

**FINAL REPORT**

**ALTERNATE METHODS OF MATERNAL MORTALITY  
RATIO ESTIMATION**

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## Abbreviations

AFMR	Adult Female Mortality Rate
BMMS	Bangladesh Maternal Mortality Survey
CC	Community Clinics
CHCP	Community Healthcare Providers
CoD	Cause of Death
DHIS-2	District Health Information System-2
FWA	Family Welfare Assistants
FWC	Family Welfare Center
GoB	Government of Bangladesh
HA	Health Assistants
IMCCoD	International Medical Certificate of Cause of Death
MCWC	
MDG	Millennium Development Goals
MMR	Maternal Mortality Ratio
MPDSR	Maternal and Perinatal Death Surveillance and Response
SDG	Sustainable Development Goal
UFPO	Upazila Family Planning Officer
UHC	Upazila Health Complex
UH&FPO	Upazila Health and Family Planning Officer
UH&FWC	Upazila Health and Family Welfare Center
VA	Verbal Autopsy

## **BACKGROUND**

The Sustainable Development Goal (SDG) targets reducing the global maternal mortality ratio (MMR) to less than 70 per 100,000 live births. In Bangladesh, despite incredible achievements during the Millennium Development Goals (MDG) era, this reduction in maternal mortality remains a critical concern. Bangladesh was committed to achieve the target of MDG goal 5 to reduce the maternal mortality ratio to 143 deaths per 100,000 live birth by 2015. Unfortunately, according to the Bangladesh Maternal Mortality Survey (BMMS) 2016, the national MMR has remained at 196 per 100,000 live births since 2010 (1). Statistic shows 14 mothers die every day due to complications of pregnancy and childbirth in the country (2). Post MDG era, progress towards achieving the SDGs demand sustained, foresighted commitments backed by smart, evidence-driven, strategic planning. An expeditious 5.5% annual reduction in MMR is required, an ambitious, however achievable target to reach the SDGs.

Currently, national mortality estimates are survey-dependent (3). With rapid reduction in mortality, maternal death is a relatively rare event, requiring a large sample to be covered to monitor mortality ratios. BMMS 2016 covered approximately 300,000 households to estimate maternal mortality in the country and is anticipated to be the last survey of its kind (1). Additionally, as these surveys are conducted at intervals of three to five years, by the time data is available, it becomes backdated, leading to retrospective evidence-based policy decisions.

Conventional surveillance systems are expensive and logistically challenging. Underreporting is frequent, with most deaths occurring outside of the health system. Thus, there is a growing need for alternative methods for measuring maternal mortality. Reduction in mortality also calls for the need to collect disaggregated real-time data to be able to identify the pockets of low performance. Such data will allow for better resource utilization and implementation of specialized programs in the low-performing or hard-to-reach areas.

## **RATIONALE**

This study focuses on measuring the numerator for estimating adult female mortality rate and maternal mortality ratio. We aimed to identify sources of total number of adult female deaths and maternal deaths, using the most effective sources of information within the routine health system.

Data capturing systems in Bangladesh have undergone significant reforms over the last two decades. A concerted effort was made for ensuring data availability to track progress towards the MDGs. In response to the global need for reporting health and relevant data for measuring progress towards the SDGs, the Government of Bangladesh (GoB) has highlighted the importance of a well-functioning vital events registration system to capture all births and deaths nationally. The most accurate source of information identified through this work may eventually be incorporated into the national vital events registration system and utilized for national and sub-national mortality estimation

## OBJECTIVES

This study was designed to address the following general and specific research objectives:

**General Objective:** To assess all possible sources of routine data for adult female and maternal death.

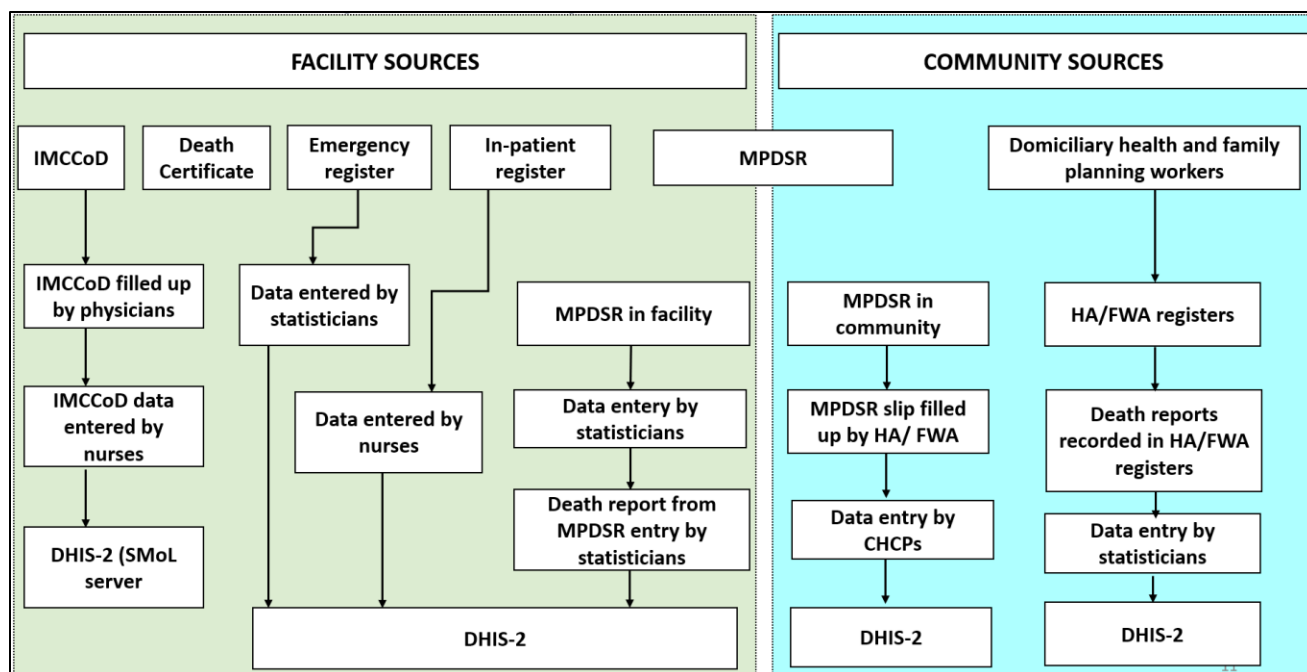
**Specific Objectives:**

- Obj-1: To explore the sources (facility & community) of routine data for adult female and maternal deaths
- Obj-2: To estimate the numbers of adult female deaths and maternal deaths reported from routine sources
- Obj-3: To assess duplication in reporting of deaths from these sources
- Obj-4: To explore the proportion of actual deaths occurring in the population through routine sources
- Obj-5: To identify the cause of death of each reported adult female death through Verbal Autopsy (VA)

## DESCRIPTION OF NATIONAL ROUTINE HEALTH INFORMATION SYSTEM

In the current health system of Bangladesh, two of the main sources of adult female death data are Directorate General of Health Services (DGHS) and Directorate General of Family Planning Services (DGFP) under the Ministry of Health and Family Welfare (MoH&FW). Both DGFP and DGHS are implementing authorities under MoH&FW with community and facility health workforce and infrastructure. At the community level, the routine sources of information are the domiciliary health and family planning workers – Health Assistants (HAs) and Family Welfare Assistants (FWAs). In the health facilities several mechanisms are in place to capture and report death data.

A brief description of community and facility death data source is provided below (Figure 1).



**Figure 1: Facility and Community data sources**

**Community routine sources:**

In the community, death reports channelled through the following mechanisms:

1. Maternal and Perinatal Death Surveillance and Response (MPDSR)
2. HA-Reporting form/ Registers
3. FWA-ELCO Register (Form-12 & 13)

**MPDSR slip:** The MPDSR community death report is a system where a designated HA/FWA provides death reports of their catchment area through a brief form (known as MPDSR slip). The MPDSR slips contain identification information, address and probable CoD of the deceased. Each death report slip is filled by HA/FWA and entered into the national District Health Information System-2 (DHIS-2) by the Community Healthcare Providers (CHCPs) located at the Community Clinics (CCs). One part is sent to the statistician at Upazila Health Complex (UHC) which is a primary level public healthcare facility.

**HA-Reporting form/ Registers:** HAs do not have a prescribed reporting form. They maintain their own registers and collect a set of information on a regular basis. The HA reports contains basic identification information and address of the deceased with a probable Cause of Death (CoD) written briefly. The probable CoD is collected from family members.

**FWA-ELCO Register (12 & 13):** The existing government routine health information system require FWAs to register pregnancies in their catchment area and report the outcomes. The FWA



reports contain basic identification information and address of the deceased with a probable CoD written briefly. The probable CoD is collected from family members.

