

# Reducing Maternal Mortality in Tanzania: Selected Pregnancy Outcomes Findings from Kigoma Region

## Background

Tanzania has the fourth highest number of maternal deaths in Sub-Saharan Africa and the sixth highest in the world (World Health Organization, 2014). The Millennium Development Goal 5 national target is to reduce maternal mortality to 193 maternal deaths per 100,000 live births by 2015 through high-skilled birth attendance (80% of all births), provision of comprehensive emergency obstetric care in 100% of hospitals, provision of basic emergency obstetric care in 70% of health centers and dispensaries, and a contraceptive prevalence rate of 60% (Ministry of Health and Social Welfare, *Sharpened One Plan*, 2014).

Since 2006, Bloomberg Philanthropies (BP) has supported the *Reducing Maternal Mortality in Tanzania Project*, aimed at decreasing maternal mortality through improved comprehensive obstetric care in Kigoma, Morogoro and Pwani regions. The World Lung Foundation implements the intervention, which has included upgrading the capacity of 15 facilities (10 health centers and 5 hospitals) to perform obstetric surgeries, in addition to training over 100 non-physician clinicians in anesthesia and emergency obstetric and neonatal care (EmONC).

In 2013, BP engaged epidemiologists from the U.S. Centers for Disease Control and Prevention (CDC) to independently evaluate the project's progress, as well as its impact on maternal health outcomes in Kigoma Region.

CDC employed a multi-method approach including: a standardized health facility assessment, extraction of pregnancy outcomes, obstetric complications, and abortion and surgery information from obstetric registers, and documentation of facility-based maternal deaths using multiple sources.

This evaluation aims to assess current practices and outcomes in project-supported facilities as well as other facilities that provide delivery care throughout Kigoma region. Kigoma is the first region to implement the project and the first to start decentralizing comprehensive emergency obstetric care to make it accessible in health centers. The evaluation provides information on the current level and trends in EmONC services and examines the contribution of project-supported facilities to the changes in the level of care in the region.

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## Methods

### Study Area

Kigoma Region is in the western part of Tanzania, with a population of approximately 2,127,930 people and a male-to-female ratio of 1:1.07. Most of the population lives in rural villages, whose economies center on agriculture, small business, and fishing, for those near Lake Tanganyika.

The region is bordered by Burundi and Kagera Region to the north, Shinyanga and Tabora Regions to the east, Democratic Republic of Congo (DRC) to the west, and Katavi Region to the south. Due to war and political instability in neighboring countries, Burundi and DRC, Kigoma Region experienced an influx of refugees. At the time of study implementation, most refugee camps in Kigoma Region had closed, with only two main camps continuing to operate.

At the time of study planning, the region was divided administratively in four districts, all of which were included in the evaluation: Kigoma Urban (Ujiji Municipality) (population: 215,458), Kigoma Rural (Kigoma DC) (population: 595,206), Kasulu District (population: 888,380), and Kibondo District (population: 428,886) (Tanzania Population and Housing Census, NBS, 2013).

The goal of the WLF-supported project is to expand access and utilization of comprehensive EmONC services and help the region achieve the MDG 5 goal. With the financial support of BP, the region upgraded nine health facilities (three hospitals and six health centers) with the technical and personnel capacity to provide and strengthen comprehensive EmONC services.

### Maternal and Child Health Indicators in Kigoma, 2010

Compared to other regions in Tanzania, Kigoma had some of the greatest need for family planning and maternal and child health, as reflected in the following indicators for year 2010 (Tanzania Demographic and Health Survey, NBS, 2013) (Table 1).

**Table 1.** Maternal and Child Health Indicators, Kigoma Region and Tanzania, 2010

Indicator	Kigoma Region	Tanzania
Modern contraceptive prevalence rate	14%	27%
Unmet family planning need	41%*	18%
Institutional delivery rate	33%†	50%
Cesarean section rate	2%‡	5%
15–19 year-olds who have begun childbearing	30%	23%
Neonatal mortality rate (per 1,000 live births)	25	26
Total fertility rate (births per woman)	7.1‡	5.4
Total wanted fertility rate (births per woman)	6.3	4.7

\* Highest unmet family planning need in the country.

† Second lowest institutional delivery rate and C-section rate in the country.

‡ Highest total fertility rate in the country.

## **Study Objectives**

Assessing progress toward the MDG 5 goal during the initiative's implementation requires a baseline measuring of maternal mortality in facilities and communities. Given the early onset of interventions, a baseline assessment was not within the scope of the CDC evaluation. This study aims to evaluate the ongoing initiatives to improve emergency obstetric and newborn health by:

- Documenting EmONC functionality, coverage, and quality of care in all facilities;
- Examining changes in the proportion of facility-based deliveries in the region;
- Examining changes in EmONC indicators and other delivery care indicators in all facilities and in project-supported facilities;
- Comparing maternal and child health outcomes in the region as a whole to the outcomes of the population receiving services from project facilities; and
- Analyzing the contribution of EmONC services in project facilities in relationship to the overall contribution of other reproductive health services in the district.

## **Data Sources**

The study assessed facilities with at least 90 deliveries per year (reference year 2012), totaling 127 health facilities (Kigoma Urban, 3; Kigoma Rural, 27, Kasulu District, 51; Kibondo District, 46).

CDC evaluated basic infrastructure and EmONC capacity/functionality in 125<sup>1</sup> health facilities currently providing obstetric services in Kigoma Region using a health facility assessment questionnaire. These facilities provided care to an estimated 97% of all institutional births in 2012, according to the data made available to CDC by each district in July 2013. CDC collected individual data from five hospitals (three project-supported; two non-project-supported), 23 health centers (six project-supported; 17 non-project-supported), and 97 health dispensaries<sup>2</sup> (all non-project-supported). Only an estimated 3% of institutional deliveries in 2012 were attended in the dispensaries not included in the study.

This report describes findings from the data resulting from the extraction of pregnancy outcomes and abortion and surgery information from obstetric registers, as well as documentation of facility-based maternal deaths. CDC retrospectively collected individual pregnancy outcome data from delivering facilities using tailored extraction data collection forms. Maternity registers were typically the only data source in lower-level facilities. Surgical and admission and discharge registers were additionally used in higher level facilities. Information on each birth was triangulated from several registers and tabulated by maternal characteristics. Although up to 3 maternal complications were captured, only the most immediately life-threatening complication was used to analyze maternal morbidity and case fatality rates.

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<sup>1</sup> Due to 2 years of missing pregnancy outcomes data, Rusaba and Kitagata dispensaries were excluded from the analysis.

<sup>2</sup> Excluded from the study are dispensaries with less than 90 annual deliveries in 2012 (Kasulu District: Kigembe, Kilelema, Shunguliba; Kibondo District: Bitare, Kagezi, Kanyonza, Muhange, Nengo, Nyabibuye; Kigoma District: Kalya, Kamara, Kashaguru, Kiganza, Matendo, Mkigo, Nkonkwa).

Detection of maternal deaths in hospitals and health centers was enhanced using the Rapid Ascertainment of Pregnancy-Induced Deaths (RAPID) methodology (Impact, 2007). RAPID minimizes reporting of facility maternal deaths by reviewing all health facility records relating to deaths among women of reproductive. These include: maternity registers, operation theater registers (obstetric and general theaters), registers from women's inpatient wards (obstetrics, gynecology, and female wards), including admission and discharge registers, daily report registers, nurses' "round books" and maternal death notification and review forms.

## Selected Findings

### *Availability of EmONC Facilities*

About 15% of women develop complications in childbirth that are potentially life-threatening and require immediate access to emergency obstetric care. Emergency obstetric and neonatal care (EmONC) is a proven cost-effective strategy to reducing maternal mortality (Singh et al., 2009). All women experiencing obstetric complications must have access to EmONC facilities with 'basic' and 'comprehensive' levels of care. Basic care interventions (aka signal functions) include the administration of parenteral antibiotics, anticonvulsants, and uterotonics; manual removal of placenta; removal of retained products of conception; assisted vaginal delivery (AVD) (vacuum extractor or forceps); and neonatal resuscitation. Comprehensive care includes all the basic functions, as well as obstetric surgery and blood transfusions.

Health facility assessments were conducted in all 125 hospitals, health centers and dispensaries that provided delivery care in 2012 (facility volume of 90 deliveries per year or higher). Information on facility infrastructure, communication and transport, drugs and equipment, human resources, and availability of routine and emergency obstetric care are published in the "Health Facility Assessment of Emergency Obstetric and Neonatal Care Services in Kigoma Region: Selected Findings" (CDC, June 2014).

Briefly, health facilities in Kigoma were classified as Basic (BEmONC) or Comprehensive (CEmONC) care facilities (or neither) on the basis of whether they had recently performed EmONC signal functions. The number of CEmONC facilities (those having the ability to perform Cesarean sections and blood transfusions, in addition to seven basic life-saving interventions that should be available in BEmONC facilities) increased from 7 to 13 due to the project's efforts<sup>3</sup>. Facilities were classified as CEmONC or CEmONC-1 (and BEmONC and BEmONC-1, respectively), with the missing function being assisted vaginal delivery. Although all project-supported facilities performed AVDs in the past 12 months, this procedure is relatively uncommon in other delivering facilities. Despite provision of other signal functions, these facilities may not qualify as providing EmONC, given that AVD is rarely performed. This report thus classifies facilities performing all BEmONC and CEmONC functions except AVD as BEmONC-1 and CEmONC-1, respectively. For the current analysis, EmONC facilities are classified as those routinely performing all other life-saving interventions, regardless of AVD performance.

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<sup>3</sup> based on the signal functions provided during the previous 12 months.

**Table 2a.** Availability of EmONC<sup>1</sup> Facilities per 500,000 Population in 12 Months Prior to Assessment, by District, July 2012–June 2013

District	Population, 2012 Census	Recommended minimum number of EmONC <sup>2</sup> facilities		Number of Existing EmONC facilities <sup>3</sup>		
		All EmONC	CEmONC	BEmONC only	CEmONC	Total EmONC
Kigoma Urban	215,458	2	1	0	2	2
Kigoma Rural	595,206	6	1	1	3	4
Kasulu	888,380	9	2	4	5	9
Kibondo	428,886	4	1	0	3	3
<b>TOTAL</b>	<b>2,127,930</b>	<b>21</b>	<b>5</b>	<b>5</b>	<b>13</b>	<b>18</b>

<sup>1</sup> Includes BEmONC and CEmONC facilities that may not have performed AVD in past 12 months (i.e., BEmONC-1 and CEmONC-1).

<sup>2</sup> WHO recommends minimum level of five EmONC facilities per 500,000 population, including at least one CEmONC facility.

<sup>3</sup> EmONC functionality is classified using signal functions over the past 12 months. Includes CEmONC and BEmONC facilities that may have not provided assisted vaginal delivery within the past 12 months.

**Table 2b.** Availability of EmONC<sup>1</sup> Facilities per 500,000 Population in Three Months Prior to Assessment, by District, April–June 2013

District	Population, 2012 Census	Recommended minimum number of EmONC <sup>2</sup> facilities		Number of Existing EmONC facilities <sup>3</sup>		
		All EmONC	CEmONC	BEmONC only	CEmONC	Total EmONC
Kigoma Urban	215,458	2	1	0	1	1
Kigoma Rural	595,206	6	1	1	3	4
Kasulu	888,380	9	2	1	4	5
Kibondo	428,886	4	1	0	1	1
<b>TOTAL</b>	<b>2,127,930</b>	<b>21</b>	<b>5</b>	<b>2</b>	<b>9</b>	<b>11</b>

<sup>1</sup> Includes BEmONC and CEmONC facilities that may not have performed AVD in past three months (i.e., BEmONC-1 and CEmONC-1).

