A quality assessment of the District Health Information Software (DHIS2)-based data for national health indicators in Bangladesh

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Independent Reference Group (IRG) for tracking and monitoring progress towards Universal Health Coverage in Bangladesh

Supported by:
USAID's Research for Decision Makers (RDM) Activity
icddr,b

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List of abbreviations

AMTSL	Active management of the third stage of labour
BMV	Bag and mask ventilation
DHIS2	District Health Information Software, v.2
EIBF	Early initiation of breastfeeding
EmONC	Emergency obstetric and newborn care
ENAP	Every Newborn Action Plan
EN-BIRTH	Every Newborn – Birth Indicators Research Tracking in Hospitals
EPI	Expanded Program on Immunization
EPMM	Ending preventable maternal mortality
HA	Health Assistant
HISP	Health Information Systems Programme
HMIS	Health Management Information System
IMCI	Integrated Management of Childhood Illness
KMC	Kangaroo mother care
MNH-intervention	Maternal neonatal health-intervention
MoHFW	Ministry of Health and Family Welfare
RDM	Research for Decision Makers
SDGs	Sustainable Development Goals
USAID	United States Agency for International Development
WHO	World Health Organization

Background

Sustainable Development Goals (SDGs) refer to targets aimed at reducing the following by 2030: the neonatal mortality rate to less than 12 per 1,000 live births; the stillbirth rate to fewer than 12 per 1,000 total births [1] and the global maternal mortality ratio to less than 70 per 100,000 live births [2]. Worldwide, an estimated 7,000 newborns die every day, which translates to 2.5 million newborns each year, in addition to 2.6 million stillbirths [3] and 295,000 maternal deaths [4]. To achieve the above SDGs targets, countries will need to accelerate their rates of progress in this context in terms of what is currently being achieved.

Focusing on newborn health is a global priority for accelerating progress towards the survival of children and achieving SDG targets promptly. In response to the United Nations Secretary General's (UNSG) Global Strategy for Women's and Children's Health (2010) and its accompanying Every Woman Every Child initiative, i.e. 'Committing to Child Survival: A Promise Renewed' (2012), the Every Newborn Action Plan (ENAP) to end preventable deaths was developed and endorsed at the 67th World Health Assembly in May 2014. The ENAP presents a framework for ending preventable newborn deaths by 2035 and is based on evidence published in the 'Every Newborn' series published by *The Lancet* [5]. The ENAP also aims to support countries in reducing preventable neonatal deaths and to achieve the SDG targets for newborn deaths and stillbirths. The framework is closely linked with the Ending Preventable Maternal Mortality (EPMM) plan [6], which aims to reduce preventable maternal mortality by 2030 and is also related to the most recent UNSG's Global Strategy for Women's, Children's and Adolescents' Health (2016-2030)
Reliable and accurate data are necessary to monitor and track progress towards achieving SDGs. Impact data, including mortality and birth weight/gestational age, and data on the effective coverage of interventions are fundamental for global governance, finance, planning and local programme planning. Approximately 5.5 million deaths among women and children related to birth occur in settings with the least amount of available data.

The ENAP measurement improvement roadmap was developed through broad consultation that included a World Health Organization (WHO) expert in a meeting in December 2014, as well as stakeholder consultation sessions throughout 2015. The ENAP metrics discussed through this process [7] aim to help advance tracking of the Global Strategy for Women's, Children's and Adolescents' Health and the broader Measurement and Accountability for Health Roadmap [8].

Table 1: The Every Newborn Action Plan (ENAP) core and additional indicators for tracking the progress of impact and coverage of newborn care interventions

Current status		Core ENAP indicators	Additional indicators
Clear definitions but the quantity and consistency of data requires improvement	*Impact*	1. Maternal mortality ratio* 2. Stillbirth rate* 3. Neonatal mortality rate*	*Intrapartum stillbirth rate* Low birth-weight rate *Preterm birth rate* *Small for gestational age* ***Neonatal morbidity rates*** ***Disability after neonatal conditions***
Contact point definitions are clear but data on the content of care requires improvement	*Coverage:* Care for all mothers and newborns	4. Skilled attendant at birth* 5. Early postnatal care for mothers and babies* 6. Essential newborn care (using breastfeeding as a tracer)	Antenatal care* Exclusive Breastfeeding up to 6 months*
Gaps exist in coverage definitions; requires validation and feasibility testing for health management information system application	*Coverage:* Complications and extra care	***7. Antenatal corticosteroid use*** ***8. Neonatal resuscitation*** ***9. Kangaroo mother care*** ***10. Treatment of serious neonatal infections***	*Caesarean section rate* ***Uterotonic use (EPMM)*** ***Chlorhexidine cord cleansing***
	Input: Service delivery packages for quality of care	Emergency obstetric care	
		Caring for small and sick newborns ***Every Mother Every Newborn quality initiative with measurable norms and standards***	
	Input: Counting	Birth registration	Death registration, cause of death