**Facility routine sources:**

The mechanisms to report death information in public health facilities under DGHS and DGFP and all private health facilities are summarized in Table 1. The public facilities under DGHS have a tier system of primary (Upazilla Health Complex-UHC), secondary (District Hospitals -DH), tertiary (Medical College Hospitals -MCH) and specialized health facilities. The DGFP has Maternal and Child Welfare centers (MCWC), Union Health and Family Welfare Centers (UH&FWC) etc.

In public facilities, sources of death reports are - International Medical Certificate of Cause of Death (IMCCoD), old death certificate form (form 804), MPDSR slip, facility registers i.e.- inpatient register and emergency register. Depending on the type of facility (public or private), the data sources may vary. Public facilities report deaths through IMCCoD. They also have their own facility registers and maintain “brought dead” reports.

**Table 1: Sources of death data from health facilities**

<b>Public facilities</b>	<b>Private facilities</b>
IMCCoD	IMCCoD
Old death certificate	Facility register (private health facilities)
Facility register (UHC, DH, MCH, MCWC, UH&FWC)	Brought dead reports
MPDSR Slip	
Brought dead reports	

\*IMCCoD=International Certification of Cause of Death; MPDSR= Maternal Perinatal Death Surveillance and Review; UHC= Upazilla Health Complex; DH= District Hospital; MCH= Medical College Hospitals; MCWC= Maternal and Child Welfare Centers; UH&FWC =Union Health and Family Welfare Centers

**IMCCoD:** It is a standard organized form to report CoD and administrative information; meant to replace the old death certificate form. IMCCoD was introduced by government of Bangladesh in 2017 through initiative of Bloomberg philanthropies and currently ongoing in 26 low and middle income countries. The administrative part of the IMCCoD form served as the source of death reports; it contains basic identification information of the deceased along with the date, time and place of death. The lower portion is relevant to CoD identification and recording sequence of CoD with time/ duration. The IMCCoD form is filled up by on duty physician and entered in the national District Health Information System-2 by nurse and/or statistician of the facility.

**Old Death Certificate:** This form contains basic identification information of the deceased along with an open section for the physicians to write the CoD with any observation. The form is filled out by on duty physician and stored by the nursing-in-charge of the hospital ward.

**Facility Register:** Deaths are usually recorded in the register copy of respective facilities which is also a source of death reports. The death reports are entered by the nurses along with the CoD identified by the on duty physician and stored with the nursing-in-charge of the hospital ward.

**MPDSR Slip:** Similar to the community MPDSR, death report slips filled up by nurses serve as a source of death report from facilities where MPDSR is being implemented.

**MCWC and FWC/UH&FWC Registers:** Death reports from facilities under the family planning wing were collected through existing MCWC/ FWC/UH&FWC registers.

**Brought Dead:** The emergency department of the facilities maintains a register for patients who were found dead upon arrival- “brought dead”. These deaths are not reported through other registers or death certificates.

## METHODS AND MATERIALS

### Study Site:

This study was conducted in Sakhipur and Ullahpara sub-districts of Tangail and Sirajganj districts respectively. The study areas were selected based on relatively well-established routine birth and death identification systems. One Upazila was selected closer to the capital city- Dhaka, another Upazila was more distant in the aim to see if there was any difference in death reporting closer to the capital. Ullahpara Upazila nearly had double the population of Sakhipur Upazila. Figure 1 below identifies the two upazilas

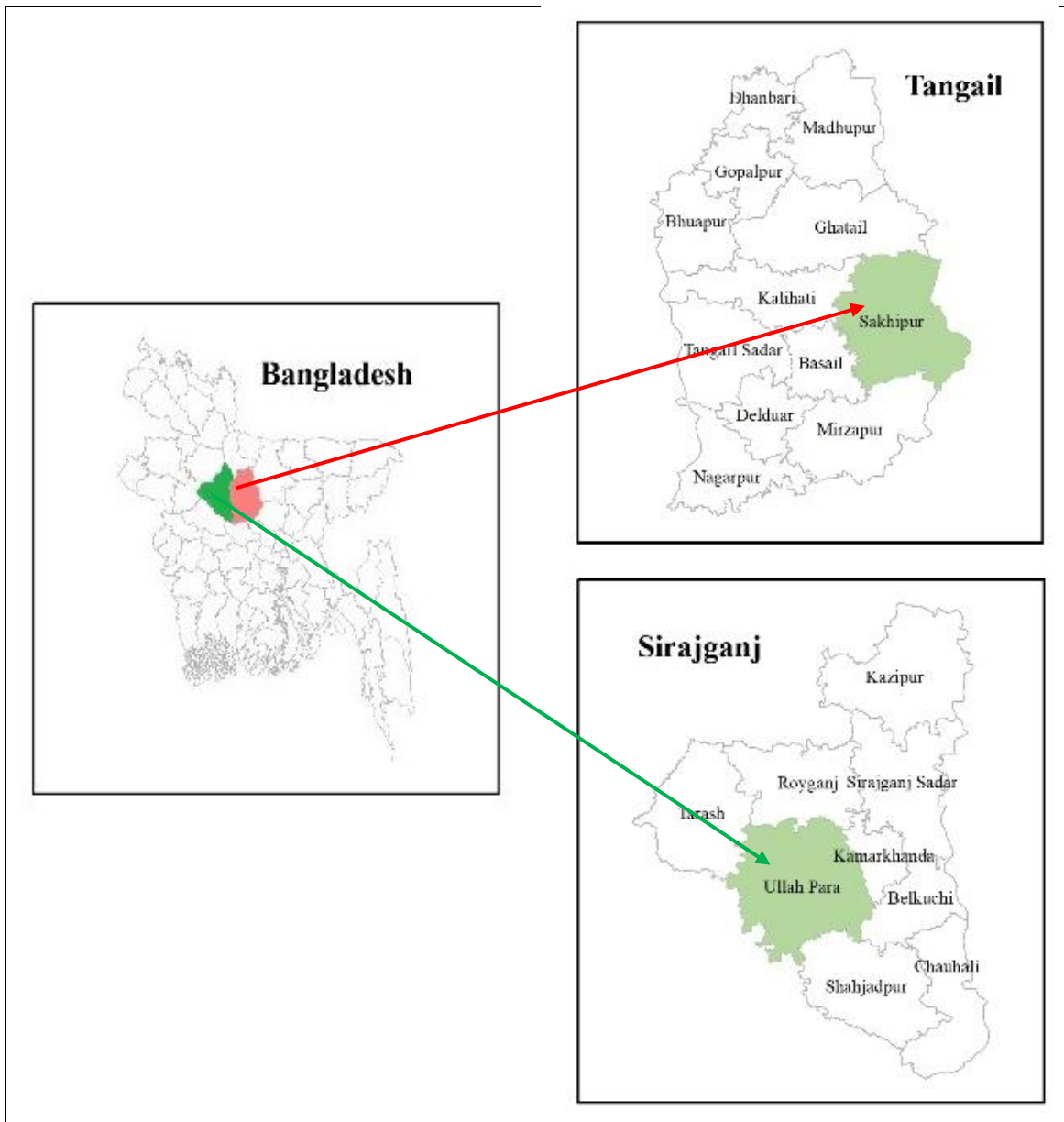


Figure 2: Study sites- Sakhipur and Ullahpara Upazila

### **Adult female death data source and data collection:**

The information on adult female deaths was collected from both the community and the facilities from all the possible sources mentioned in the previous section.

From community- List of all domiciliary health and family planning workers working in the study areas was collected from Upazila Health and Family Planning Officer (UH&FPO) and Upazila Family Planning Officer (UFPO) of each Upazila. Upon discussion with UH&FPO, UFPO and civil surgeons of the respective sites, it was decided that data would be collected from HA register, FWA registers and MPDSR slips during monthly meetings.

Project recruited staff attended monthly meetings and collected death information from reports collected by HAs and FWAs. If data collection was not possible by regular meeting, they visited HA/FWAs individually to collect the data. Project core team researchers also attended monthly meetings of HA/FWA to monitor the quality of data collection process. All data they collected were sent to the central office including image of the data in each register. All the information were entered and stored in an electronic data collection platform as death reports.

