. There are 18 unions in Projahnmo surveillance site.

Village: Village is a naturally formed area of habitation in rural areas of Bangladesh with well-defined boundary. Population size of village is highly variable. Though we tried to keep the village structures same as it was but for smooth field operation purposes we divided large villages based on population size. Average population of a village is ~1,500 in Projahnmo area. There are 583 operational villages in Projahnmo surveillance area.

Cluster: Cluster is project defined geographic areas assigned to a CHW to conduct surveillance and study related activities including collection of study specific data. The cluster size varies depending on the nature of the study but surveillance data is collected through home visits once every 2 months.

Block: One cluster is divided in smaller areas of approximately 60 households. Each small area is called block and a CHW is expected collect surveillance data from a block in a day.

***Bari*:** *Bari* is a naturally occurring group of adjacent households usually around a common courtyard and having a common connecting road to the main road. Each *bari* is known by a name.

Household: A household is defined as a person or group of persons who usually live together in the same dwelling unit(s), who have common cooking and eating arrangements, and who acknowledge one adult member as head of the household. For Projahnmo surveillance we actually count household with at least one MWRA (Married Women of Reproductive Age).
New HH:
New HH can be formed in two ways:

1. Separation of group of people from one existing HH/Splitting of Existing HH: Such HH updated in Projahnmo surveillance system without any waiting period as members of such HH are already in Projahnmo surveillance system.
2. Building of new HH: For a totally new HH CHW observe for 6 months to register in Projahnmo surveillance system

Household head:
Household head is usually a senior member of a household who is treated as the primary decision maker of the household by all members and usually lives in the household. The head may be the main earner of the household or one respected person in the family.

Household membership:
Persons who usually live and eat together are members of a HH.

Criteria for new HH membership:

1. If a person moves to an existing HH, s/he is observed for six months. If the person lives in the HH for 6 months then s/he is listed as a member of the household
2. There are two exceptions to this rule:
    a. If a person comes to a household by marriage with a household member then s/he will be registered immediately as a household member.
    b. Newborn child of a registered household member will be registered as a household member immediately

Married Woman of Reproductive Age (MWRA): A MWRA is a woman who is 13-49 years old and currently married. An MWRA must be a household member in the surveillance areas to be included in the Projahnmo surveillance database.
However, if a MWRA does not qualify to be a household members but eligible for a particular study may be enrolled in the study but not included in the surveillance data system.

Internal movement: Any movement between two surveillance HHs.
Examples:

1. One HH to another HH within the same cluster (HH splitting)
2. One Cluster to another cluster within Surveillance area

Migration: Migration is the movement for more than six months of a person from/to surveillance area

Migration-in: When a new person joins in any household of surveillance area from non-surveillance area and lives at least for six months.

Migration-out: When a HH member moves out of the surveillance area and doesn't come back within six months

Last Menstrual Period (LMP): The date of the first day of the most recent menstruating period of a woman is the date of LMP.

Expected Date of Delivery (EDD): Expected date of delivery is calculated by adding 280 days (9 solar calendar months and 10 days) to the LMP date.

Annex-2: Surveillance Procedures (Details)

Initial mapping, listing, and periodic census

- Baseline mapping and census conducted in 2002 across Zakiganj, Kanaighat, and Beanibazar.
- Updates completed in 2007, 2009, and 2016.
- All villages, baris, health facilities, and landmarks geo-referenced using GPS, data stored on secured servers.
- Ongoing GIS updates during routine surveillance.
- Data from large Projahnmo studies used to improve and enrich the database.

Ongoing surveillance procedure

- Surveillance area divided into **16 clusters**, each covering ~14,000–15,000 people.
- Each cluster is subdivided into **blocks of ~60 households**.
    - Each CHW covers ~40 blocks; one block is visited per day.
- All households are visited every **two months** following a structured "block visit schedule."
    - The schedule rotates blocks in a crisscross pattern (e.g., 1, 11, 21, 31, 2, 12, etc.) to ensure CHWs cover all parts of the community evenly.
    - CHWs collect data on new pregnancies, pregnancy outcomes, births, deaths, and migrations.
    - "Follow-up days" are built in to cover any missed visits due to emergencies.