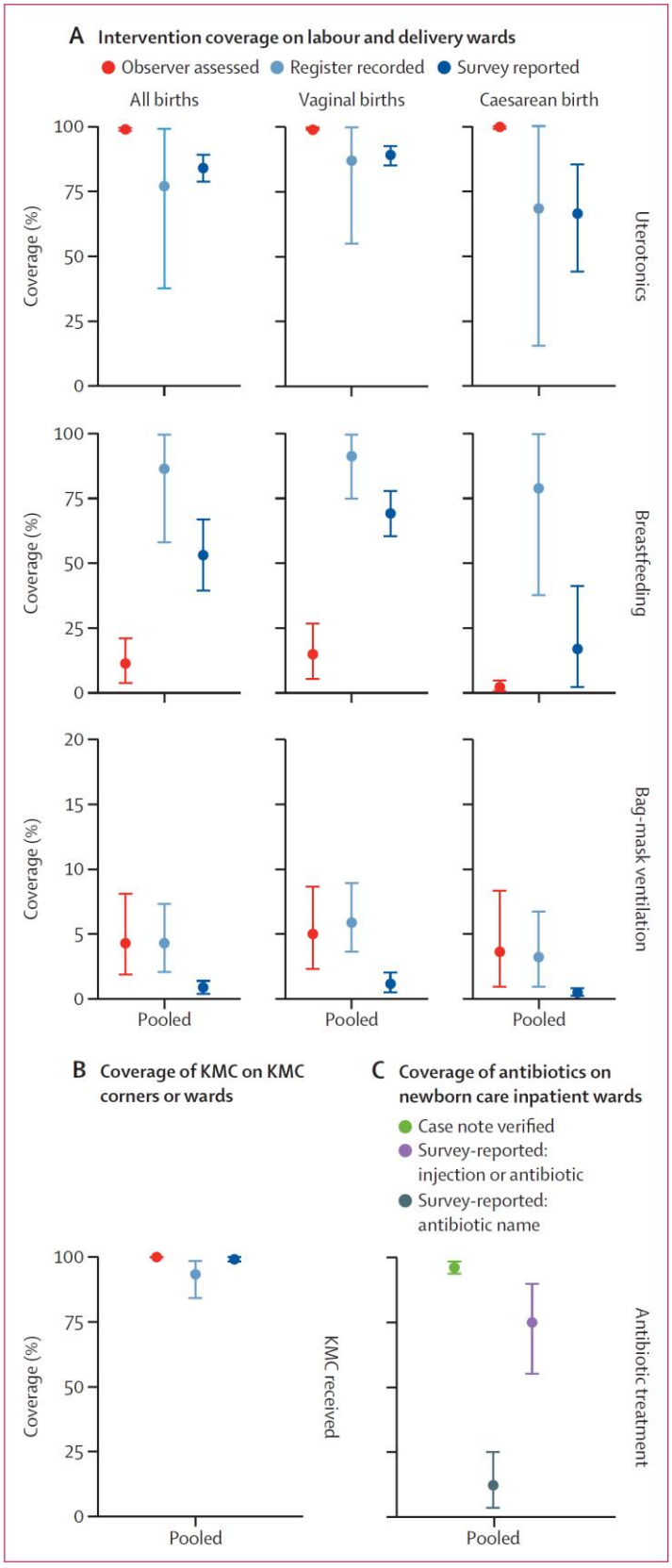
Italics = Not currently routinely tracked at a global level
Bold and underlined = Indicator requiring additional testing to inform consistent measurement
*Also an SDG core or complementary indicator. Indicators were disaggregated based on equity, such as urban/rural location, income, and education.
Adapted from the WHO and the United Nations Children's Emergency Fund, ENAP (2014), Mason et al; *The Lancet* (2014), Moxon et al.; BioMed Central (BMC) Pregnancy and Childbirth (2015) [9].

One of the five strategic objectives of ENAP is to transform the measurement and use of data to track coverage and the quality of care. The ENAP framework prioritizes the validation of coverage measures including the 'content' of care for selected interventions in facilities [10]. Ten core indicators (see Table

1) are prioritized as part of the 'every newborn' multi-country consultation process including impact, coverage and input, where 'impact' (e.g. maternal mortality, newborn mortality, stillbirth) and selected coverage indicators have clear definitions (e.g. skilled attendance at birth and the provision of postnatal care). The ENAP roadmap highlights gaps in the coverage definitions of four core coverage indicators (i.e. neonatal resuscitation, kangaroo mother care, the treatment of serious neonatal infection and antenatal corticosteroid use) and recommends validation and feasibility testing before Health Management Information System (HMIS) integration.