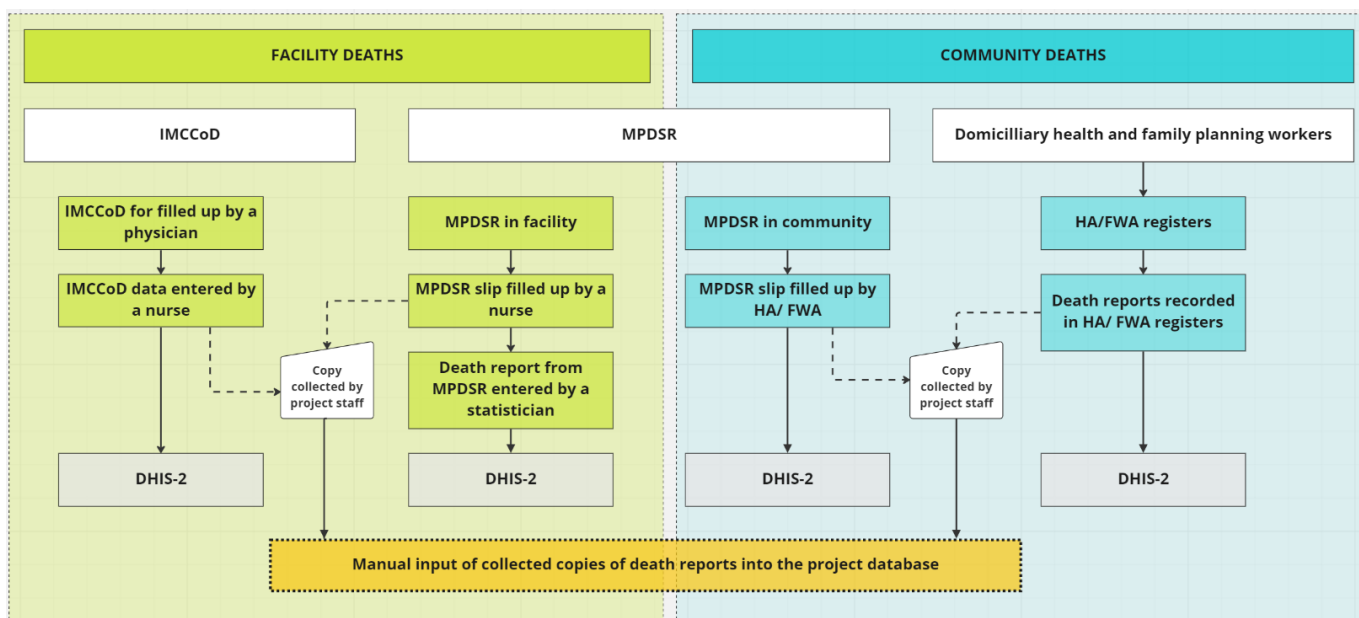
From health facilities- To capture complete information on adult female deaths in both public and private facilities, death reports were collected by project staff and copies were taken and entered into an electronic data collection system. The facilities were selected based on the presence of a maternity and female ward. The project staff conducted a situation analysis to identify all facilities that meet several specific criteria from the two Upazilas. We asked local gatekeepers and key informants regarding the frequently visited facilities outside the two Upazilas. The facilities from outside the study area where a high volume of female patients sought care for pregnancy and maternity issues were selected. All public and private facilities within and outside the study areas were included for death report collection. These included Upazilas and District hospitals from adjacent facilities as well as high-volume private facilities. A total of 79 facilities were included, 36 in Tangail district and 43 in Sirajganj district; seven facilities were public, rest were private facilities (Table 2). All facilities are listed in Annex 01. Project staff collected the data by paying multiple weekly visits (2-3 times a week) to each facility.

As a part of this study, the study team provided technical assistance to the DGHS to introduce IMCCoD in Tangail and Sirajgonj districts by training physicians, nurses and statisticians of health facilities. For this study, 473 physicians both from private (326) and public (147) facilities were trained. We also trained 74 nurses and statisticians from public (28) and private (46) facilities. Further details of these trainings by facility is described in Annex 02.

**Table 2: Number of facility by facility type and area distribution**

	Public Facility	Private Facility	Total
Inside Sakhipur	1	6	7
Outside Sakhipur	1	28	29
Inside Ullahpara	2	9	11
Outside Ullahpara	3	29	32
<b>Total</b>	<b>7</b>	<b>72</b>	<b>79</b>

Additionally any information on any patient referred from the facilities were collected by the project staff. This was done to link any deceased later identified from the community who died during the commute either to another facility or home.



**Figure 3: Collection of death reports from routine sources**

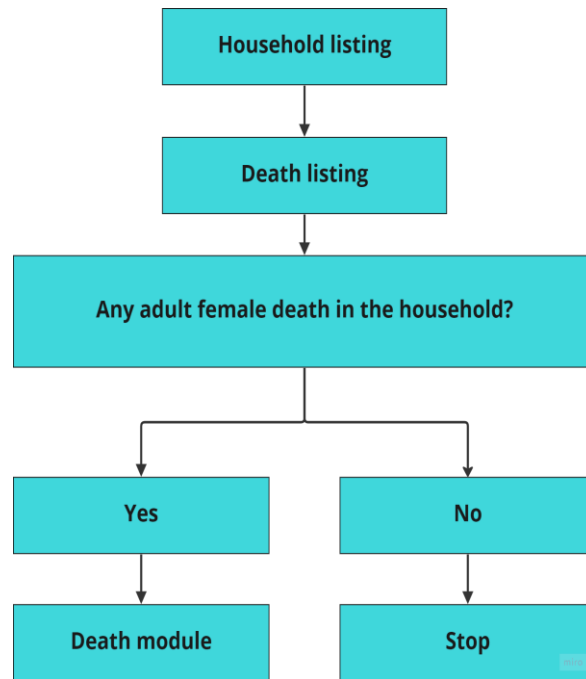
**Verification of extracted death data and identification of duplicates:**

Each reported death from all routine sources was confirmed by project staff through a household visit. These visits have been referred to as verification of death reports throughout the rest of the report. During the verification visits, the project recruited staff collected information on the name of the deceased, age of the deceased, husband’s name, father’s name, date of death, mobile number and household GPS. If a single death was reported from multiple sources, the household was visited multiple times. While additional information were collected during the first visit, individual death reports were matched with the previous reporting sources during the subsequent visit using

the household GPS. All these information were stored in the project database and were used to identify multiple records for the same person.

**Completeness of adult female death data assessment through census:**

At the end of the study period, a census was conducted to assess the completeness of routine sources of death reports. The census collected information on all deaths in the two upazilas covering the time period between January 2019 to Dec 2020. The project recruited and trained staff visited every household in the study area and collected death information of all household members including all adult females (age 13+). Apart from the death information the name, age, and sex of all individuals who currently live in the household were recorded. Some basic socio-economic characteristics were also collected from every household. Figure 4 below shows the process of data collection in the household census.

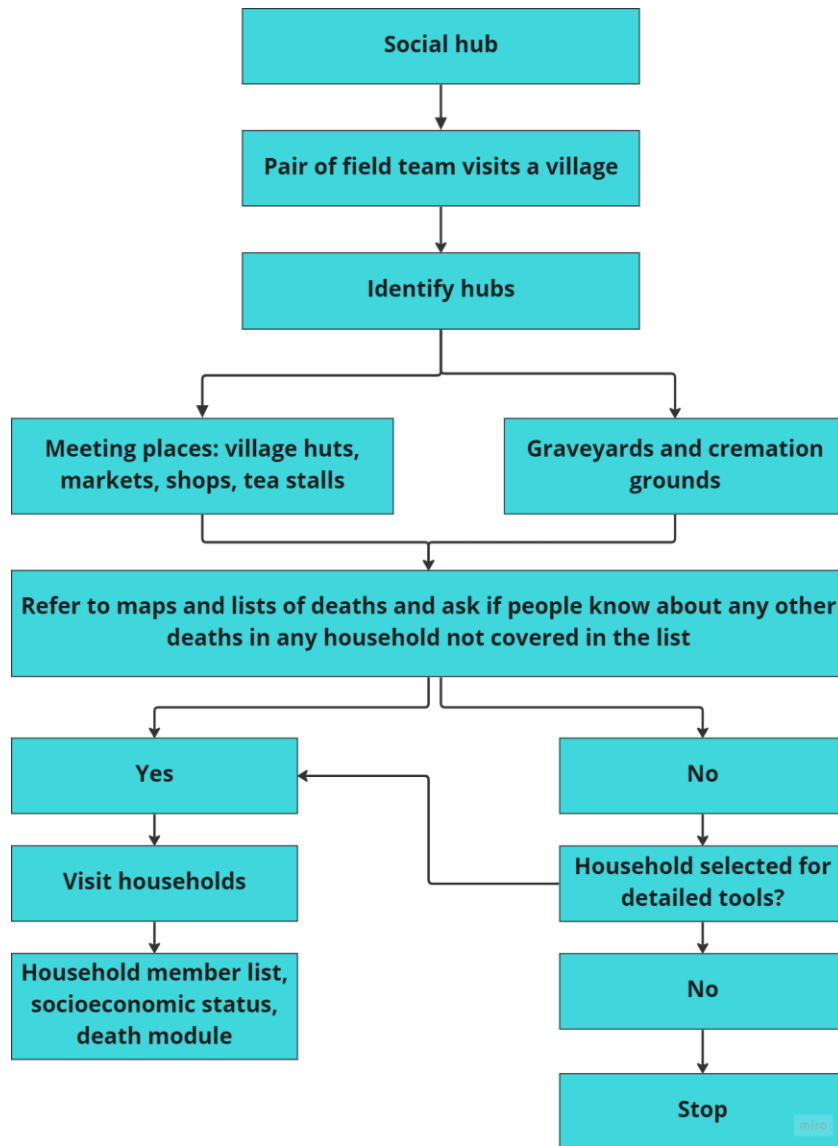


**Figure 4: Process of death identification through census**

Once complete, the census data was checked for gap identification. Repeat visits were carried out in selected areas at bari level and a social hub method was implemented in order to verify the existing list of deaths collected through the household visits and identify additional deaths.