<sup>2</sup> WHO recommends minimum level of five EmONC facilities per 500,000 population, including at least one CEmONC facility.

<sup>3</sup> EmONC functionality is classified using signal functions over the past three months. Includes CEmONC and BEmONC facilities that may have not provided assisted vaginal delivery within the past three months.

- In the past 12 months, 18 facilities per 2,179,618 population provided EmONC services (13 CEmONC and 5 BEmONC), which is lower than the WHO-recommended number of at least 5 EmONC facilities per 500,000 population (Table 2a). All districts meet the WHO-recommended number of 1 CEmONC facility per 500,000 population. Only Kasulu met the minimum recommended number of EmONC facilities.
- In the past 3 months, 11 facilities (9 CEmONC and 2 BEmONC) provided the full range of EmONC services (Table 2b). Less than optimal access to emergency obstetric care may explain the slow progress in achieving a minimum rate of cesarean deliveries and in increasing met need for emergency obstetric care in Kigoma Region.

Table 3 shows common indicators that relate specifically to life-saving interventions provided in EmONC settings, where all emergency obstetric complications that cause most maternal deaths should be treated.

**Table 3.** EmONC Indicators\* and additional delivery care indicators

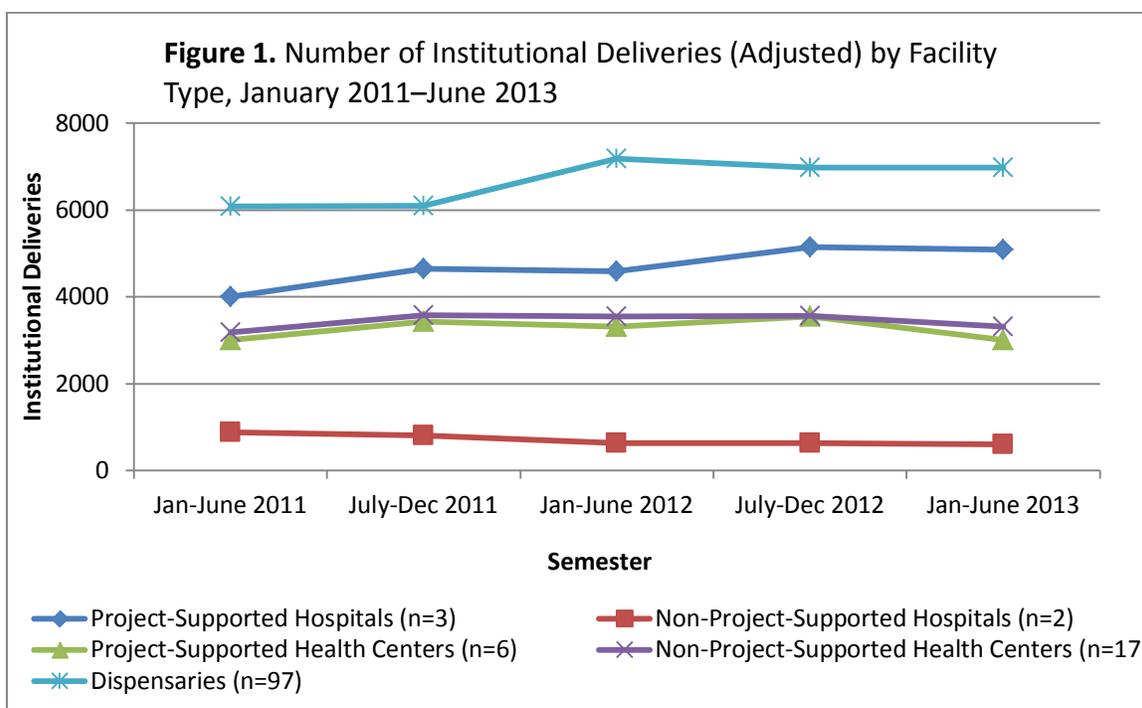
Indicator	Definition
Availability of EmONC*	<i>The number of facilities providing EmONC<sup>†</sup> per 500,000 population</i>
Proportion of institutional deliveries (%)	<i>The number of women who delivered in health facilities divided by the expected number of live births in the area of observation</i>
Proportion of all births in EmONC facilities* (%)	<i>The number of women who delivered in EmONC facilities divided by the expected number of live births in the area of observation</i>
Population-based Cesarean section (CS) rate* (%)	<i>The number of Cesarean sections performed in health facilities for any reason divided by the expected number of live births in the area of observation</i>
Facility CS rate (%)	<i>The number of Cesarean sections performed in CEmONC facilities for any reason divided by the number of births in CEmONC facilities</i>
Met need for EmONC services* (%)	<i>The number of women who delivered in health facilities and were treated for direct obstetric complications divided by the expected number of women with direct obstetric complications</i>
Direct obstetric case fatality rate* (%)	<i>The number of women who died of direct obstetric complications in facilities divided by the number of women diagnosed/treated with direct obstetric complications in the same facilities</i>
Proportion of indirect maternal mortality* (%)	<i>The number of maternal deaths from indirect obstetric causes in facilities divided by the number of maternal deaths of direct and indirect obstetric causes in the same facilities</i>
Institutional maternal mortality ratio (per 100,000 live births in facilities)	<i>The number of maternal deaths from direct and indirect obstetric causes in facilities divided by the number of live births in the same facilities, expressed per 100,000 live births</i>
Stillbirth rate (‰)	<i>The number of stillbirths in facilities divided by the number of total births in the same facilities, expressed per 1,000 births</i>
Intrapartum stillbirth rate (‰)	<i>The number of fresh stillbirths divided by the number of total births in the same facilities, expressed per 1,000 births</i>
Neonatal mortality rate (‰)	<i>Proportion of pre-discharge neonatal deaths divided by the number of live births in the same facilities, expressed per 1,000 live births</i>

\*Indicators recommended for monitoring the EmONC care (WHO, 2009)

† EmONC facilities include both CEmONC and BEmONC facilities

### Institutional Delivery Rate<sup>4</sup>

- Only 38% of estimated births occurring in Kigoma Region in January–June 2013 took place in facilities designated for delivery care<sup>5</sup>. Thus, over half of all deliveries are estimated to have occurred at home without any skilled obstetric care. Overall, 21% of births in Kigoma in 2013 took place in health centers and hospitals that provided BEmONC or CEmOC care.
- The overall number of institutional deliveries increased from 17,162 to 18,999 (11%) in Kigoma Region from January–June 2011 to January–June 2013 (Figure 1). The institutional delivery rate increased by 6% during the same period of time.
- Project-supported health centers and hospitals comprise 7% of all health facilities included in the study; 42% of institutional deliveries in Kigoma occurred in these facilities from January 2011–June 2013. Non-project-supported health centers and hospitals (comprising 15% of health facilities in Kigoma) accounted for 22% of the regional institutional deliveries during this time, whereas dispensaries (comprising 78% of health facilities) accounted for 36% of institutional deliveries in the region. No dispensary provided complete BEmONC.
- Thus, project-supported facilities, which comprise 32% of all health centers and hospitals in Kigoma Region, provided most (66%) delivery care occurring in health centers and hospitals from January 2011–June 2013.
- Project-supported facilities saw a 16% increase in institutional deliveries January–June 2011 to January–June 2013, whereas non-project-supported health centers and hospitals experienced a 3% decrease in institutional deliveries.



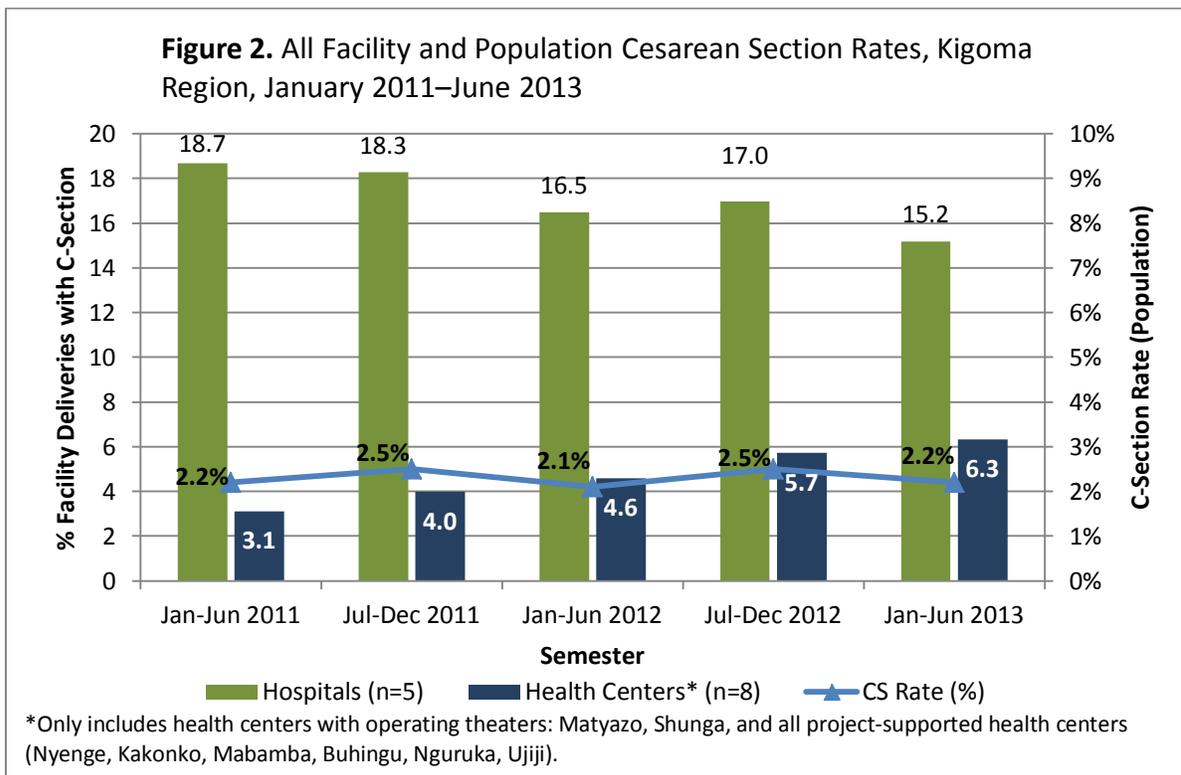
<sup>4</sup> To account for missing months in the facility data, 323 of 3,750 (8.6%) facility-months were imputed for January 2011–June 2013. All other indicators were calculated with raw data.

<sup>5</sup> Estimated number of births projected from 2012 Tanzania Population and Housing Census, published 2013.

### Cesarean Section Rate

Cesarean sections (C-sections) can prevent both maternal and neonatal deaths, in addition to severe maternal health complications (e.g., obstetric fistulae). The population-based C-section rate (CSR, number of C-sections performed as a proportion of all births) thus serves as an indicator of access to life-saving obstetric care. WHO recommends an optimal range of 5-15% (WHO, 2009), and anything below 5% suggests that women in need of this life-saving procedure cannot access it.

- At 2.3%, the average CSR in Kigoma Region is substantially lower than the minimum recommended C-section rate (Figure 2). Moreover, there is minimal change over the study period. This low overall CSR raises concerns regarding low accessibility to EmONC for women needing the procedure.
- Among women who delivered in CEmONC facilities in January 2011–June 2013, 12% delivered by C-section (hospitals: 15%; health centers: 6%).