The 'Every Newborn – Birth Indicators Research Tracking in Hospitals' (EN-BIRTH, 2020) study attempted to address existing evidence gaps by assessing the accuracy of capturing five maternal and newborn health (MNH) intervention coverage indicators (numerator and denominator) through hospital-register records and women's exit-survey reports. These data can inform policies for their potential integration in routine health information systems and population-based surveys for national and global tracking. The overall validation paper in this study, titled 'Assessment of the validity of the measurement of newborn and maternal health-care coverage in hospitals (EN-BIRTH): An observational study' was published in *The Lancet Global Health* in 2021 [11]. **Figure 1** presents the primary findings related to indicator coverage of the EN-BIRTH study, disaggregated by normal vaginal delivery and caesarean section.

Figure 1: Coverage for five selected indicators measured by observation

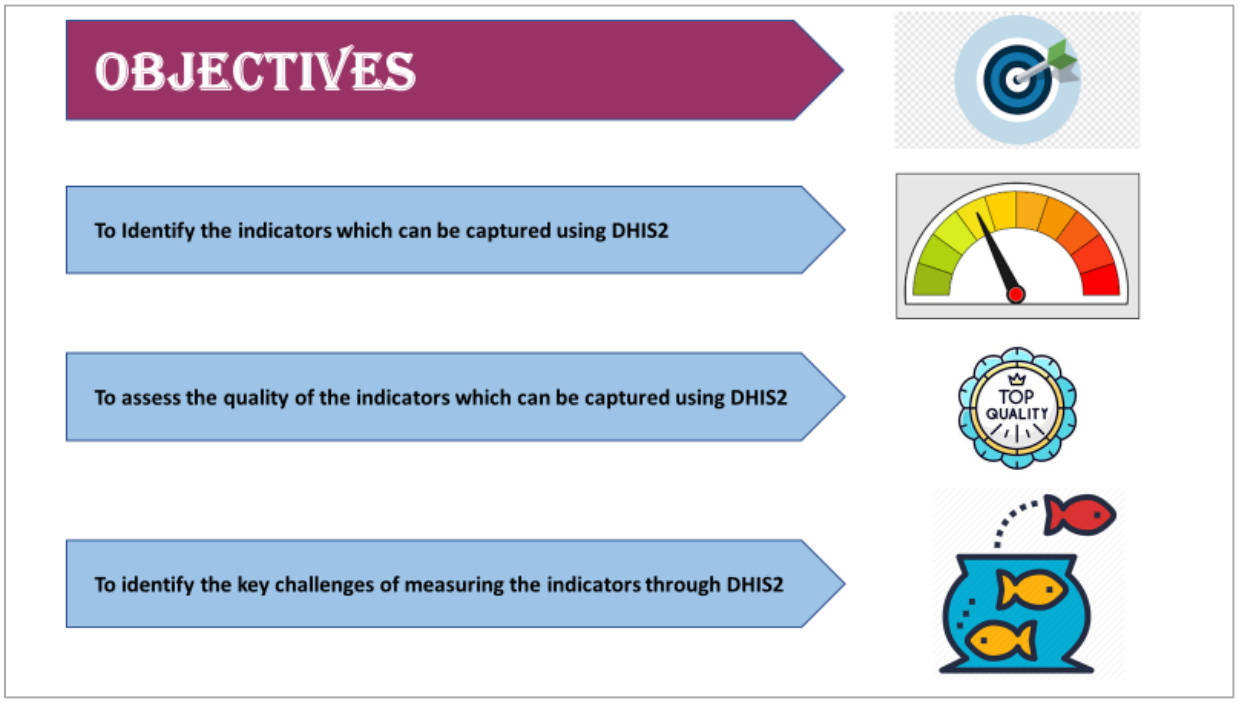


Health-facility data represent a primary data source for assessing the performance of the health sector. Ministries related to health accordingly compile data regularly to track progress related to goals and objectives, to plan for future needs and to set priorities for the health system. Health planners need to know what level of trust they can place in this data and what investments they must make to strengthen the data quality and reporting systems. Poor quality data will result in a lack of trust among users.

Several health-related indicators are captured through routine data sources, e.g. the District Health Information Software (v.2; DHIS2). The DHIS2 is a key source of data related to service utilization for capturing, reporting, analyzing and disseminating the relevant data for all health programs developed by the Health Information Systems Programme (HISP). This has been introduced in more than 60 countries to manage and visualize routine health data, particularly facility-based data [12]. Bangladesh's HMIS adopted the DHIS2 to record real-time data about health service utilization in 2009 [13]. The execution of the DHIS2 has upgraded the reporting of health service coverage indicators [14]. It is important to be aware of the reliability of national coverage and other estimates derived from HMIS data because this information often forms the basis for annual monitoring.