At first, all HHs within a Bari was listed and death information for deaths between January 2019 – December 2021 were collected. All deaths were listed and HHs with adult female deaths (13+) were visited for detailed data collection

The second step followed the social hub method for identification of deaths. Two data collectors identified important meeting places within a village. Once that was done, they visited and talked to people in these points and shared the list of deaths and households where the deaths were identified. They then asked people about any additional deaths not included in the list. If any additional deaths were identified and reported, those households were visited and detailed data was collected. Figure 05 below shows the flow of how social hub method was implemented in selected study areas.



**Figure 5: Social hub method for death identification**

**Verbal autopsy to identify the cause of deaths:**

During census, if, at the time of death, the deceased person was a woman aged 13–49, a verbal autopsy was conducted at a later date with the household member who knew the most about the deceased person. The BMMS 2016 verbal autopsy questionnaire was used in this study. The VAs were conducted by project-recruited data collectors with prior experience and rigorous training. Algorithm (Incilico VA) based analyses to identify each Cause of Death (CoD) were implemented. CoD for maternal deaths identified from verbal autopsies were also analyzed.



## RESULTS

The background characteristics of the study population are provided below (Table 3). A total of 82,455 households in Sakhipur Upazila and 123,813 households in Ullahpara Upazila were covered during the census. In these households, we found 97,403 adult females (13 years and above) in Sakhipur and 2,06,265 adult females in Ullahpara. Sixty-six percent of women in Sakhipur and 65% in Ullahpara were reproductive-age women. During the study period, 1,526 and 1,783 adult females aged 13 years or more died in Sakhipur and Ullahpara respectively. Approximately 82% of women in Sakhipur and 76% in Ullahpara who died were aged 50 years or above.

**Table 3: Background characteristics of the population in the study areas**

Summary estimates	Sakhipur		Ullahpara	
	N	%	N	%
Number of HHs	82,455		123,813	
Total number of adult female	97,403		206,265	
Number of deceased adult females (2019-2020)	1,526		1,783	
Number of deceased reproductive-age women	280		350	
<b>Age distribution of adult females (in years)</b>				
13-19	14,139	14.5	29,606	14.4
20-24	10,766	11.1	22,220	10.8
25-29	10,801	11.1	23,735	11.5
30-34	8,529	8.8	19,905	9.7
35-39	9,833	10.1	20,044	9.7
40-44	6,063	6.2	11,297	5.5
45-49	4,163	4.3	7,598	3.7
50-65	25,087	25.8	56,173	27.2
66-80	5,066	5.2	9,324	4.5
81+	2,956	3.0	6,363	3.1
Total	97,403	100.0	206,265	100.0
<b>Age distribution of deceased women (in years)</b>				
<13	0	0.0	85	4.8
13-19	41	2.7	42	2.4
20-34	81	5.3	113	6.3
35-49	158	10.4	195	10.9
50-65	345	22.6	508	28.5
66-80	447	29.3	466	26.1
81+	454	29.8	374	21.0

Source: Household census

### Coverage of adult female deaths by routine information sources

Table 4 shows the number of adult female (age 13+) deaths and deaths among women of reproductive age (13-49 years) from routine information systems in the facilities and community. A total of 1424 unique adult female deaths and 292 unique death in reproductive-age women were reported from two Upazilas. In both cases, most of the deaths were reported from community sources.

In Sakhipur 79% of adult female deaths and 71% of reproductive-age women's death were reported from only community sources. In Ullahpara, the community notification number were more compared to Sakhipur. In adult females 95% and in women of reproductive age 92% deaths were reported by the community sources in Ullahpara.

Death notification from the facility sources was higher in Sakhipur compared to Ullahpara. In Sakhipur 18% of adult female deaths and 27% of deaths in reproductive-age women were reported by only facility sources. In Ullahpara the facility notification percentage was quite low (3% for adult female deaths and 4% for women of reproductive age deaths).

**Table 4: Coverage of adult female deaths from routine information system**

Routine source	Adult female (age 13+)				Women of reproductive age (13-49 y)			
	Sakhipur		Ullahpara		Sakhipur		Ullahpara	
	N	%	N	%	N	%	N	%
Only facility report	64	18.2	33	3.1	20	26.7	9	4.1
Only community report	277	78.7	1018	95.0	53	70.7	199	91.7
Both facility & community report	11	3.1	21	2.0	2	2.7	9	4.1
<b>Total</b>	<b>352</b>	<b>100.0</b>	<b>1072</b>	<b>100.0</b>	<b>75</b>	<b>100.0</b>	<b>217</b>	<b>100.0</b>

Table 5 presents the death notification by different sources. It shows that the number of facility notification were low and distribution was almost similar among the different sources. We did not observe any difference between the notification of adult female death and reproductive-age women's death.

Facility notification was lower in Ullahpara compared to Sakhipur. In Sakhipur 23% of death in adult females and 32% of death in women reproductive-age were reported from the facility sources. Whereas in Ullahpara only 5% and 8% death of adult females and women reproductive-age were reported from facilities. While comparing the death reports sources within the facility by Upazila, we found that the in-patient register was better maintained in Ullahpara compared to Sakhipur. In Ullahara, 48% of death in adult females and 42% of deaths in women of reproductive-

age were reported. In comparison, 30% of death in adult females and 32% of deaths in women of reproductive-age were reported in Sakhipur. We observed quite the opposite scenario in case of IMCCoD forms. IMCCoD reports were better in Sakhipur compared to Ullahpara. In Sakhipur, IMCCoD form was fill-up for 37% of the adult females and 36% for the of women of reproductive age. In Ullahpara, IMCCoD form was filled up for 28% and 25% of the adult female and women of reproductive age respectively.

Among the community sources, the HA register reported a higher number of deaths while community MPDSR had the lowest number of reports in both Upazilas. Overall the FWA notification was higher in Ullahpara compared to Sakhipur.

Among the adult female deaths, 74% in Sakhipur and 51% in Ullahpara were reported by HAs. Whereas, FWA reported 26% of the adult female death in Sakhipur and almost half (48%) of the deaths in Ullahpara. While death notification of women of reproductive-age was considered, 69% and 52% were reported by HAs in Sakhipur and Ullahpara respectively. The FWA reporting was higher in Ullahpara compared to Sakhipur (28% in Sakhipur vs 45% in Ullahpara).

**Table 5: Number of notifications by routine source and place**

Routine source	Adult female (age 13+)				Women of reproductive age (13-49 y)			
	Sakhipur		Ullahpara		Sakhipur		Ullahpara	
	N	%	N	%	N	%	N	%
Total facility report	100	23.4	71	5.2	28	31.5	24	8.4
In-patient register	30	30.0	34	47.9	9	32.1	10	41.7
Emergency register	33	33.0	17	23.9	9	32.1	8	33.3
IMCCoD	37	37.0	20	28.2	10	35.7	6	25.0
Total community report	328	76.6	1296	94.8	61	68.5	262	91.6
FWA Register-13	84	25.6	621	47.9	17	27.9	119	45.4
HA Register	241	73.5	665	51.3	42	68.9	135	51.5
MPDSR Community	3	0.9	10	0.8	2	3.3	8	3.1
<b>Total report</b>	<b>428</b>	<b>100</b>	<b>1367</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>286</b>	<b>100</b>

Table 6 presents the number of times each death was reported by different sources. It shows that the number of multiple notifications was higher in Ullahpara compared to Sakhipur.

In adult females, 81% of deaths were reported only once in Sakhipur, while 17% were reported twice and 2% were reported three times. In Ullahpara, 74% of deaths were reported once and 25% were reported twice. In both Upazila, only one death has been reported a maximum of four times.