- Health centers with CEmONC capacity experienced a continuous increase in the proportion of C-sections; the CSR in health centers doubled from 3.1% in the first half of 2011 to 6.3% in 2013, likely due to the increased number of health centers' operating theaters from the intervention. However, the proportion of C-section deliveries in the two non-project-supported CEmONC health centers (Matyazo, a private facility, and Shunga) surpasses the proportion of C-sections in project-supported health centers (Nyenge, Kakonko, Mabamba, Buhingu, Nguruka, Ujiji) by a considerable margin (January–June 2011: 11.3% vs. 1.1%, respectively; January–June 2013: 13.8% vs. 4.3%, respectively). One possible explanation is the more extensive practice of vacuum-assisted delivery in the project health centers,

which potentially avoids C-sections in the absence of absolute surgical indications. Another is the availability of surgical teams and skills, which is greater in Matyazo, a private not-for-profit health center managed by the only obstetrician in the region.

- This increase in surgical capacity in health centers likely contributed to the decreased proportion of C-section deliveries in hospitals (Figure 2). Between 2011 and 2012, C-section deliveries in project-supported hospitals increased by only 4%, while the C-section deliveries declined by 32% in non-project-supported hospitals (data not shown).

### ***Obstetric Complications and Met Need for EmONC***

Monitoring the proportion of all women with major direct obstetric complications who receive treatment in EmONC facilities provides insights into the coverage and utilization of EmONC services. Direct obstetric complications include: hemorrhage (antepartum, intrapartum, or postpartum), prolonged or obstructed labor, ruptured uterus, postpartum sepsis, complications of abortion, pre-eclampsia/eclampsia, and ectopic pregnancy.

CDC estimated the number of direct obstetric complications by triangulating information from multiple sources. Data sources differ for complications that occur at the time of delivery and soon after birth and for first trimester obstetric complications (e.g., complications of abortion and ectopic pregnancy). To ensure completeness, individual information were gathered on direct obstetric complications associated with the delivery and immediate postpartum periods from maternity registers (i.e., labor and delivery logbooks), obstetric surgery logbooks, and obstetric admission and discharge logbooks. CDC only recorded complications associated with labor, delivery, and early postpartum periods to avoid double counting.

Aggregate data were collected on abortions from several wards and registers (e.g., female or gynecology ward logbooks, major and minor surgery logbooks, and obstetric logbooks). All evacuation procedures and surgeries for first and second trimester abortions were counted and considered that virtually all of these procedures were performed for post-abortion complications.

CDC calculated the met need for EmONC using two approaches: a) taking into account only care provided for direct obstetric complications during labor, delivery, and early postpartum, and b) adding to the complications attended, the surgical post-abortion care and surgical treatment provided for ectopic pregnancies.

- Annually, about 5,000 women who deliver in health facilities in Kigoma experience severe direct obstetric complications<sup>6</sup> (Annex A: Table A1). Most of these women received care in project-supported facilities (from 69% in January–June 2011 to 72% in January–June 2013). The regional and district hospitals provided care for the highest number of major obstetric complications (from 55% in January–June 2011 to 58% in January–June 2013). Non-project supported hospitals experienced a decrease in the number of complications attended (from 14% to 9%, respectively), while the project supported health centers cared constantly for 14% of complications. The 2 other CEmONC health centers (Matyazo and Shunga, both

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<sup>6</sup> Includes: antepartum and postpartum hemorrhage, uterine rupture, prolonged or obstructed labor, postpartum sepsis, eclampsia/preeclampsia, and first trimester complications requiring surgical interventions (e.g., complicated abortions and ectopic pregnancies)

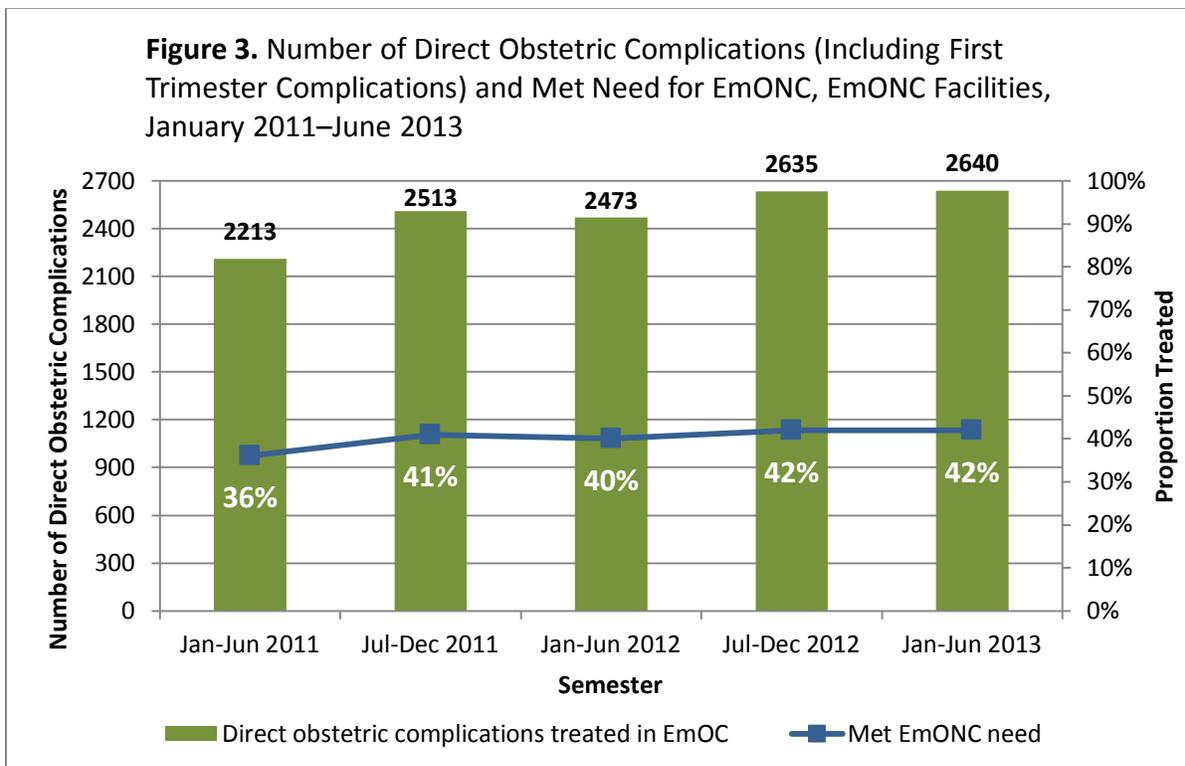
faith-based facilities) provided care for an increased proportion of complications (from 9% to 14%, respectively).

- Overall, about 16% of all women who delivered in facilities from January–June 2011 to January–June 2013 received care for major direct obstetric complications (Annex A: Table A1).

**Met EmONC Need**

Measuring met need for EmONC provides insight into whether pregnant women can access (due to geographic coverage/proximity) and use EmONC services. WHO recommends the use of this indicator in two settings: EmONC-only facilities and all facilities.

Met need is the proportion of women receiving EmONC services for serious obstetric complications among those expected to experience severe pregnancy complications, usually estimated to occur in 15% of pregnancies. WHO recommends that 100% of such women receive treatment in EmONC facilities. The expected number of complicated pregnancies in a population is difficult to ascertain; WHO recommends using the number of live births [estimated by applying the crude birth rate (CBR) to the population of the region] multiplied by .15 as a proxy (WHO, 2009).

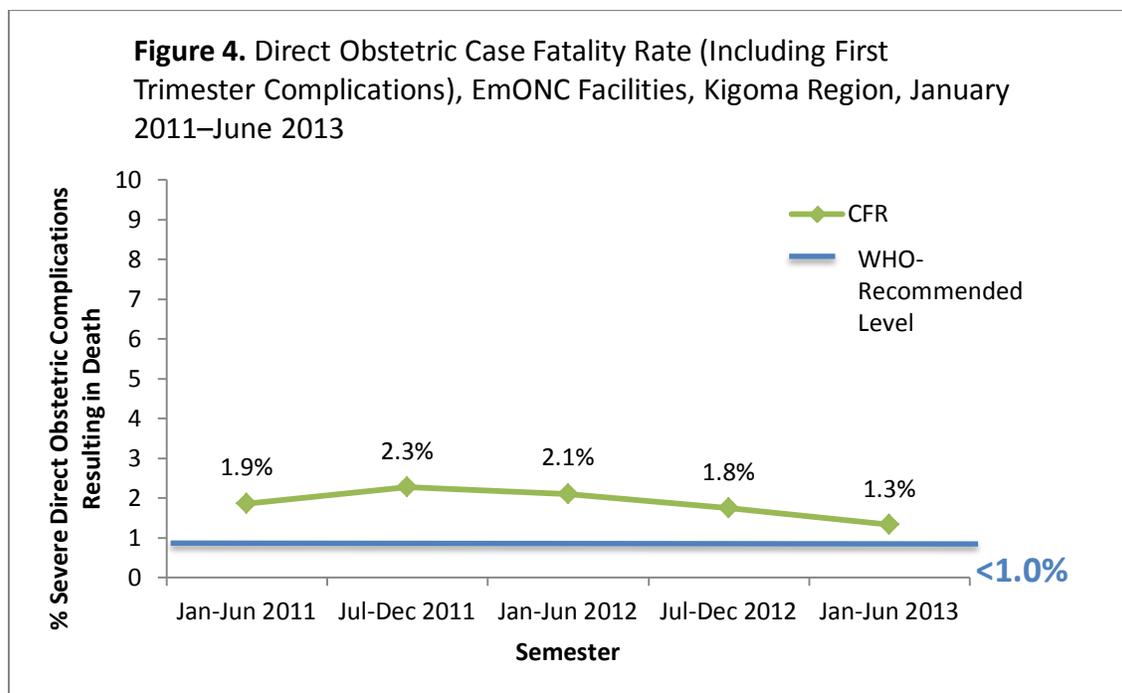


- Although the number of EmONC facilities in Kigoma has increased, three out of four districts have not reached the WHO-recommended minimum per 500,000 population (Table 2). As a result, met EmONC need in Kigoma Region remains low (Annex A: Table A1).
- Direct obstetric complications treated in all facilities (including care provided in dispensaries) as a proportion of all expected complications was 38% in January–June 2011 and 43% in January–June 2013 (Annex A: Table A1). Similarly, the met need in EmONC facilities increased from 36% to 42%, respectively (Figure 3).
- Project-supported facilities provide most of the EmONC care in the region. Between 71% (2011) and 74% (July 2012–June 2013) of the met need for EmONC was accomplished through emergency obstetric care provided in the project-supported facilities (Annex A: Table A1). This increase is entirely due to increased CEmONC care in the project-supported health centers, whose share of complicated deliveries increased from 11% in January–June 2011 to 12% in January–June 2013. Some of the increase may be explained by redistribution of care from Maweni Regional Hospital to Ujiji Health Center. Most of it, however, is likely due to better access to CEmONC services for women with severe pregnancy complications, achieved by upgrading the other five health centers currently providing EmONC services.
- The met need for EmONC was also calculated through care provided only for major direct obstetric complications occurring during labor, delivery and early postpartum (excluding first trimester complications related to abortions and ectopic pregnancies). As expected, this conservative estimate of met obstetric need was lower in all facilities, though gradually increasing (from 26% in January–June 2011 to 28% in January–June 2013 (Annex A: Table A2)).

### Direct Obstetric Case Fatality Rate

The case fatality rate (CFR) is the proportion of facility-treated women with serious direct obstetric complications who die despite receiving care. There is generally a strong correlation between the CFR, the number of facility-based maternal deaths, and, to some extent, population-based maternal deaths. It is generally used as a proxy for facility-based quality of care. Limitations exist, however, because a facility cannot control the condition in which a woman arrives.