The availability of ENAP indicators along with the quality of data collection and processing through DHIS2 must be checked. Reviewing the data quality of health-related indicators will help to improve health sectors in a country like Bangladesh and contribute towards achieving SDGs through informed decision-making based on these indicators. With the support of the United States Agency for International Development (USAID), Research for Decision Makers (RDM) activity, implemented by icddr,b, aimed to assess the data quality of health-related specific indicators. The aim of doing so was to assess the quality of the core ENAP indicators reported for national tracking through the DHIS2 and to identify gaps and challenges for obtaining a national-level estimate for ENAP core coverage indicators.

Figure 2: The objectives of assessing the quality of the core ENAP indicators




Methods

Methods

Literature review

A desk review of the available data was performed to examine specific dimensions of data quality. Table 2 summarizes the list of documents that we reviewed to understand the DHIS2 mechanism and to identify the indicators for assessment.

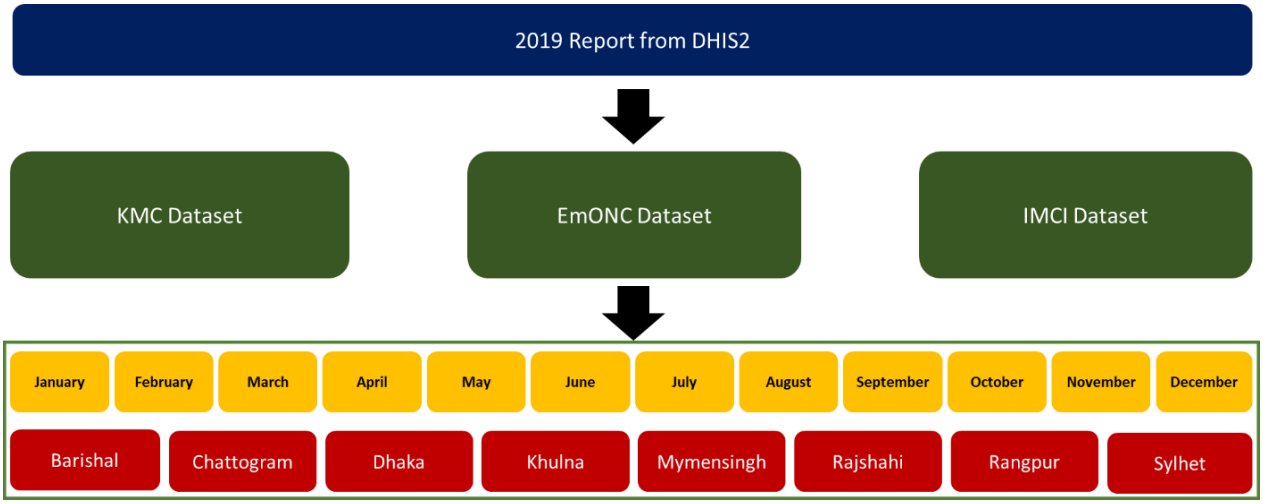
Table 2: A list of the reviewed documents

Title of the document	Publication year
'Using the DHIS2 software to collect health data in Bangladesh' Measure evaluation, USAID	2019
'Bangladesh's electronic management information system: using digital technology to link community data with facility data: case study Measure Evaluation, USAID	2018
'Strengthening district-based health reporting through the district health management information software system: the Ugandan experience'	2014
'National evaluation platform: DHIS-2 data quality assessment'	2018
'Data quality review: A toolkit for facility data quality assessment' WHO	2017
'"Every Newborn–BIRTH" protocol: Observational study validating indicators for coverage and quality of maternal and newborn healthcare in Bangladesh, Nepal and Tanzania	2019
'Count every newborn: a measurement improvement roadmap for coverage data'	2015

Expert consultation

The Ministry of Health and Family Welfare (MoHFW) and HISP Bangladesh were consulted to identify the source reports for the selected indicators. A meeting was held on October 22, 2020 with nine people from MoHFW, HISP Bangladesh, and icddr,b. The goal of the meeting was to map selected ENAP indicators and identify reports from which data could be extracted for the selected indicators to assess the data quality. The experts recommended exploring and assessing kangaroo mother care (KMC), monthly emergency obstetric and newborn care (EmONC) and Integrated Management of Childhood Illness (IMCI) datasets from the DHIS2 for each month of the most recent reporting year (2019) for each division (Barishal, Chattogram, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur and Sylhet) to assess the data quality. The flow of the analysis is shown in **Figure 3**.