We observed almost a similar scenario in death report of women of reproductive-age. Eighty-four percent of the deaths in Sakhipur and 70% of deaths in Ullahpara were reported only once. Approximety, 13% of deaths in Sakhipur and 28% of deaths in Ullahpara were reported twice. Only 3% and 2% of deaths were reported three times in Sakhipur and Ullahpara respectively.

**Table 6 Number of times death reported by different sources**

Number of times death reported	Adult female (age 13+)				Women of reproductive age (13-49)			
	Sakhipur		Ullahpara		Sakhipur		Ullahpara	
	N	%	N	%	N	%	N	%
1	284	80.7	790	73.7	63	84.0	152	70.0
2	61	17.3	270	25.2	10	13.3	61	28.1
3	6	1.7	11	1.0	2	2.7	4	1.8
4	1	0.3	1	0.1				
<b>Total</b>	<b>352</b>	<b>100</b>	<b>1072</b>	<b>100</b>	<b>75</b>	<b>100.0</b>	<b>217</b>	<b>100.0</b>

### **Deaths identified in Census vs Routine sources**

This section reports the number of deaths in adult females and women of reproductive-age reported by community and facility sources and by Upazilla in comparison to census data.

Table 7 shows that a total of 3,309 adult female deaths were recorded from the census (1,526 from Sakhipur and 1,783 from Ullahpara). Only 1,424 (43%) unique deaths were reported from routine sources. The proportion of adult female death reported by the routine sources was higher in Ullahpara compared to Sakhipur (60% from Ullahpara and 23% from Sakhipur). The highest number of death was reported from routine community sources (18% in Sakhipur and 57% in Ullahpara) followed by the facility sources (4% in Sakhipur and 2% in Ullahpara). Only 1% of deaths in both Upazilla were reported from both facility and community sources.

When considering the women of reproductive age, 630 deaths were recorded from the census (280 from Sakhipur and 350 from Ullahpara). Approximately 46% of these deaths were reported from

routine sources. Similar to the adult female deaths, more deaths in women of reproductive-age were reported by the routine sources in Ullahpara compared to Sakhipur (62% vs 27%). The highest number of deaths were reported from the community sources (57% in Ullahpara and 19% in Sakhipur), followed by the facility sources (3% in Ullahpara and 7% in Sakhipur). Only 1% of deaths in Sakhipur and 3% in Ullahpara were also reported from both facility and community sources.

**Table 7 Coverage of adult female deaths by routine systems report**

All death (all ages)	Adult female (age 13+)				Women of reproductive age (13-49 y)			
	Sakhipur		Ullahpara		Sakhipur		Ullahpara	
	N	%	N	%	N	%	N	%
Female death recorded (2019 & 2020) from census	1,526	100%	1,783	100%	280	100%	350	100%
% of unique death reported by routine sources	352	23.1%	1,072	60.1%	75	26.8%	217	62.0%
% of unique death notified by routine facility sources	64	4.2%	33	1.9%	20	7.1%	9	2.6%
% of unique death notified by routine community sources	277	18.2%	1,018	57.1%	53	18.9%	199	56.9%
% of unique death notified by both routine facility & community sources	11	0.7%	21	1.2%	2	0.7%	9	2.6%

Table 8 provides a reflection on reported and not reported deaths by place of death. This information was extracted from the verbal autopsies conducted throughout the study for all deceased adult women. In Sakhipur among 277 deaths, 59.6% died within the upazilla and 37.5% died outside the upazila. Among the 165 deaths that occurred inside Sakhipur, 50 (30.3%) were reported by routine sources. Among the 104 deaths that occurred outside Sakhipur, 27 (26%) were reported by routine sources. In Ullahpara, among the 368 deaths, 64.4% were inside and 29.6% were outside Ullahpara. Among the 237 deaths that occurred inside Ullahpara, 157 (66.2%) were reported by routine sources. Among the 109 deaths that occurred outside Ullahpara, 64 (58.7%) were reported by routine sources. For eight women in Sakhipur and 22 women in Ullahpara, the place of death could not be identified from the verbal autopsy reports.

**Table 8 Number of deaths reported by place of death**

Census deaths (N=615) from VA										
	SAKHIPUR					ULLAHPARA				
ADULT FEMALE	Inside Sakhipur		Outside Sakhipur		Not known	Inside Ullahpara		Outside Ullahpara		Not known
Place of death	Reported from routine	Not reported from routine	Reported from routine	Not reported from routine		Reported from routine	Not reported from routine	Reported from routine	Not reported from routine	
Upazila total	277					368				
Total inside and outside upazila	165		104		8	237		109		22
Total by reporting source	50	115	27	77		157	80	64	45	
Community	38	97	0	28		135	63	2	16	
Public facility	9	8	16	34		6	4	47	16	
Private facility	1	2	9	9		9	2	10	11	
On the way	2	8	2	6		7	11	5	2	

### Cause of death distribution (CoD)

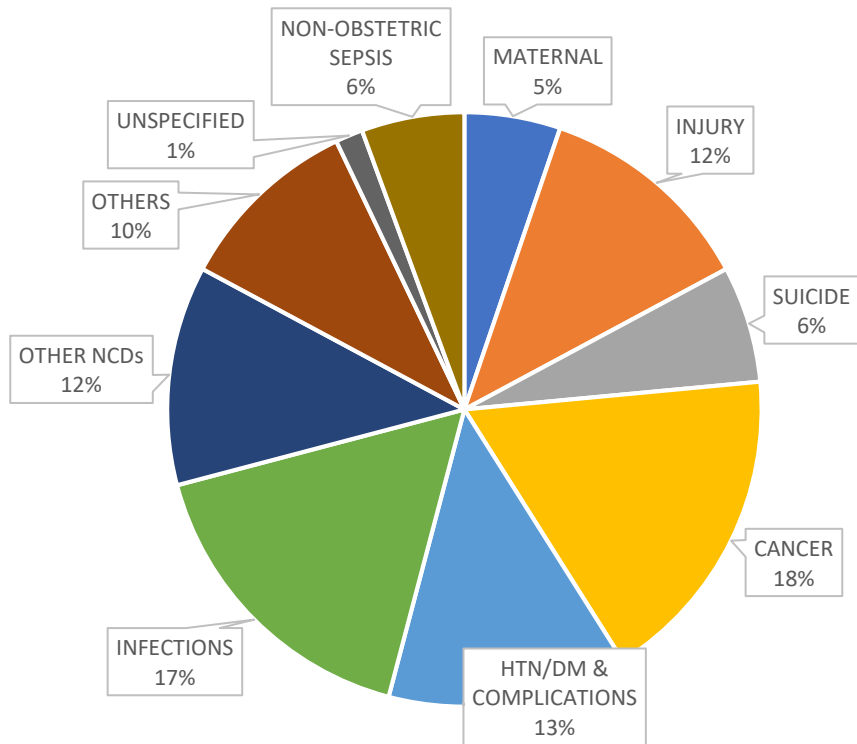
Among 645 adult female deaths of 13-49 years, 30 VAs could not be performed, hence we ended up with 615 complete VAs which were used for CoD determination; 268 from Sakhipur and 347 from Ullahpara.

### Distribution of causes of deaths in women of reproductive age

This study identified 615 deaths of women of reproductive age (13-49 years). Out of these 615 deaths, the cause of death could not be specified 1% women in both Upazillas. Among the women of reproductive age, 5% in Sakhipur and 10% in Ullahpara died due to maternal causes. Excluding the maternal deaths from both Upazilla (49 women), most women of the reproductive age group, died due to hypertension, diabetes and related complications and other NCDs in Ullahpara (25%) and in Sakhipur (26%). Different type of cancers and neoplasm killed 18% women in Sakhipur and 24% in Ullahpara. Different types of injuries including self-harm and assault caused 18% deaths in Sakhipur and 19% deaths in Ullahpara. Approximately 23% died of different infective causes including non-obstetric sepsis in Sakhipur and 13% died of same causes in Ullahpara. Around 7-10% of the women died due to other causes including anemia, malnutrition, liver and kidney diseases in both Upazillas (Figure 6).