- During the observation period, the CFR for major, direct obstetric complications (including complications during the first trimester) was twice the WHO recommendation (2% vs. <1%) (Figure 4).



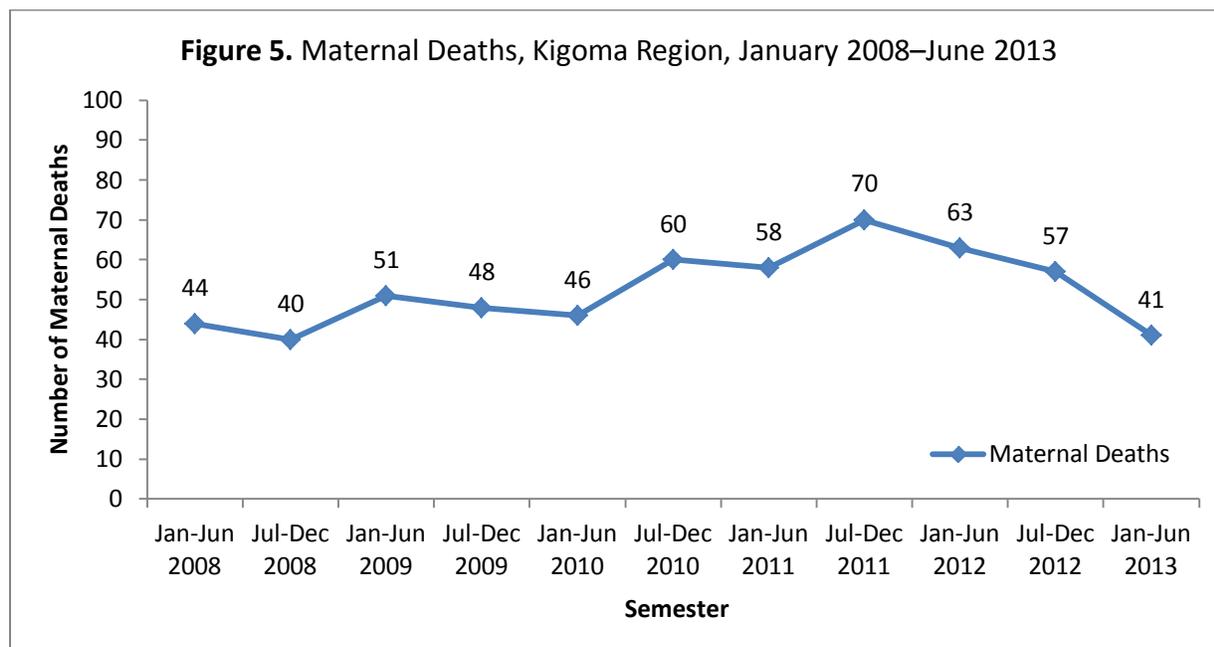
- The CFR during the first 6 months of 2013, however, decreased to 1.3%. This suggests that the quality of care for direct obstetric complications improved.
- Excluding first trimester complications, the CFR was 3 times greater than the WHO recommended level of <1%. The CFR for complications during labor, delivery and early postpartum follows the same declining trend, with the lowest levels occurring July 2012–June 2013.

## Institutional Maternal Mortality

### Maternal Deaths

WHO defines maternal death as the death of a woman during pregnancy or within 42 days of the pregnancy's termination, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management. It does not include accidental or incidental causes. Maternal deaths result from direct<sup>7</sup> and indirect<sup>8</sup> obstetric causes [Chapter O, digits from O 00–99 of the 10th revision of the International Classification of Diseases (ICD-10)] (WHO, 1994).

Between 2008 and 2012, the number of maternal deaths increased by 43% (2008: 84 deaths; 2012: 120 deaths). This may be due to better reporting of maternal deaths over time, as well as increases in facility-based deliveries and women's care-seeking for obstetric complications. Because most complications are cared for in the project sites, most maternal deaths also occurred in project-supported facilities (2008: 93%; 2009: 95%; 2010: 92%; 2011: 88%; 2012: 98%; 2013: 95%).



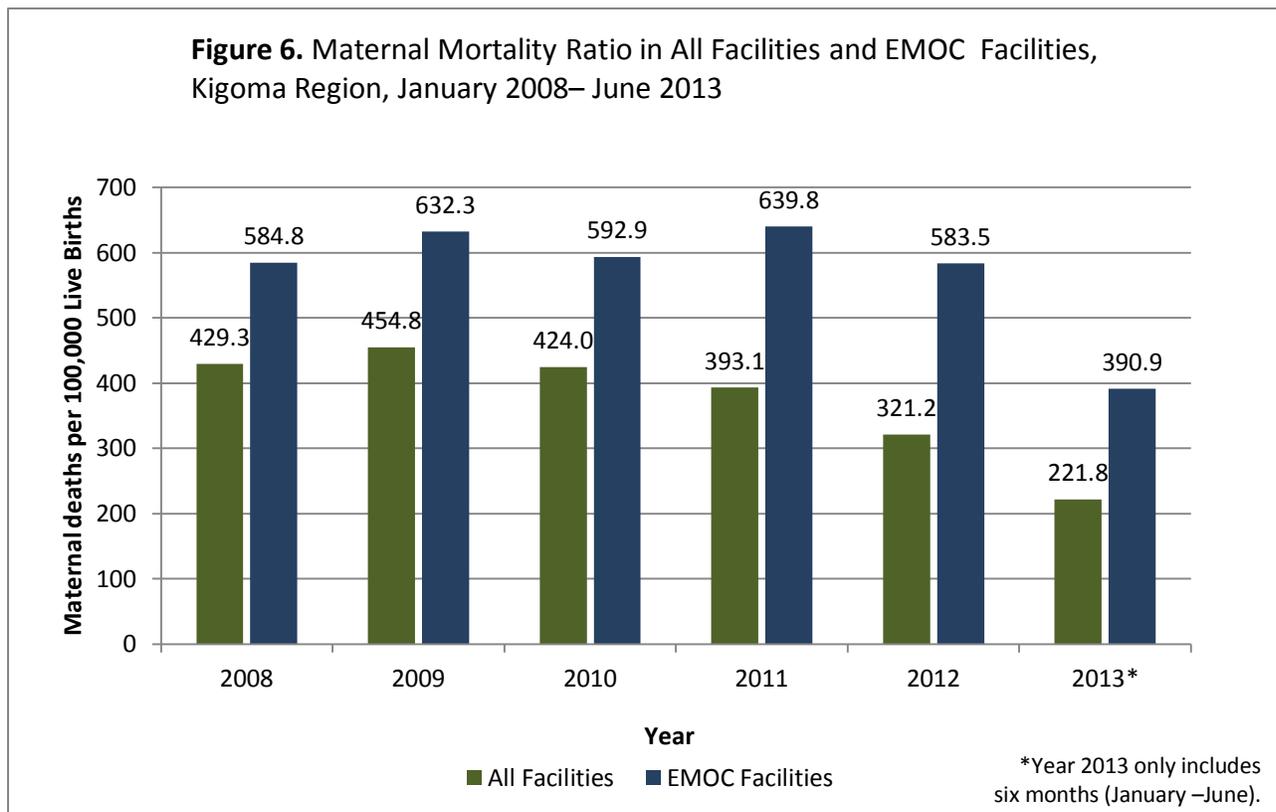
The maternal mortality ratio (MMR) in facilities is defined as the number of all maternal deaths from direct and indirect obstetric causes per 100,000 live births delivered in the same facilities during a period of time. The MMR is the most widely used indicator of maternal health, as it illuminates women's access to and quality of obstetric services. It can also be used to target and monitor interventions.

Facility-based MMRs should be viewed in the context that women with severe complications typically receive care in higher-level facilities, as they are at greatest risk of dying.

<sup>7</sup> Antepartum and postpartum hemorrhage (PPH), uterine rupture, obstructed labor, abortion, eclampsia and preeclampsia, sepsis or chorioamnionitis amniotic fluid embolism or thromboembolism, and others.

<sup>8</sup> Causes (e.g., tuberculosis, malaria, HIV, anemia, and cardiovascular disease) that are aggravated by pregnancy, childbirth, or puerperium.

- In Kigoma Region, the MMR in all facilities decreased by 18% (from 393 to 321 maternal deaths per 100,000 live births) between 2011 and 2012. Further reductions continued through the first half of 2013 (Figure 6).
- The MMR<sup>9</sup> for all facilities peaked at 455 in 2009 and declined to 222 maternal deaths per 100,000 facility live births by 2013. The EmONC facility MMR is higher overall. Other studies have shown a similar trend with women with severe complications and at greater risk of dying being cared for in higher-level facilities. Such studies show an initial increase in the facility MMR, when EmONC signal functions start to become available. The increase may also be due to more open and accurate reporting.

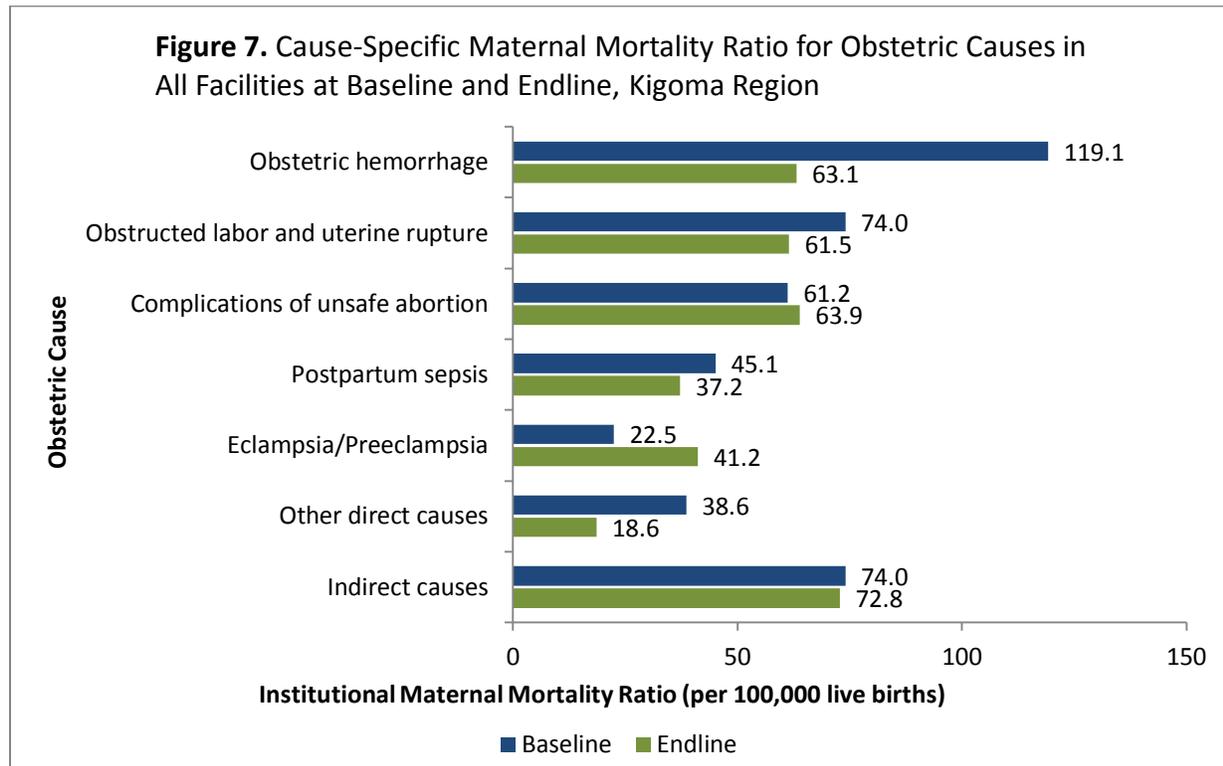


- The observed decline in maternal mortality in EmONC facilities (Figure 6) is likely to be the result of the reduced risk of dying from direct obstetric complications. This is consistent with reduction in maternal deaths in EmONC facilities during the period around labor and delivery, when major obstetric complications are the most lethal.