Figure 3: The data analysis flow chart

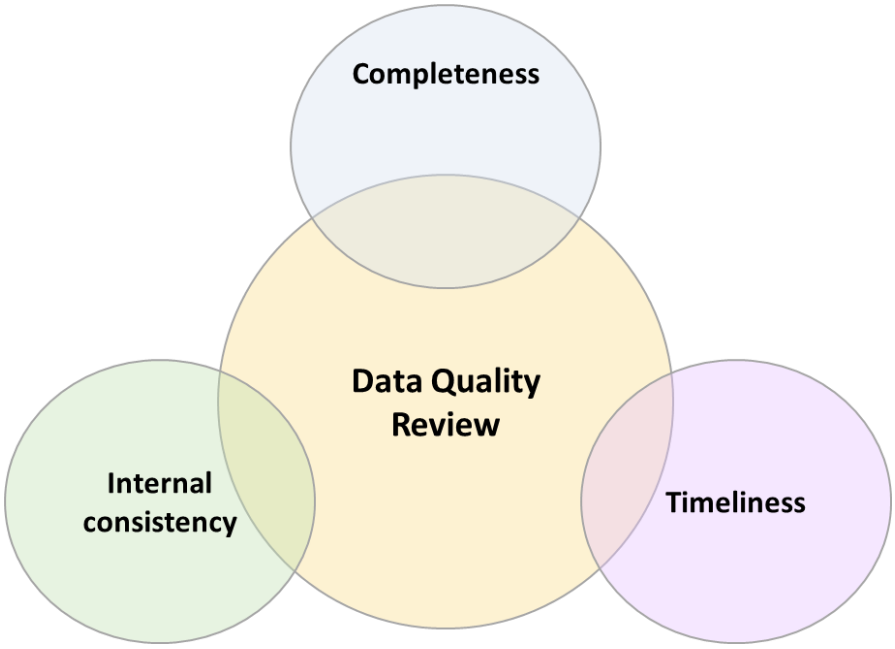


Expert recommendations and comments on the availability of relevant numerators and denominators of the selected indicators in the reporting form of the DHIS2 were gathered through this meeting. Based on expert opinions, the data quality of the DHIS2 could be measured in terms of accuracy, completeness and timeliness. Another virtual meeting was held with the HISP Bangladesh team leader and one of the Directorate General of Health Services (DGHS) consultants to understand issues regarding data extraction from the DHIS2.

DHIS2 data quality assessment

The availability of the reporting value of the selected indicators was observed. Coverage of the available indicators was found by extracting the numerator and denominator values of these indicators. Data quality was assessed by timeliness, completeness and the consistency of facility reporting (**Figure 4**).

Figure 4: The data quality dimensions



The operational definitions of the data quality dimensions were as follows.

1) **The completeness of data reported in the DHIS2 database:** The completeness of a specific data set (e.g. the reported EmONC) described in the DHIS2 database was assessed by comparing the total number of health facilities/community workers reported (from the data available) in the DHIS2 database with the total number of health facilities/community workers expected to be reported. This can be measured by both reporting the frequency (monthly/daily/quarterly) and administrative/geolocation level information (division/district/*upazila*). In this assessment, this aspect was assessed based on both monthly and division-based data for the selected reports. The completeness of data reported in the DHIS2 database was calculated using the formula below:

$$Completeness\ of\ data\ set\ reported\ in\ DHIS2 = \frac{\#\ of\ health\ facilities/community\ workers\ reported}{Total\ \#\ of\ health\ facilities/community\ worker\ expected\ to\ be\ report\ in\ DHIS2}$$

2) **Reporting timeliness in the Health Management Information System/DHIS2 database:** Reporting timeliness in the DHIS2 was documented by assessing the availability of reports in the DHIS2 database within a fixed reporting date. For example, monthly reports were to be sent within the second week of the month for the preceding month. The timeliness of DHIS2 monthly reports was calculated using the formula below:

$$Timeliness\ of\ report\ (data\ set)\ in\ DHIS2\ = \frac{\#\ of\ reports\ submitted\ on\ time}{Total\ \#\ of\ expected\ reports}$$

3) **The reporting consistency in the DHIS2 database:** The DHIS2 database comprises several features that can help to improve data quality. This includes validation during data entry to ensure that data are captured in the correct format and within a reasonable range, as well as user-defined validation rules, based on mathematical relationships between the data being captured and outlier analysis functions. The consistency of reporting in the DHIS2 database (for KMC, EmONC and IMCI) was assessed by plotting the monthly values obtained for each data element from the DHIS2.