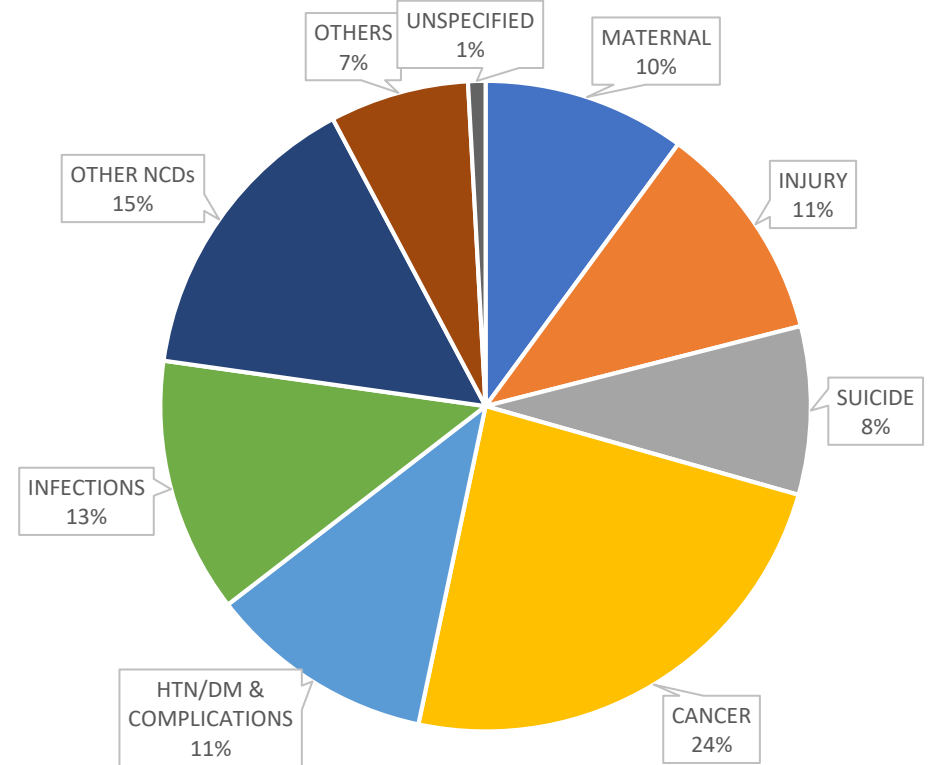
**Figure 6: Distribution of cause of deaths in women of reproductive age (n= 615)**

**Women of reproductive age (n=268)**



**Sakhipur**

**Women of reproductive age (n=347)**



**Ullahpara**

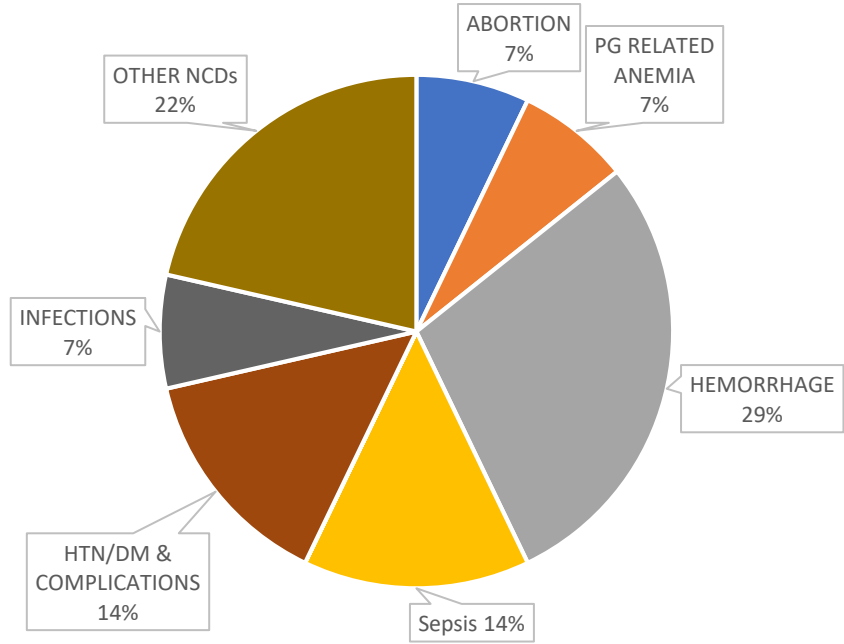
### Distribution of causes of maternal deaths in women of reproductive age (13-49 years)

Out of 615, the study identified 49 as maternal deaths. When causes of maternal deaths were explored, among the direct causes, hemorrhage was the most common cause of maternal death (19%; Sakhipur- 29% and Ullahpara- 14%), followed by eclampsia/ preeclampsia (6%; Ullahpara- 9% and none in Sakhipur), abortion (4%; Sakhipur-7% and Ullahpara- 3%) and sepsis (4%; Sakhipur- 14% and none in Ullahpara). Anemia, and ruptured uterus were among the other direct causes of maternal deaths (2%). Eighteen percent of the mothers (7% in Sakhipur and 23% in Ullahpara) died due other infections that includes malaria, HIV, acute respiratory infection etc. Approximately 45% of the mothers died of indirect causes. The most common indirect causes included hypertension, diabetes and related complications and other NCDs (36% in Sakhipur and 37% in Ullahpara). Eight percent died of different neoplasms (None in Sakhipur, 11% in ullahpara) (Figure 7).

**Figure 7 Distribution of causes of maternal deaths in women of reproductive age (n=49)**

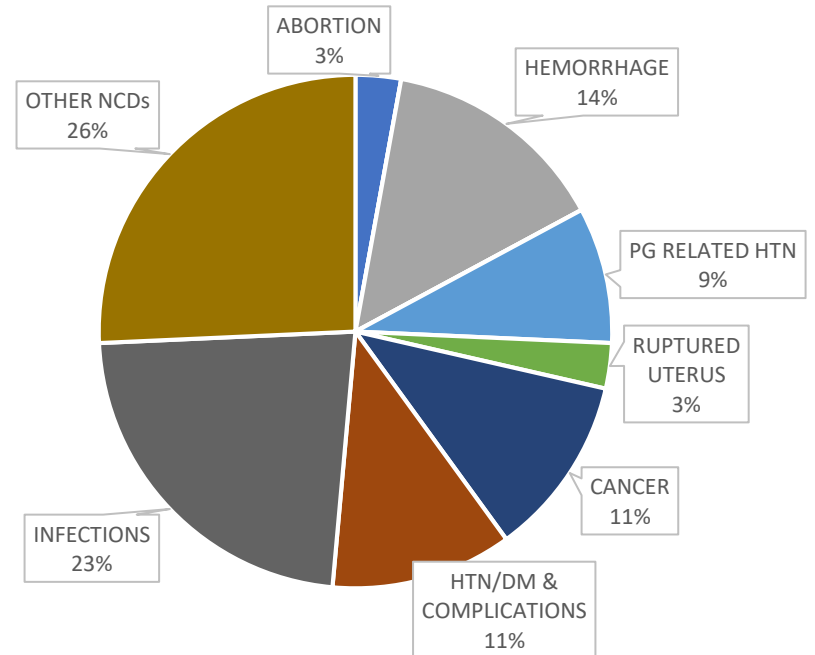


Maternal Deaths (n=14)



**Sakhipur**

Maternal Deaths (n=35)



**Ullahpara**

## DISCUSSION

Routine system coverage in reporting adult female deaths was low overall. We found large difference in reporting performance of the two Upazilas. Over half of the deaths were captured in Ullahpara while this was less than one-third in Sakhipur. The majority of the reports in both Upazilas came from community-level sources. Within facilities, IMCCoD and in-patient registers were the primary sources of death reports in Sakhipur and Ullahpara respectively.

The HAs reported the highest number of deaths in both upazilas. However, the performance of FWAs was almost as good as HAs in Ullahpara. In Sakhipur Upazila, vacant post rate for HAs was 40% and more than half for the FWAs. In Ullahpara the vacancy rate was 30% for both HAs and FWAs. The modality of collection of death and other reports for both HA and FWA is through visiting the household of their catchment areas. The FWAs have the responsibility to list all eligible couples and follow each event starting from marriage, reproduction and family planning. These may take priority over correctly collecting and recording death reports. Additionally, difficult terrain in Sakhipur Upazila consisting of small isolated hilly areas along with more than half vacant posts of FWAs may have hindered household visits, death information collection, recording and reporting.

Facility reports were found to be very poor. A total of 79 facilities were included in this study, 36 in the Tangail district and 43 in the Sirajganj district; seven facilities (five in Tangail and two in Sirajganj) were public, rest were private facilities. Poor reports from the facilities may also be due to lower number of deaths in facilities. However, as an increasing proportion of deliveries are taking place in facilities now, it is expected that facilities will be able to capture more maternal deaths with time. The recently introduced IMCCoD is a timely step taken by the GoB to record facility deaths in an organized manner, however, as the physicians turnover rate is high in the facilities, frequent refresher training, orientation and rigorous supervision is required for correct reporting through IMCCoD. IMCCoD is not nationally implemented in all private facilities, only in secondary, tertiary and specialized public facilities and some large private hospitals. The introduction of IMCCoD in other private facilities with rigorous monitoring may be beneficial to increase facility reporting. There also should be accountability mechanisms in place for both private and public facilities; i.e. – warnings, presence of a valid license, license revoking etc. In a recent study done by icddr,b with USAID RDM funding, it was seen that 64% of all private facilities did not have a valid license and still were providing healthcare services. Strong monitoring, necessary actions to hold defaulters accountable may increase all types of health services and reporting, including death reporting from facilities.