Obstetric hemorrhage continues to be a leading cause of maternal death in both periods of time in Kigoma (baseline: January 2008–June 2009; endline: July 2009–June 2013). The most striking change between baseline and endline is the decline in MMR for obstetric hemorrhage, suggesting that the increased access to and availability of EmONC services had a large impact

<sup>9</sup> Facility MMR refers maternal deaths among live births in facilities. The estimated overall MMR can be found in Table 4.

on this cause of death (Figure 7). Obstructed labor and its most severe complication, rupture of the uterus, along with unsafe abortion, were also common contributors to the direct maternal mortality. There was a small decrease in obstructed labor/uterine rupture. This is consistent with the essentially unchanged population cesarean section rate (Figure 2). It is anticipated that with increased facility EmONC utilization, a resultant increase in cesarean sections would decrease mortality from obstructive labor and uterine rupture.



*Maternal Mortality Due to Indirect Causes in EmONC Facilities*

In Sub-Saharan Africa, pregnancy and childbirth can further impair the health of women living with HIV, malaria, or tuberculosis. Looking beyond direct maternal deaths to these potential causes of indirect maternal deaths, one can better understand how such health conditions, typically not addressed by EmONC life-saving interventions, contribute to maternal deaths. This understanding can lead to effective interventions to prevent or control these diseases, especially HIV. Ultimately, this may help reduce the numbers of maternal deaths.

The MMR from indirect causes remained stable between baseline and endline periods (Figure 7). Proportionally, maternal deaths due to indirect obstetric causes represent about 20% of all maternal deaths (data not shown).

Intensified efforts in EmONC facilities to identify maternal deaths and minimize underreporting revealed that facilities can identify more maternal deaths by expanding reviews to registers and case notes from all wards. Such sources indicate where women of reproductive age may die and where their deaths may be recorded but not necessarily recognized as maternal deaths. Facilities identified more indirect maternal deaths in case notes.

### Summary of EmONC and Other Delivery Care Indicators

The project in Kigoma resulted in improvements of most EmONC indicators, including, but not limited to, substantial reductions in the number of maternal deaths in facilities. Table 4 summarizes these indicators and compares them with the WHO guidelines.

**Table 4.** EmONC and other delivery care indicators, Kigoma Region, January–June 2013

Indicator	Kigoma Level	Recommended Level (WHO, 2009)
Availability of EmONC	4.2 (3.1 CEmONC)	Minimum 5 (at least one CEmONC)
Proportion of institutional deliveries	38.4%	>80%
Proportion of all births in EmONC facilities	21.0%	NA
Population-based Cesarean section (CS) rate	2.2%	5–15%
Facility CS rate, % institutional births	11.6%	-
Met need for EmONC services	41.5%	100%
Direct obstetric case fatality rate	1.3%	<1%
Institutional Intrapartum stillbirth rate	13.5%	NA
Institutional pre-discharge neonatal mortality rate	10.4%	NA
Institutional maternal mortality ratio (per 100,000 institutional live births)	222	NA
Proportion of indirect maternal mortality (2009–2013)	20.3%	NA

### Maternal Deaths Averted through EmONC

Information on met need and CFR in EmONC facilities could be used to estimate to what extent the care provided to women with serious, direct obstetric complications treated in these facilities averts maternal deaths in a population (Maine et al., 2005). In the calculation in this report, CDC used regional population and expected births data, yearly expected direct obstetric complications in the region, and directly collected data on complications and deaths from EmONC facilities. Not included are outcome data from dispensaries providing maternity care because these facilities do not qualify as EmONC facilities.

Approximately 5,000 women annually access EmONC care in Kigoma and receive medical or surgical treatment for major, direct obstetric complications and surgical treatment for first trimester complications (Table 5). Met need for EmONC, through provision of such care, was 39% in 2011 and 41% in 2012, assuming that about 15% of pregnant women experience severe obstetric complications. The number of women who died of major direct obstetric complications

in Kigoma EmONC facilities was 98 in 2011 and 98 in 2012. As a result, the case fatality rate (CFR) in EmONC facilities was 2% in both years.

**Table 5.** Estimation of Maternal Deaths Averted through EmONC in Kigoma Region and Intervention Sites Using Facility and Population Figures for 2011 and 2012

Year	2011	2012
Kigoma Population (Tanzanian Census, 2012)	2,077,468	2,127,930
Expected live births (using the CBR=39 births per 1,000 population)	81,021	82,989
Expected complications (15% of all births)	12,153	12,448
Major direct obstetric complications (DOC) treated in EmONC*(collected in the evaluation)	4726	5108
Met need for EmONC (proportion of expected major DOC that received treatment in EmONC facilities)	39%	41%
Maternal deaths due to major DOC in EmONC facilities (collected in the evaluation)	98	98
Case Fatality Rate (CFR) in EmONC facilities (proportion of women who died in facilities of major DOC)	2%	2%
MMR**(maternal deaths per 100,000 live births)	740	740
Expected number of maternal deaths per year in Kigoma	600	614
Expected number of maternal deaths due to major direct obstetric complications (DOC)†	480	491
Expected maternal deaths due to DOC occurring outside EmONC facilities	382	393
Expected direct obstetric complications outside EmONC facilities	7,427	7,340
CFR for women not treated in EmONC facilities (deaths outside facilities/complications outside EmONC care)	5%	5%
Deaths averted through EmONC per year [(CFR_complications untreated*complications treated)-MD treated]	145	176
Deaths averted through EmONC provided in project-supported facilities per year‡	103	126

\* includes: antepartum and postpartum hemorrhage, uterine rupture, prolonged or obstructed labor, postpartum sepsis, eclampsia/preeclampsia; and surgically treated first trimester complications (complicated abortions and ectopic pregnancies).

\*\*Source: 2012 WHO Global Trends in Maternal Mortality 1990-2010, upper 95% CI of the MMR value for Tanzania

† Considers that 80% of maternal deaths are due to major direct obstetric complications.

‡ In 2011 and 2012, project-supported facilities provided care for 71% and 72% of women with major direct obstetric complications, including abortions.

The MMR in Kigoma, the region with the lowest institutional delivery rate and highest fertility in Tanzania, is likely much higher than the country average of 460 maternal deaths per 100,000 live births. To estimate the regional MMR, the evaluation team used the upper limit of the confidence interval calculated around the country MMR (760 maternal deaths per 100,000 live births). This MMR was applied to the annual population and live births in the region and estimated that 600 and 614 maternal deaths occurred in 2011 and 2012, respectively.

It is estimated that the number of direct obstetric deaths in the region represented 80% of all maternal deaths (2011: 480 deaths; 2012: 491 deaths). This WHO-recommended proportion

was confirmed in our cause-specific analysis of maternal deaths in Kigoma facilities. By subtracting the maternal deaths in EmONC facilities from the total estimated maternal deaths due to direct obstetric complications, approximately 382 and 393 maternal deaths occurred outside EmONC facilities in 2011 and 2012.

The deaths occurring among women with obstetric complications who did not access EmONC services were compared with the estimated number of women with such complications who did not access EmONC care (calculated as the difference between expected direct obstetric complications and complications documented as being treated in EmONC facilities). Women not accessing care experienced a CFR 2.5 times higher than women with complications who received care in EmONC facilities (5% vs. 2%).

To estimate the maternal deaths averted through care in EmONC facilities, the evaluation team first applied the CFR of women with untreated complications to the number of women who received EmONC care for direct obstetric complications. This yields the number of maternal deaths expected to have occurred in the population had EmONC not been available [2011: 243 maternal deaths (5% of 4,726 complications); 2012: 274 maternal deaths (5% of 5,108 complications)].

Each year, however, an estimated 98 women died as a result of direct obstetric causes, despite receiving EmONC care. The number of institutional EmONC direct maternal deaths were thus subtracted from the hypothetical deaths averted, yielding the following total of maternal deaths averted through EmONC services:

- 2011:  $243 - 98 = 145$
- 2012:  $274 - 98 = 176$

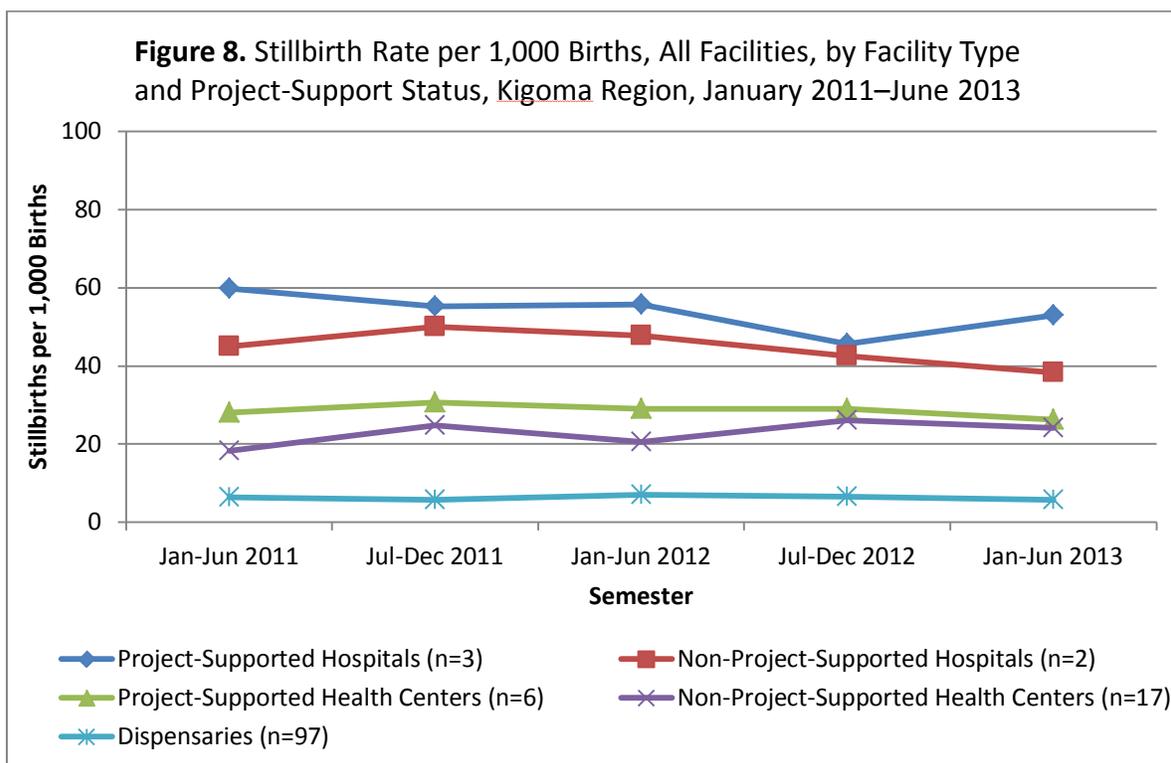
Project-supported facilities provide care for over 70% of women with major direct obstetric complications who had accessed care (3,354 and 3,672 women in 2011 and 2012, respectively) (Annex A: Table A1). In 2011 and 2012, 103 and 126 maternal lives were saved through care provided in project-supported facilities, respectively (Table 4). For each maternal death averted, over 30 major direct obstetric complications were successfully treated.