Appendix 3: Data Collection Details

- **Visit schedule:** CHWs follow a structured "block visit" system to ensure complete household coverage every two months.
- **Data capture:** Transitioned from registers/paper forms to Android tablets in 2022, streamlining data quality and transfer.
- **Respondents:** A responsible adult provides general household information; MWRA and pregnant women are directly interviewed for reproductive health data.

Types of Data Collected (Table X3)

Health and Demographic Indicators	**Information**
Household	Name of the household head, Household ID, GIS coordinates, source of drinking water, type of sanitation, construction materials of dwelling house, asset ownership, religion, electricity connection
Household Member	Name, sex, date of birth, education, marital status
Birth	Date of Birth, place of birth, sex of the newborn, birthweight, link to mother's and father's ID, type of birth attendant, mode of delivery, ANC visits during pregnancy
Death	Date of death, place of death, cause of death, for females' death during pregnancy, childbirth, or postpartum period
Pregnancy	1st day of Last Menstrual Period (LMP), Expected Date of Delivery (EDD), pregnancy outcome
In-migration	Date of in-migration, reason for in-migration
Out-migration	Date of out-migration, reason for out-migration

Socioeconomic Status (SES):

- Measured at baseline and updated annually.
- Assessed using principal component analysis (PCA) of household assets, housing materials, water source, and sanitation type.

Appendix 4: Quality Assurance and Data Management (Details)

Training and Supervision

- New CHWs receive 5 days of basic training and 1 week of practical field training.
- 3 Field Research Assistants supervise 16 CHWs, with spot checks of key events (e.g., deaths, migrations).
- Oversight is provided by a Senior Field Research Officer, Zakiganj and Sylhet office leadership, and investigators from Dhaka and Johns Hopkins University.

Electronic Data Capture and Validation

- Android tablets used since 2022 with built-in range, cut-point, and consistency checks.
- Double entry for key dates and measurements (e.g., delivery date, LMP, respiratory rate).
- Real-time dashboard and reporting system provides graphical summaries and tables for monitoring.

Database Management

- Longitudinal relational database stores births, deaths, marriages, divorces, and migrations, with linkages to parents and household heads.
- Data transferred electronically from tablets to central PRF server.
- Automated checks and computer routines correct coding errors, out-of-range values, or inconsistencies.
- Database maintained on Windows and Android platforms with SQL Server backend, hosted at PRF Sylhet office.
- Database updated continuously and finalized after each round.

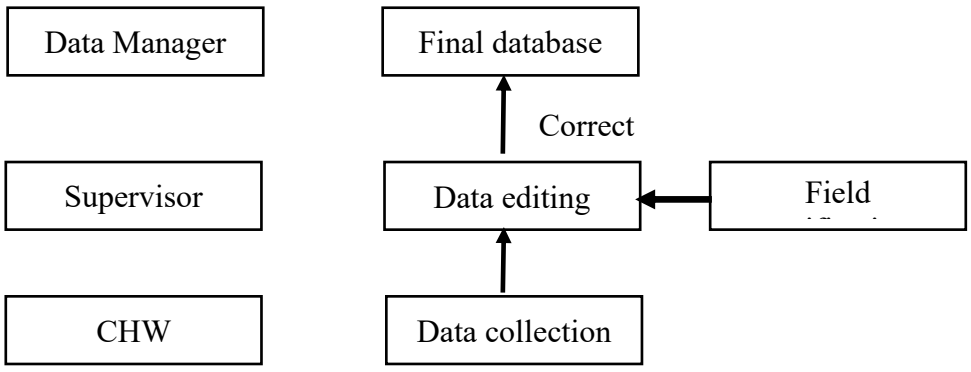

Figure X4.1 Data Flow Chart