We got more death reports from routine sources in Ullahpara than from Sakhipur. We have tried to explore the reasons behind this pattern by looking into socio economic status and geographic location of the deceased. We found no strong logic to explain why one Upazilla was relatively better at reporting deaths though both were underreporting. We expected better coverage of reporting from community sources if the woman died inside the community, however, though we

found the case to be true in Ullahpara, in Sakhipur, 72% of deaths within the community were not reported by community sources. As expected, when the female died outside the Upazilla, community reports were much lower (94% in Sakhipur and 70% in Ullahpara were not reported).

In addition to underreporting of deaths, we observed that one deceased woman can be reported from different routine community and facility sources giving rise to another layer complication-multiple/duplicate death reports. We acknowledge that though it is possible to nationally streamline all death data sources into one data source by removing duplications through imposing mandatory utilization of national identification cards (NID) during death reporting and alignment of different platforms, currently there is no such system in place. Without appropriate deduplication efforts, we will often overestimate AFMRs and other vital estimates like MMRs even if coverage of routine death reporting increases.

The census conducted in Sakhipur and Ullahpara provided us 280 and 350 deaths among the women of reproductive ages. We estimated the Adult Female Mortality Rates (AFMR) from the census and compared the AFMR with other data sources. In our estimates, AFMR in Ullahpara and Sakhipur were 1.13 and 1.92 per 1000 women of reproductive age. When compared to BMMS, 2016 and some other well established national demographic surveillance systems (DSS) (Baliakandi, Mirzapur, Matlab), there was substantial differences in the AFMRs. It is likely that in these two areas, mortality is higher than national as one is hard to reach terrain while another one is also falling behind in terms of economic development and health and nutrition indicators. Relevant figure can be found in annex 03.

When looked into causes of deaths in women aged 13-49 years, based on our analysis, maternal deaths account for around 8% of deaths (5% in Sakhipur and 10% in Ullahpara). According to the national estimates, it was 13% in BMMS 2016 and 14% in BMMS 2010. The maternal death as a proportion to adult female deaths from this analysis, therefore, is lower than the national rates; much lower in Sakhipur compared to Ullahpara. When other causes of adult female deaths (13-49 years) were explored, the main cause of death in women of this age group was cancers and different circulatory diseases related to hypertension and diabetes 47%; while the BMMS 2016 reports 47% of deaths due to same causes. However, in Sakhipur, deaths due to these causes were 43%, lower than the national estimates and in Ullahpara 50%; higher than the national estimates. When different injuries were concerned (self-harm, assault, accidents etc.), we found 19% (18% in Sakhipur and 19% in Ullahpara) of deaths while BMMS, 2016 reports 12%; higher than BMMS. Similarly, death due to infective causes were much higher in our area (23% in Sakhipur and 13% in Ullahpara) when compared to national estimates (4%).

When maternal deaths were concerned, BMMS, 2016 reported ante and post-partum hemorrhage (31%) and eclampsia and preeclampsia (24%) as the most common causes of maternal deaths in Bangladesh. In our analysis, we found hemorrhage to be the cause of death in 19% mothers, lower than the national estimates. However, Sakhipur Upazilla had higher deaths due to hemorrhage

(29%), almost similar to national estimates. When eclampsia and preeclampsia were looked at; 6% of mothers in our area died of eclampsia and preeclampsia with no deaths in Sakhipur due to these causes. We found most mothers died due to indirect causes, i.e.- hypertension, diabetes and related complications, other NCDs, cancers etc (45%), much higher than the BMMS, 2016 estimates of 20%.

We explored the causes of maternal deaths by source of death data, i.e. – routine source vs. from census. When maternal deaths from routine sources were concerned, we found that out of 615 maternal deaths, 31 came from routine sources. All maternal deaths captured from the routine system were due to indirect causes. All of the 18 mothers that died due to direct causes were captured by project conducted census. We need to be able to answer why routine sources do not know about these deaths or do not report these deaths, are these women dying outside of the Upazillas, in private hospitals or other secondary/ tertiary hospitals? If so, how can we make sure the community providers do not miss these reports and how can we integrate all health facility (public and private) death data sources in a common platform through a unique identifier.

## **Limitations**

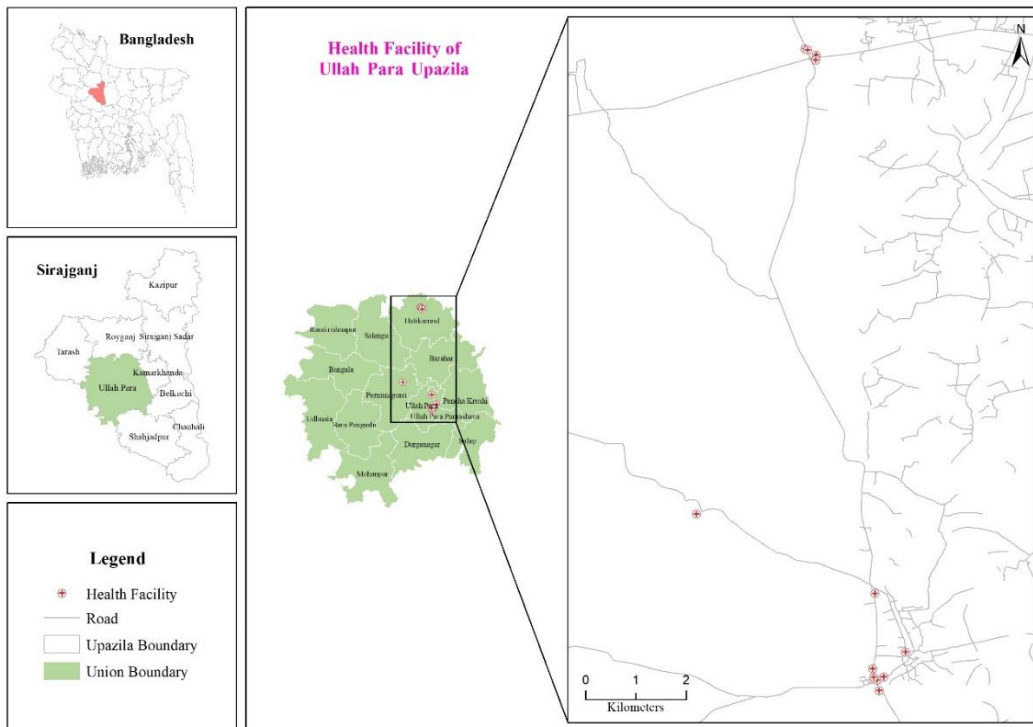
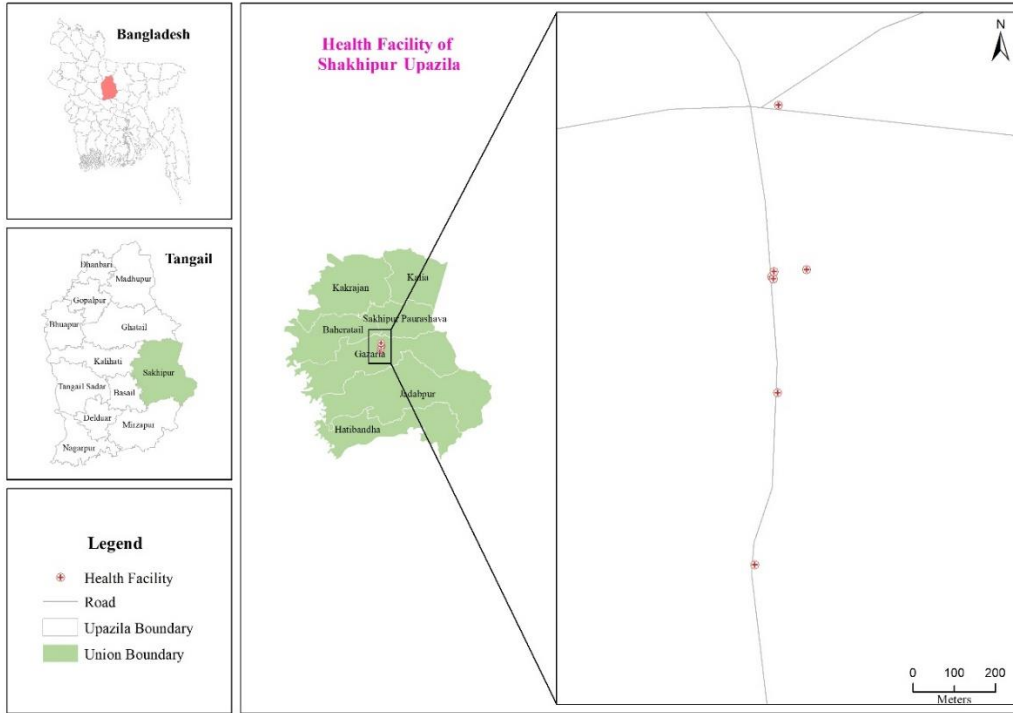
Although the census was assumed to be a gold standard, there were gaps identified. Methods like the social hub approach had to be adopted in order to fill the gaps as a supplement. A continuous surveillance system would perhaps better serve as a gold standard, however, they are expensive. The social hub approach as a stand-alone method would not suffice either as the enumerators were given a list of deaths from the census and people from the community were asked if they recognized those and if any deaths were missing. It is still unclear how a social hub approach without a pre-existing list would work.