## Perinatal Outcomes in Health Facilities

### Stillbirth Rate

The total stillbirth rate is the number of stillbirths (macerated and fresh, based on appearance or time of death) in facilities, divided by the total number of births in the same facilities during the same period; it is expressed per 1,000 total births.

- In January–June 2013, the overall stillbirth rate in all facilities was 26.2 stillbirths per 1,000 births, lower than the available national estimates of 29–30 per 1,000 births (Stanton, 2006; Cousens, 2011). The overall institutional stillbirth rate for the region decreased by 10% between 2011 and 2012 (29.0 to 26.1 stillbirths per 1,000 births).
- The average stillbirth rate from January–June 2011 to January–June 2013 was higher in project-supported hospitals (53.9 stillbirths per 1,000 births) than non-project-supported hospitals (44.7 stillbirths per 1,000 births). The average stillbirth rate during this time period was also higher in project-supported health centers (28.6 stillbirths per 1,000 births) than non-project-supported health centers (22.8 stillbirths per 1,000 births). The average was lowest in dispensaries (6.3 stillbirths per 1,000 births), which typically do not deliver complicated pregnancies.
- Hospitals experienced a decline in stillbirth rates between January–June 2011 and January–June 2013 (project-supported: 11% decline, 59.8 to 53.0 stillbirths per 1,000 births; non-project-supported: 15% decline, 45.0 to 38.3 stillbirths per 1,000 births). Project-supported health centers experienced a slight decrease in stillbirth rates during this time (6%, 28.1 to 26.3 stillbirths per 1,000 births), compared to non-project-supported health centers, which experienced a 32% increase in stillbirths (18.3 to 24.1 stillbirths per 1,000 births).

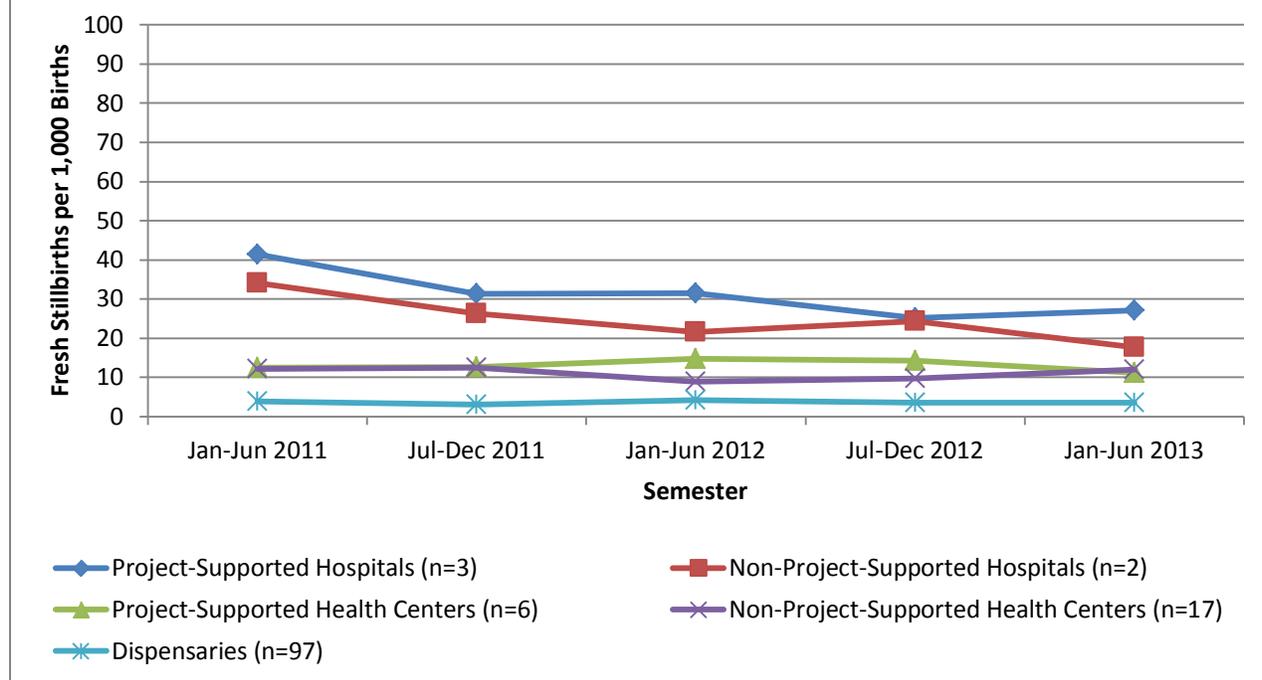


### *Intrapartum Stillbirth Rate*

Not all stillbirths can be prevented, but those occurring during labor and delivery (intrapartum stillbirths or fetal deaths that occurred in utero 12–24 hours prior to delivery) may be related to the quality of delivery care. As such, high quality obstetric care may prevent these stillbirths.

- From January 2011–June 2013, 50% of stillbirths in all facilities were intrapartum stillbirths, with an overall intrapartum stillbirth rate of 14.6 intrapartum stillbirths per 1,000 births for the region during this time period. The overall intrapartum stillbirth rate for the region decreased by 19% between 2011 and 2012 (16.7 to 13.5 intrapartum stillbirths per 1,000 births).
- The average intrapartum stillbirth rate from January–June 2011 to January–June 2013 was highest in hospitals (project-supported: 31.3 intrapartum stillbirths per 1,000 births; non-project-supported: 24.7 intrapartum stillbirths per 1,000 births). The average intrapartum stillbirth rate during this time period was higher in project-supported health centers (13.0 intrapartum stillbirths per 1,000 births) than non-project-supported health centers (11.0 intrapartum stillbirths per 1,000 births). It was lowest in dispensaries (3.6 intrapartum stillbirths per 1,000 births).
- Between 2011 and 2012, the intrapartum stillbirth rate decreased in all hospitals (project-supported: 22% decrease, 36.1 to 28.1 intrapartum stillbirths per 1,000 births; non-project-supported: 25% decrease, 30.3 to 22.9 intrapartum stillbirths per 1,000 births). This may be due to the fact that more early neonatal deaths occurred in hospitals during the same period of time, suggesting poor survivability of infants saved from being stillborn.
- Project-supported health centers saw a slight increase in intrapartum stillbirths in 2012, dropping to 11.1 intrapartum stillbirths per 1,000 births in January–June 2013. Non-project-supported health centers, however, saw a decrease in intrapartum stillbirths in 2012, increasing to 11.9 intrapartum stillbirths per 1,000 births in January–June 2013 (Figure 9). Intrapartum stillbirth rates remained generally stable in dispensaries.

**Figure 9. Intrapartum Stillbirth Rate per 1,000 Births, All Facilities, by Facility Type and Project-Support Status, Kigoma Region, January 2011–June 2013**



### Neonatal Mortality Rate

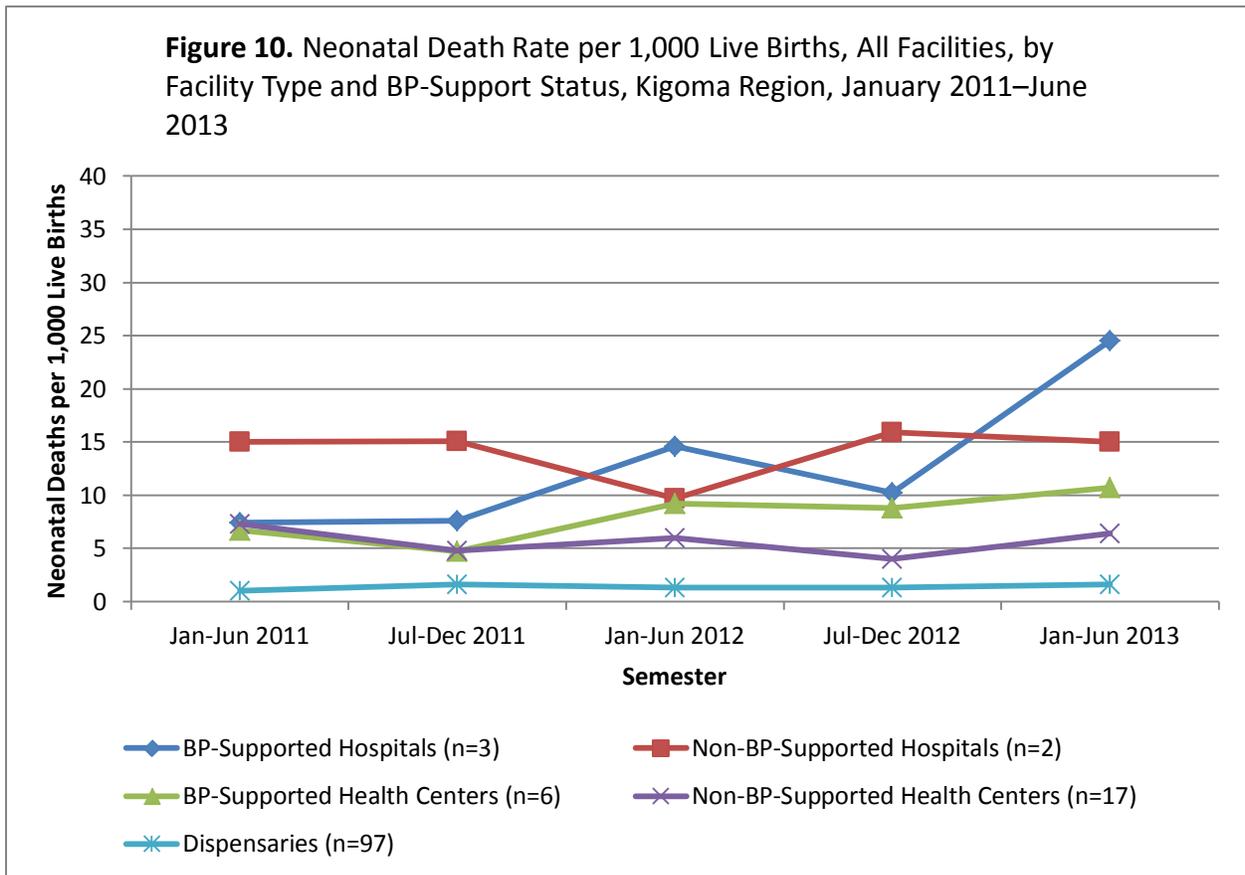
Newborns are most vulnerable in their first hours of life. After a live birth, some may require stimulation, assistance with respiration, or help in keeping warm. Various evidence-based interventions designed to keep newborns alive and healthy comprise essential newborn care.

The neonatal period is the first 28 days of life, but this analysis on neonatal outcomes only covers the period from birth to the time of facility discharge (usually within 24 hours of birth). The “pre-discharge” neonatal mortality rate (NMR) is the number of pre-discharge neonatal deaths divided by the number of live births in the same facilities during the same period; it is expressed per 1,000 live births.

- Between January 2011 and June 2013, the regional pre-discharge NMR was 6.8 neonatal deaths per 1,000 live births. The overall NMR increased by 21% between 2011 and 2012 (5.3 to 6.4 neonatal deaths per 1,000 live births), and it nearly doubled from January–June 2011 to January–June 2013 (5.7 to 10.4 neonatal deaths per 1,000 live births).
- The average NMR from January–June 2011 to January–June 2013 was higher in non-project-supported hospitals (14.1 neonatal deaths per 1,000 live births) than project-supported hospitals (12.9 neonatal deaths per 1,000 live births). The average NMR during this time period was higher in project-supported health centers (8.0 neonatal deaths per 1,000 live births), however, than in non-project-supported health centers (5.7

neonatal deaths per 1,000 live births). It was lowest in dispensaries (1.4 neonatal deaths per 1,000 live births).