Results

Results

A reference sheet for five Every Newborn Action Plan indicator

Table 3: Mothers who received a uterotonic immediately after giving birth

Indicator: The proportion of mothers giving birth in a facility who received a uterotonic immediately after giving birth.		
	Numerator	**Denominator**
Definition	The number of women in a facility who received a uterotonic immediately after giving birth	The total number of women and girls who gave birth in the facility
Dataset	EmONC	EmONC
Monthly reporting name	EmONC services' monthly progress	EmONC services' monthly progress
Monthly reporting variable	The number of normal deliveries with AMTSL at the facility level	Total delivery
Register name	EmONC	EmONC
Register variable	AMTSL done	The type of delivery, i.e. normal, forceps/vacuum/breech delivery, caesarean or a destructive operation
Status	Partially available	Available
Definition issues	Recording time immediately following the birth may be subjective	The denominator is the total number of women who gave birth in a facility, which may be different from the number of total deliveries
Measurement issues	The AMTSL as a prophylactic intervention comprising a package of three components or steps: 1) administration of a uterotonic (preferably oxytocin) immediately after the birth of the infant; 2) controlled cord traction to deliver the placenta; 3) massage of the uterine fundus after the placenta is delivered. The DHIS2 reports the number of normal deliveries with AMTSL instead of the number of women giving birth who received a uterotonic immediately after birth. It was difficult to understand which step of AMTSL had been completed.	The dataset includes mostly public facilities; private facilities are not included and less representation is present for urban facilities in the data.
Recommendation	Registers must be updated to collect information from the facilities about women receiving a uterotonic immediately after giving birth in a facility.	All private facilities should be brought under the domain of the DHIS2 to compile a comprehensive measure of this indicator.

Table 4: The early initiation of breastfeeding

Indicator: The proportion of breastfed infants before the age of one hour among live births		
	Numerator	**Denominator**
Definition	The number of live-born infants breastfed within the first hour following birth	The total number of live births
Dataset	EmONC	EmONC
Monthly reporting name	The EmONC services monthly progress report	The EmONC services monthly progress report
Monthly reporting variable	The number of newborns for whom breastfeeding was initiated within one hour following birth.	The number of live births.
Register name	EmONC	EmONC
Register variable	The newborn was breastfed within one hour of birth	Live births
Status	Available	Available
Definition issues	Before the age of one hour or within the age of one hour need to be specific	N/A
Measurement issues	Information about breastfeeding may be misinterpreted concerning when the newborn is put to the breast for skin-to-skin care without suckling. It is difficult to measure whether breastfeeding had been initiated within one hour of birth; over-reporting of early initiation may occur.	This data is only available for facility births; community births are not included in the denominator. Additionally, the dataset includes primarily public facilities; few private facilities are included and less representation is present for urban facilities in the data.
Recommendation	The care provider should be mindful of recording when breastfeeding is initiated.	All private facilities should be brought under the domain of the DHIS2 to ensure a comprehensive measure of this indicator. Additionally, community births should be considered for reporting on this indicator.

Table 5: Bag and mask ventilation

The proportion of infants receiving bag and mask ventilation		
	Numerator	**Denominator**
Definition	The number of newborns resuscitated with bag and mask ventilation (BMV).	The number of birthed newborns not breathing (live births and fresh stillbirths).
Dataset	EmONC	EmONC
Monthly reporting name	The EmONC services' monthly progress	The EmONC services' monthly progress
Monthly reporting variable	The number of newborns resuscitated with BMV (after stimulation) after drying	The number of live births, the number of fresh stillbirths, and the number of macerated stillbirths
Register name	EmONC	EmONC
Register variable	Using a BMV	Live birth/stillbirth
Status	Available	Available
Definition issues	Bag and mask ventilation may be used as a proxy of resuscitation. However, only reporting on BMV use may lead to under-reporting the proportion of newborns resuscitated as many may not require this type of ventilation if they received earlier stimulation or drying.	Capturing the true denominator for clinical needs is difficult; newborns may require BMV if breathing ineffectively or experiencing apnoea after initial drying/stimulation or subsequently at any time.
Measurement issues	Only reporting on BMV may lead to under-reported resuscitation.	Difficult to identify whether a newborn is breathing or not. Difficult to differentiate between fresh and macerated stillbirths.
Recommendation	The timely provision of resuscitation in the first minute is critical for programme planning. The resuscitation timing/time should thus be considered.	True denominator measurement requires further research. This should include the assessment of non-crying newborns.