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# ANNEXES

## Annex 1A: Map of selected facilities in the study area



**Annex 1B: List of selected public and private facilities in the study area (Ullahpara, Sirajgonj)**

<b>Facility Code</b>	<b>Facility Name</b>	<b>Facility Type</b>
20101	250 Bedded Banga Mata Seikh Fazilatunnesa Mujib General Hospital, Sirajganj	Govt
20102	Ullahpara (Sadar) 30 Bedded Hospital, Sirajganj	Govt
20103	Upazila Health Complex, Ullahpara, Sirajganj	Govt
20104	Upazila Health Complex, Shahjadpur, Sirajganj	Govt
20105	Upazila Health Complex, Kamarkhanda, Sirajganj	Govt
20106	North Bengal Medical College Hospital, Sirajganj	Pvt
20107	Prime Hospital Complex, Sirajganj	Pvt
20108	Nagar Matrisodhon Kendro, Sirajganj	Pvt
20109	Seba General Hospital, Sirajganj	Pvt
20110	Dishari General Hospital, Sirajganj	Pvt
20111	Medinova Hospital Complex, Sirajganj	Pvt
20112	Cokkho General Hospital, Ullahpara	Pvt
20113	Sakhawat H Memorial Hospital, Ullahpara	Pvt
20114	Matrisodon Shishu Hospital, Shahjadpur/ Child & Mother Care Hospital, Shahjadpur	Pvt
20115	Ekusha Hospital Private Limited, Sahajadpur	Pvt
20116	PPD Trust Hospital, Sahajadpur	Pvt
20117	Badhon Diagnostic and Central Hospital, Shahjadpur	Pvt
20118	Sotota General Hospital, Kamarkhanda	Pvt
20219	Al-Modina General Hospital, Ullahpara	Pvt
20220	Avisina Hospital Private LTD. Sirajganj	Pvt
20221	Community hospital old, Sirajganj sadar	Pvt
20222	Community hospital new, Sirajganj sadar	Pvt
20223	Sheba hospital, Sirajganj sadar	Pvt
20224	Ma general hospital, Road, Ullahpara	Pvt
20225	Central Hospital, Sirajganj sadar	Pvt
20226	Armac Hospital, Sirajganj sadar	Pvt
20227	Bangladesh Care Hospital, Road, Ullahpara	Pvt
20228	Moinuddin Hospital, Sirajganj sadar	Pvt
20229	City Hospital, Sirajganj sadar	Pvt
20230	Arafat Hospital, Sirajganj sadar	Pvt
20231	Amena clinic, Shahjadpur	Pvt
20232	Bondhon Hospital and Daigonostic Center, Sahajadpur	Pvt
20233	Saha Mokhodum Hospital, Sahajadpur	Pvt
20234	Ma clinic, Shahjadpur	Pvt
20235	Peace Lab & Hospital, Sahajadpur	Pvt
20236	Sheba Clinic and Daigonostic, Sahajadpur	Pvt

Facility Code	Facility Name	Facility Type
20237	Nurzahan Daiagonastic Center & Hospital, Sahajadpur	Pvt
20238	Modern Clinic and Diagnostic Center, Sahajadpur	Pvt
20239	Asma Clinic and Diagnostic, Sahajadpur	Pvt
20240	Seba General Hospital & Diagnostic Center, Ullahpara	Pvt
20241	Bengal Community Hospital & Diagnostic Center, Ullahpara	Pvt
20242	Care Hospital & Diagnostic Center, Ullahpara	Pvt
20243	Doctors Hospital, Ullahpara	Pvt

**Annex 1C: List of selected public and private facilities in the study area (Sakhipur, Tangail)**

Facility Code	Facility Name	Facility Type
10101	250 Bedded General Hospital, Tangail	Govt
10102	Upazila Health Complex, Sakhipur	Govt
10103	Kumudini Womens Medical College and Hospital, Mirzapur	Pvt
10104	Ma O Sishu Care Clinic	Pvt
10105	New Suveccha Clinic and Nursing Home	Pvt
10106	Life Care Clinic	Pvt
10107	Al-Ihsan General Hospital	Pvt
10108	Health Care Clinic & Nursing Home	Pvt
10109	Modern Doctors Hospital	Pvt
10110	Manob sheba Hospital, Tangail Sadar	Pvt
10111	Amena clinic, Tangail Sadar	Pvt
10112	Green Lab Hospital, Tangail Sadar	Pvt
10113	Shapla Nursing and Diagnostic Center, Tangail Sadar	Pvt
10114	Sotota clinic and Nursing Home, Tangail Sadar	Pvt
10115	Alnoor Hospital, Tangail Sadar	Pvt
10116	Pilot hospital, Tangail Sadar	Pvt
10117	Care clinic and nursing home, Tangail Sadar	Pvt
10118	Onia nursing home, Tangail Sadar	Pvt
10119	General pilot hospital, Tangail Sadar	Pvt
10120	Sonia nursing home and Hospital, Tangail Sadar	Pvt
10121	Rajdhani Nursing Home, Tangail Sadar	Pvt
10122	Jono sheba Hospital, Tangail Sadar	Pvt
10123	Dhaka clinic, Tangail Sadar	Pvt
10124	Doyal Diagnostic and Home, Tangail Sadar	Pvt
10125	M.S Hospital, Tangail Sadar	Pvt
10126	Sunrise Hospital, Tangail Sadar	Pvt
10127	National Clinic. Tangail Sadar	Pvt
10128	Desh Bondhu Hospital, Tangail Sadar	Pvt



10129	Dr. Md N I Jakir Hospital, Tangail Sadar	Pvt
10130	Asia Hospital, Tangail Sadar	Pvt
10131	Digital Hospital, Tangail Sadar	Pvt
10132	Tangail Clinic and Hospital, Tangail Sadar	Pvt
10133	New life clinic and Hospital, Tangail Sadar	Pvt
10134	Sonar Bangla Hospital, Tangail Sadar	Pvt
10135	Al Shefa Hospital, Tangail Sadar	Pvt
10136	Ma o Shishu Kollan Kendro Hospital, Tangail Sadar	Pvt

### Annex 02: Details of IMCCoD training

The IMCCoD training is constructed in two parts. The first part deals with training of the physicians to correctly fill up the IMCCoD form. The second part deals with training of nurses and relevant IT personnel from the health facilities to enter the data in the designated server of DHIS-2.

During the first part, total 473 physicians were trained on IMCCoD in eight different venues from April-May, 2019. Among the participants, 232 were male and rest were females. The training was conducted by master trainer who were physicians.

During the second stage, 74 nurses and IT personnel received the SMoL training in MIS conference room of DGHS, Mohakhali, Dhaka.

Table 2a: Date and venue of IMCCoD training

Venue	Date	Sex of Participants		Total
		Male	Female	
North Bengal Medical College Hospital, Sirajganj	23 - 25 April, 2019	60	53	113
250 Bedded Banga Mata Seikh Fazilatunnesa Mujib General Hospital, Sirajganj	28 - 30 April, 2019	45	16	61
Upazila Health Complex, Shahjadpur, Sirajganj	24 April, 2019	10	2	12
Upazila Health Complex, Kamarkhanda, Sirajganj	29 April, 2019	4	2	6
Upazila Health Complex, Ullahpara, Sirajganj	30 April, 2019	3	3	6
250 Bedded General Hospital, Tangail	14 - 16 May, 2019	51	22	73
Kumudini Welfare Medical College and Hospital, Mirzapur, Tangail	14 - 16 May, 2019	52	140	192
Upazila Health Complex, Sakhipur, Tangail	15 May, 2019	7	3	10
		<b>232</b>	<b>241</b>	<b>473</b>

### Annex 03: Comparison of AFMR with BMMS by Upazila