- Between 2011 and 2012, the overall pre-discharge neonatal mortality rate increased by 21% in Kigoma (5.3 to 6.4 neonatal deaths per 1,000 live births). Project-supported hospitals experienced a 63% increase in the neonatal mortality rate (7.5 to 12.2 neonatal deaths per 1,000 live births). Non-project-supported hospitals, however, experienced a 15% decrease (15.0 to 12.8 neonatal deaths per 1,000 live births). Project-supported health centers experienced a 58% increase in neonatal deaths (5.7 to 9.0 neonatal deaths per 1,000 live births), while the rates in non-project-supported health centers declined (6.0 to 5.0 neonatal deaths per 1,000 live births).

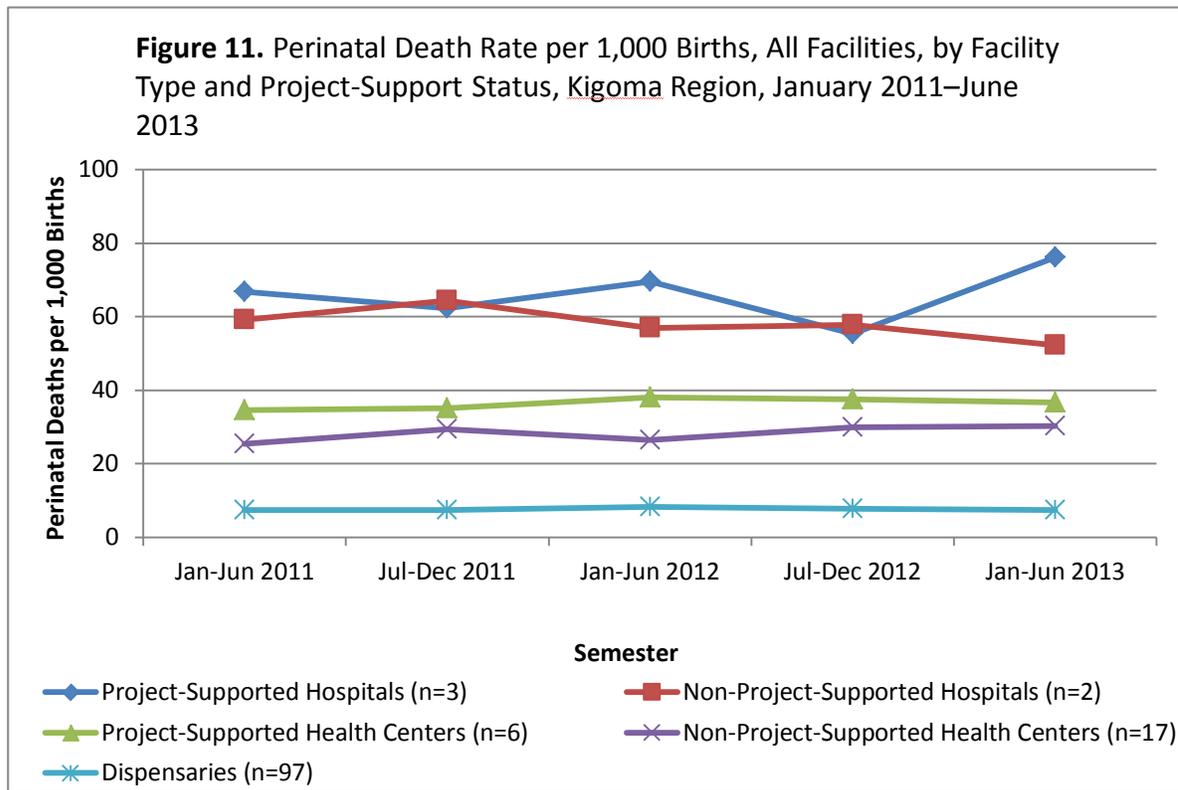


### *Perinatal Mortality Rate*

The perinatal mortality rate (PMR) includes both stillbirths and neonatal deaths, providing an overall understanding of what happens to a baby before labor, through labor and delivery, and after its birth. Both stillbirths and neonatal deaths are included to minimize the impact of misclassification (i.e., stillbirth instead of live birth resulting in neonatal death), thus capturing all deaths, regardless of whether they happened before or after delivery. PMR thus serves as an overall measure of the obstetric care provided around delivery and related outcomes.

The PMR is the number of stillbirths and pre-discharge neonatal deaths divided by the total number of births in the same facilities; it is expressed as per 1,000 total births. Use of the PMR also provides insight into the holistic impact of perinatal interventions. Rather than focusing on outcomes of stillbirths versus neonatal deaths, the PMR integrates the natural continuum between the periods when stillbirths and neonatal deaths occur. This is important for those perinatal interventions successful in reducing stillbirths but unsuccessful in improving neonatal survival of those live-born babies who were “saved” from stillbirth. The PMR still captures these “delayed” deaths.

- The overall regional PMR from January 2011–June 2013 was 33.9 perinatal deaths per 1,000 births. Between January–June 2011 and January–June 2013, the overall institutional PMR increased from 33.8 to 36.3 perinatal deaths per 1,000 births (7% increase). The overall PMR increased by 6% between 2011 and 2012 (34.2 to 32.3 perinatal deaths per 1,000 births).
- The average PMR from January–June 2011 to January–June 2013 was higher in project-supported hospitals (66.0 perinatal deaths per 1,000 births) than non-project-supported hospitals (58.1 perinatal deaths per 1,000 births). The average PMR during this time period was higher in project-supported health centers (36.4 perinatal deaths per 1,000 births) than non-project-supported health centers (28.3 perinatal deaths per 1,000 births). It was lowest in dispensaries (7.7 perinatal deaths per 1,000 births).
- The PMR increased by 38% in project-supported hospitals and decreased by 9% in non-project-supported hospitals in the last two semesters (July–December 2012: 55.4 and 57.8 perinatal deaths per 1,000 births, respectively; January–June 2013: 76.2 and 52.7 perinatal deaths per 1,000 births, respectively) (Figure 11). The PMR in the two other hospitals (both faith-based hospitals) declined slightly (Figure 11).
- In project-supported health centers, the PMR increased between 2011 and 2012 (35.2 and 38 perinatal deaths per 1,000 births in July–December 2011 and January–June 2012, respectively) but decreased after the first semester of 2012 (37.5 and 36.7 perinatal deaths per 1,000 births in July–December 2012 and January–June 2013, respectively) (Figure 11). Non-project-supported health centers, however, saw opposite trends; the PMR decreased between 2011 and 2012 (29.4 and 26.4 perinatal deaths per 1,000 births in July–December 2011 and January–June 2012, respectively) and increased after the first semester of 2012 (30 and 30.3 perinatal deaths per 1,000 births in July–December 2012 and January–June 2013, respectively) (Figure 11).



The increase in facility PMR in the context on decreasing stillbirth rates may suggest poor survivability of infants saved from being stillborn. Another possibility is that the classification of live births has improved (i.e., infants previously classified as stillbirths may be now correctly classified as neonatal deaths). Changes in the cause-specific near-miss and maternal deaths in facilities may also influence the facility PMR.

### Other Obstetric Care

Project-supported facilities also provided a number of other life-saving obstetric surgeries (Annex B: Table B1). In particular, project-supported facilities provided care for 1,968 complicated pregnancies in January 2011–June 2013 that resulted in fetal losses (Annex B: Table B2).

## Implications and Recommendations

- To help sustain maternal health initiatives in Kigoma Region, a taskforce of partners should be established. The taskforce should bring together public agencies and private organizations in a partnership aiming to: meet regularly to assess progress of maternal health activities, monitor the initiatives' cost-effectiveness, reduce duplication of activities, and ensure sharing of resources and information.
- Given the continued low rate of institutional deliveries in Kigoma Region, qualitative approaches should explore factors (e.g., logistical, personal, political, religious) preventing women from seeking and accessing facility-based care. Additionally, community outreach activities should be undertaken to educate community members about available health facility services and encourage use of such facilities for perinatal care and delivery.
- In conjunction with community outreach activities, health facilities must increase their capacity to treat the increasing the number of patients seeking facility-based care. This could include increased numbers of medical staff, beds, and delivery kits and medications, as well as continuous on-the-job education and supervision and improved quality of care assurance practices. Dispensaries experienced an increase in facility deliveries, as they are the most geographically accessible to women. Thus, interventions to improve quality of care must occur at all levels, including the dispensary level.
- The documented increase in volume and complexity of delivery care should be considered for procurement and logistics related to equipment, supplies, essential drugs and blood, infrastructure maintenance, and human resources allocation.
- Improving transportation availability and accessibility could contribute to increased institutional deliveries and decreased maternal and perinatal mortality, as it would decrease care-seeking delays (e.g., travel time to facility). Most transport delays can be addressed by a combination of community mobilization activities and an effectively linked communications system that ties all components of the healthcare system together. Establishing a point of contact in each community to alert facilities of incoming complicated deliveries and designated emergency transport pathways between facilities is also an effective approach.
- Protocols should be introduced for emergency transport at the lower-level facilities and case management guidelines and drills for immediate care of severe obstetric complications at in-referral facilities. Future studies should assess the protocols and effectiveness of emergency referrals between low- and high-level health facilities in ensuring that women with obstetric complications benefit from timely access the EmONC services. Such assessments should explore the ability of low-level facilities' personnel to diagnose severe obstetric complications, their knowledge of where and when to refer, how to stabilize them before transport, as well as how to communicate, organize, and get feedback on referrals.
- The current availability of EmONC facilities does not meet the WHO recommendation, given the minimal number of BEmONC facilities. As Kigoma Region currently meets the WHO recommendation of one CEmONC facility per 500,000 population, interventions should prioritize scaling up quality BEmONC services.

- The project should consider developing a rotation for midwives in remote areas to practice obstetric skills at facilities with a higher number of severe obstetric cases. The project should also consider supporting low-technology, simulation-based EmONC practice.
- Given the low C-section rate and high perinatal mortality and case fatality rates, capacity to perform quality obstetric surgeries in the project sites should be strengthened. Such efforts should include increased availability of clean surgical equipment, surgical checklists, surgical training of medical personnel, and supportive supervision.
- Develop concrete steps in facilities to utilize the results of reviews of near-miss obstetric deaths and maternal deaths (i.e., maternal death reviews and World Lung Foundation audits) to identify gaps, improve the quality of obstetric care, and mobilize political will and commitments at the district and regional level.
- Pre-discharge neonatal mortality remains high, indicating the need for better monitoring of intrapartum hypoxia (reduction of oxygen to body's tissue), increased capacity to perform C-sections, and improved use of protocols for neonatal resuscitation.
- Improve the quality of facility-based maternal and perinatal health outcome data and the facility's ability to utilize them in decision-making. This would entail training on key quality-of-care indicators, as well as data interpretation and understanding the relevance and use of accurate information for identifying gaps, mobilizing and allocating resources, and monitoring and evaluating changes.