Table 6: The initiation of kangaroo mother care

The proportion of newborns initiated on facility-based kangaroo mother care.		
	Numerator	**Denominator**
Definition	The number of newborns initiated on facility-based KMC	The total number of newborns with a birth weight below 2,000 g
Dataset	KMC	KMC
Monthly reporting name	KMC	KMC
Monthly reporting variable	The number of babies provided with KMC services	The number of infants born with a weight below 2,000 g
Register name	KMC	KMC
Register variable	Facility-based KMC initiated	Kangaroo mother care (there is no variable in the register to state how many babies were admitted to the KMC ward)
Status	Partially available	Available
Definition issues	Coverage of KMC is not a good proxy for receiving high-quality KMC. The initiation of KMC may only include one component of KMC among the three components, i.e. post-admission counselling, birthweight measurement at admission and skin-to-skin care.	Children born outside a facility may subsequently receive KMC in a facility. Therefore, this indicator cannot measure the rate of received KMC within a facility using the reported values of these data elements.
Measurement issues	Difficulty measuring the initiated KMC where it includes all three components.	It can be difficult for mothers to remember the birthweight of their newborn. Recall issues may lead to mothers erroneously reporting birthweights. The denominator cannot be directly calculated from a column. The birthweights column must be carefully reviewed to identify infants who were admitted with a birth weight below 2,000 g. Very few private facilities are included and less representation is present for urban facilities in the data.
Recommendation	The data reporting should consider capturing all components of KMC including completion of admission, the initiation of skin-to-skin care and the provision of counselling.	All private facilities should be brought under the domain of the DHIS2 to ensure the comprehensive measurement data for this indicator. Additionally, the reporting of community births should be considered for this indicator.

Table 7: The treatment of neonatal infection

The proportion of newborns who received an injectable antibiotic who were admitted to the inpatient ward with a diagnosis of neonatal infection (sepsis, pneumonia, meningitis).		
	Numerator	**Denominator**
Definition	The number of newborns given one or more doses of injectable antibiotics.	All infants that were admitted to the inpatient ward with a diagnosis of neonatal infection (sepsis, pneumonia, meningitis).
Dataset	Not available	IMCI
Monthly reporting name	Not available	A monthly IMCI reporting form.
Monthly reporting variable	Not available	The IMCI pneumonia instances (number of pneumonia/ severe or very severe disease cases)
Register name	Not available	IMCI
Register variable	Not available	Pneumonia/severe or very severe disease cases.
Status	Not available	Partially available
Definition issues	The definition includes the first or more doses, which may not be the recommended dose. This renders the indicator definition vague.	There are issues concerning the identification of suspected sepsis for reporting this indicator.
Measurement issues	The numerator was not available in the DHIS2. This will be partially available from the revised IMCI dataset in the 'first dose of Gentamicin' indicator.	We cannot capture information on newborn meningitis from the DHIS2. No data is available for the inpatient ward. However, these elements can be captured from the outpatient ward using the IMCI register.
Recommendation	Introducing inpatient records to capture specific antibiotic information. More research should be conducted on standardised inpatient records.	Information regarding all possible severe bacterial infections should be included in the DHIS2 along with pneumonia and severe or very severe disease instances. All private facilities should be brought under the domain of the DHIS2 to ensure the comprehensive measure of this indicator. Additionally, the reporting of community births should be considered for this indicator.