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## Annex A: Direct Obstetric Complications

**Table A1**  
Distribution of Direct Obstetric Complications, Including First Trimester Complications, by Type of Treating Facility, 2011–2013

Facility Type	Jan–June 2011				July–Dec 2011				Jan–June 2012				July–Dec 2012				Jan–June 2013							
	Direct obstetric complications*		Complications as proportion of total deliveries	Proportion of expected complications treated†	Direct obstetric complications*		Complications as proportion of total deliveries	Proportion of expected complications treated†	Direct obstetric complications*		Complications as proportion of total deliveries	Proportion of expected complications treated†	Direct obstetric complications*		Complications as proportion of total deliveries	Proportion of expected complications treated†	Direct obstetric complications*		Complications as proportion of total deliveries	Proportion of expected complications treated†				
	N	(%)	(%)	(%)	N	(%)	(%)	(%)	N	(%)	(%)	(%)	N	(%)	(%)	(%)	N	(%)	(%)	(%)				
Dispensary	86	3.7	1.7	1.4	87	3.3	1.8	1.4	90	3.5	1.4	1.4	81	3.0	1.3	1.3	71	2.6	1.1	1.1				
Project-Supported Health Center (CEmONC) (n=6)	316	13.7	10.5	5.2	341	13.1	10.0	5.6	352	13.7	10.6	5.7	374	13.8	10.6	6.0	373	13.8	12.3	5.9				
Project-Supported Hospital (n=3)	1271	55.3	31.7	20.9	1426	54.8	30.6	23.5	1393	54.4	30.4	22.4	1553	57.2	30.2	25.0	1572	58.0	30.7	24.7				
Non-Project-Supported Health Center (BEmONC) (n=15)	83	3.6	9.5	1.4	77	3.0	8.2	1.3	98	3.8	10.5	1.6	108	4.0	11.7	1.7	81	3.0	10.9	1.3				
Non-Project-Supported Health Center (CEmONC) (n=2)	214	9.3	29.5	3.5	287	11.0	34.9	4.7	341	13.3	42.9	5.5	324	11.9	39.1	5.2	370	13.6	45.4	5.8				
Non-Project-Supported Hospital (n=2)	329	14.3	36.8	5.4	382	14.7	46.9	6.3	289	11.3	45.3	4.6	276	10.2	43.1	4.4	244	9.0	39.7	3.8				
<b>Total</b>	<b>2299</b>	<b>100%</b>	<b>16%</b>	<b>38%</b>	<b>2600</b>	<b>100%</b>	<b>17%</b>	<b>43%</b>	<b>2563</b>	<b>100%</b>	<b>15%</b>	<b>41%</b>	<b>2716</b>	<b>100%</b>	<b>16%</b>	<b>44%</b>	<b>2711</b>	<b>100%</b>	<b>16%</b>	<b>43%</b>				
<b>Met need EmONC (w/o dispensaries)</b>	<b>2213</b>			<b>36%</b>	<b>2513</b>			<b>41.4%</b>	<b>2473</b>			<b>40%</b>	<b>2635</b>			<b>42.3%</b>	<b>2640</b>			<b>41.5%</b>				
Proportion of met need for EmONC due to project support				<b>72%</b>	Proportion of met need for EmONC due to project support				<b>70%</b>	Proportion of met need for EmONC due to project support				<b>71%</b>	Proportion of met need for EmONC due to project support				<b>73%</b>	Proportion of met need for EmONC due to project support				<b>74%</b>

\* Includes: antepartum and postpartum hemorrhage, uterine rupture, prolonged or obstructed labor, postpartum sepsis, eclampsia/preeclampsia, and first trimester complications (complicated abortions and ectopic pregnancies).

**Table A2**  
Distribution of Direct Obstetric Complications, Excluding First Trimester Complications, by Type of Treating Facility, 2011–2013

Facility Type	Jan–June 2011				July–Dec 2011				Jan–June 2012				July–Dec 2012				Jan–June 2013							
	Direct obstetric complications*		Complications as proportion of total deliveries	Proportion of expected complications treated†	Direct obstetric complications*		Complications as proportion of total deliveries	Proportion of expected complications treated†	Direct obstetric complications*		Complications as proportion of total deliveries	Proportion of expected complications treated†	Direct obstetric complications*		Complications as proportion of total deliveries	Proportion of expected complications treated†	Direct obstetric complications*		Complications as proportion of total deliveries	Proportion of expected complications treated†				
	N	(%)	(%)	(%)	N	(%)	(%)	(%)	N	(%)	(%)	(%)	N	(%)	(%)	(%)	N	(%)	(%)	(%)				
Dispensary	68	4.2	1.4	1.1	70	3.6	1.4	1.2	71	4.0	1.0	1.1	64	3.6	1.0	1.0	58	3.1	0.9	0.9				
Project-Supported Health Center (CEmONC) (n=6)	247	15.1	8.1	4.1	295	15.1	8.6	4.9	261	14.6	7.9	4.2	294	16.4	8.3	4.7	290	15.7	9.6	4.6				
Project-Supported Hospital (n=3)	940	57.5	23.4	15.5	1171	60.0	25.1	19.3	1111	62.2	24.2	17.8	1081	60.3	22.6	17.4	1129	61.1	22.0	17.8				
Non-Project-Supported Health Center (BEmONC) (n=15)	39	2.4	4.4	0.6	14	0.7	1.5	0.2	17	1.0	1.8	0.3	25	1.4	2.7	0.4	17	0.9	2.3	0.3				
Non-Project-Supported Health Center (CEmONC) (n=2)	120	7.3	16.5	2.0	147	7.5	17.8	2.4	148	8.3	18.6	2.4	153	8.5	18.5	2.5	181	9.8	22.1	2.8				
Non-Project-Supported Hospital (n=2)	220	13.5	24.4	3.6	256	13.1	31.4	4.2	178	10.0	27.7	2.9	177	9.9	27.7	2.8	174	9.4	28.2	2.7				
<b>Total</b>	<b>1634</b>	<b>100%</b>	<b>11%</b>	<b>27%</b>	<b>1953</b>	<b>100%</b>	<b>13%</b>	<b>32%</b>	<b>1786</b>	<b>100%</b>	<b>10%</b>	<b>29%</b>	<b>1794</b>	<b>100%</b>	<b>10%</b>	<b>29%</b>	<b>1849</b>	<b>100%</b>	<b>11%</b>	<b>29%</b>				
<b>Met need EmONC (w/o dispensaries)</b>	<b>1566</b>			<b>26%</b>	<b>1883</b>			<b>31%</b>	<b>1715</b>			<b>28%</b>	<b>1730</b>			<b>28%</b>	<b>1791</b>			<b>28%</b>				
Proportion of met need for EmONC due to project support				<b>76%</b>	Proportion of met need for EmONC due to project support				<b>78%</b>	Proportion of met need for EmONC due to project support				<b>80%</b>	Proportion of met need for EmONC due to project support				<b>79%</b>	Proportion of met need for EmONC due to project support				<b>79%</b>

\* Includes: antepartum and postpartum hemorrhage, uterine rupture, prolonged or obstructed labor, postpartum sepsis, eclampsia/preeclampsia, and first trimester complications (complicated abortions and ectopic pregnancies).

† Assuming that 15% of all women who give births would experience direct obstetric complications

Annex B: Other Obstetric Care

**Table B1.** Obstetric Procedures Performed in Project-Supported-Facilities, January 2011–June 2013<sup>1</sup>

Type of Procedure	Kasulu District						Kibondo District						Kigoma District (Rural)						Kigoma District (Urban)											
	Kasulu Hospital			Nyenge HC			Kibondo Hospital			Kakonko HC			Mabamba HC			Buhingu HC <sup>2</sup>			Nguruka HC			Maweni Hospital			Ujiji HC <sup>3</sup>					
	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013			
Cesarean sections	455	669	279	7	7	5	458	333	197	27	68	31	19	31	7	6	24	16	58	37	23	587	509	245				26	48	
Operation on ruptured uterus (repair or hysterectomy)	45	25	13	0	0	0	13	17	8	0	2	1	1	1	0	0	4	2	2	3	2	12	18	10				2	1	
Surgery for ruptured ectopic pregnancy	4	2	2	0	0	0	1	7	3	0	0	0	0	0	0	0	0	0	1	1	0	15	28	5				0	0	
Laparotomy and drainage for post-abortion complications	0	6	0	0	0	0	2	4	1	0	0	0	0	0	0	0	0	0	0	0	0	9	5	3	OT closed			0	0	
Hysterectomy for post-abortion complication	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0				0	0	
Hysterectomy for postpartum hemorrhage	3	5	0	0	0	0	2	2	2	0	0	0	0	0	0	0	0	0	1	1	1	6	2	0				0	0	
Manual removal of placenta performed in OT	2	1	0	0	0	0	4	6	5	0	4	0	3	2	0	0	1	0	7	8	2	14	9	5				0	1	
Manual removal of placenta performed in L&D	0	1	0	0	0	0	2	0	0	0	3	0	1	0	0	0	0	0	0	0	0	5	10	5				0	0	0
Retained placenta treated in L&D	36	27	19	1	1	3	3	6	8	2	2	3	2	4	0	0	0	1	3	3	5	35	26	20				4	6	3

<sup>1</sup>2013 includes months January-June only.

<sup>2</sup>Buhingu OT opened August 2011.

<sup>3</sup>Ujiji OT opened November 2012.

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**Table B2.** Number of Abortion Complications & Ectopic Pregnancies Surgically Treated\*, by District and Facility, 2011–2013

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Reducing Maternal Mortality in Tanzania: Selected Pregnancy Outcomes in Kigoma Summary

Period	Jan-Jun, 2011	Jul-Dec, 2011	Jan-Jun, 2012	Jul-Dec, 2012	Jan-Jun, 2013
<b>KASULU</b>					
<b>Project-Supported Facilities</b>					
Kasulu Hosp.	134	88	151	195	193
Nyenge HC	0	4	16	9	19
<b>Non-Project-Supported Facilities</b>					
Heri Hosp.	27	36	21	31	24
Kabanga Hosp.	82	90	90	67	46
Biharu HC	14	15	11	14	16
Janda HC	3	6	12	10	8
Kiganamo HC	1	3	0	0	0
Mulera HC	2	7	3	7	1
Muyama HC	3	3	5	4	2
Nyakitonto HC	4	1	0	1	0
Rusesa HC	4	13	21	14	13
Shunga HC	31	40	76	73	69
Buhigwe Disp.	0	0	0	0	1
Kibande Disp.	0	1	0	0	0
Munyegera Disp.	0	0	0	1	0
Mwali Disp.	0	0	0	1	0
<b>KIBONDO</b>					
<b>Project-Supported Facilities</b>					
Kibondo Hospital	70	60	60	108	124
Kakonko HC		1	0	8	0
Mabamba HC	36	37	51	37	31
<b>Non-Project-Supported Facilities</b>					
Gwanumpu HC	1	0	2	2	0
Nyanzige HC	3	5	9	13	0
Kabare Disp.	18	16	19	15	10
Katanga Disp.	0	0	0	0	1
Kumsenga Disp.	0	0	0	0	1
<b>KIGOMA URBAN</b>					
<b>Project-Supported Facilities</b>					
Maweni Hospital	127	107	71	90	126
Ujiji HC	0	2	4	3	0
<b>Non-Project-Supported Facilities</b>					
Gungu HC	0	0	0	1	0
<b>KIGOMA RURAL</b>					
<b>Project-Supported Facilities</b>					
Buhingu HC	1	0	15	18	3
Nguruka HC	31	2	5	4	30
<b>Non-Project-Supported Facilities</b>					
Bitale HC	7	9	10	9	19
Matyazo HC	63	100	117	98	120
Mwamgongo HC	2	1	8	8	5
Kidahwe HC	0	0	0	1	0
<b>Total</b>	<b>665</b>	<b>647</b>	<b>777</b>	<b>841</b>	<b>862</b>

\*Treated in labor and delivery ward, minor operating theater, and major operating theater.