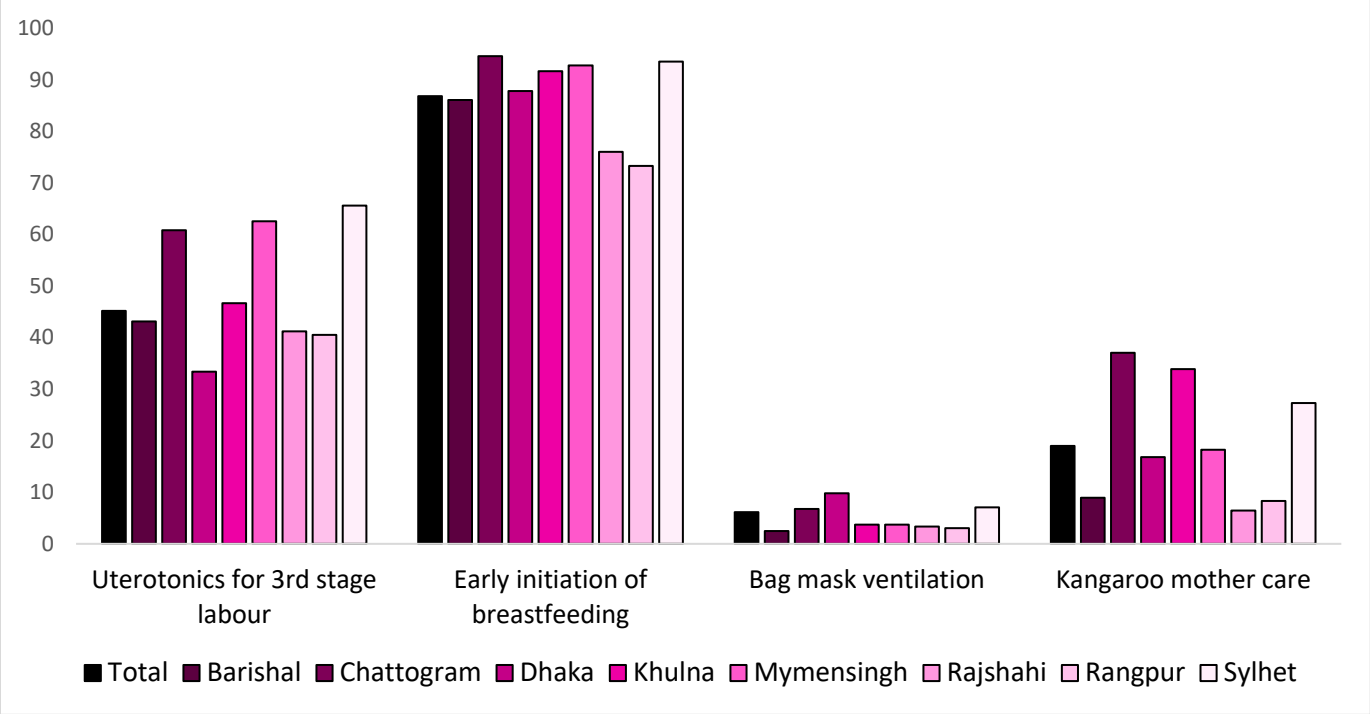
Overall comments on the indicators

Indicator name	Status	Comment
Uterotonic use for the third stage of labour	Partially available	Administering a uterotonic is one aspect of AMTSL. We could not directly obtain the numerator for uterotonics from the DHIS2 to report on this indicator. However, as a proxy of uterotonic administration, we obtained the elements related to AMTSL.
Early initiation of breastfeeding (within one hour of birth)	Available	Potentially, EIBF can be over-reported due to inaccuracies related to reporting timing. The newborn may have been breastfed, but this may have happened after one hour of birth. There are well-recognised issues related to the accurate reporting of timing, and evidence suggests that these issues are exacerbated at the time of birth and during the immediate postnatal period when both women and health workers may miscalculate time. Additionally, breastfeeding is a multi-step process and it is likely that data collectors, health workers, and mothers may identify different parts of the breastfeeding process as the time of EIBF, e.g. putting the infant to the breast or when the newborn latches or starts suckling. Breastfeeding initiation is not a one-time, easily recorded event. Register design can improve the accuracy of this aspect by including one part of the EIBF process, such as 'putting the infant to the breast' or 'suckling'.
Bag and mask ventilation	Available	Bag and mask ventilation can potentially be underreported if this is considered as a proxy for resuscitation because BMV may not be initiated when a newborn already responds to tactile stimulation and suction using a penguin sucker. When identifying fresh stillbirths and live births, it can be difficult to identify whether a newborn is breathing or not. It is also difficult to differentiate between fresh and macerated stillbirths when reporting the values for this indicator.
Kangaroo mother care	Partially available	It can be difficult to measure initiated KMC, which includes birthweight measurement at admission, skin-to-skin care, post-admission counselling, and follow-up over the phone. Additionally, children born outside a facility may subsequently receive KMC in a facility. Therefore, this indicator cannot measure the rate of KMC received within the facility using the reported values of these data elements. The denominator issue here is that it cannot be calculated directly from a column. The birthweight column must be carefully reviewed to identify newborns who had been admitted with a birth weight below 2,000 g.
Neonatal infection treatment	Not available	There are issues with the identification of suspected sepsis for reporting this indicator. Additionally, this numerator had previously not been fully available in the DHIS2. It is partially available from the revised IMCI dataset using the 'first dose of Gentamicin' element. Moreover, no data for antibiotic coverage is available for the inpatient ward. However, these elements can be captured from the outpatient ward using the IMCI register.

Indicator coverage

Figure 5 shows the coverage of selected ENAP indicators available in the DHIS2 for the year 2019. The coverage of uterotonics for third-stage labour, the early initiation of breastfeeding, BMV and KMC were 45%, 87%, 6%, and 19%, respectively. **Table 1** from Annex shows the exact numerator and denominator counts for these coverages.

Figure 5: Coverage of the DHIS2 indicators in health facilities



Uterotonics administration for third-stage labour. The coverage of uterotonics administration for third-stage labour varied across divisions. The lowest coverage was 33.4% (observed in Dhaka) and the highest was 65.6% (in Sylhet).

Early initiation of breastfeeding. The coverage of EIBF ranged from 73.3% to 94.6% across divisions. The lowest coverage was observed in Rangpur and the highest in Chattogram.

Bag and mask ventilation. The coverage of BMV was low across divisions. The lowest coverage was 2.5% (observed in Barishal) and the highest was 9.8% (in Dhaka).

Kangaroo mother care. The coverage for KMC ranged from 6.5% to 37.0%. The lowest coverage was observed in Rajshahi and the highest in Chattogram.

Data quality dimensions

Internal consistency

Figure 6 shows the time-trend range for the months of 2019 concerning the number of normal deliveries with AMTSL and the newborn being breastfed before the age of one hour.

Figure 6: The consistency of the available numerator and denominator values related to uterotonics administration for third-stage labour

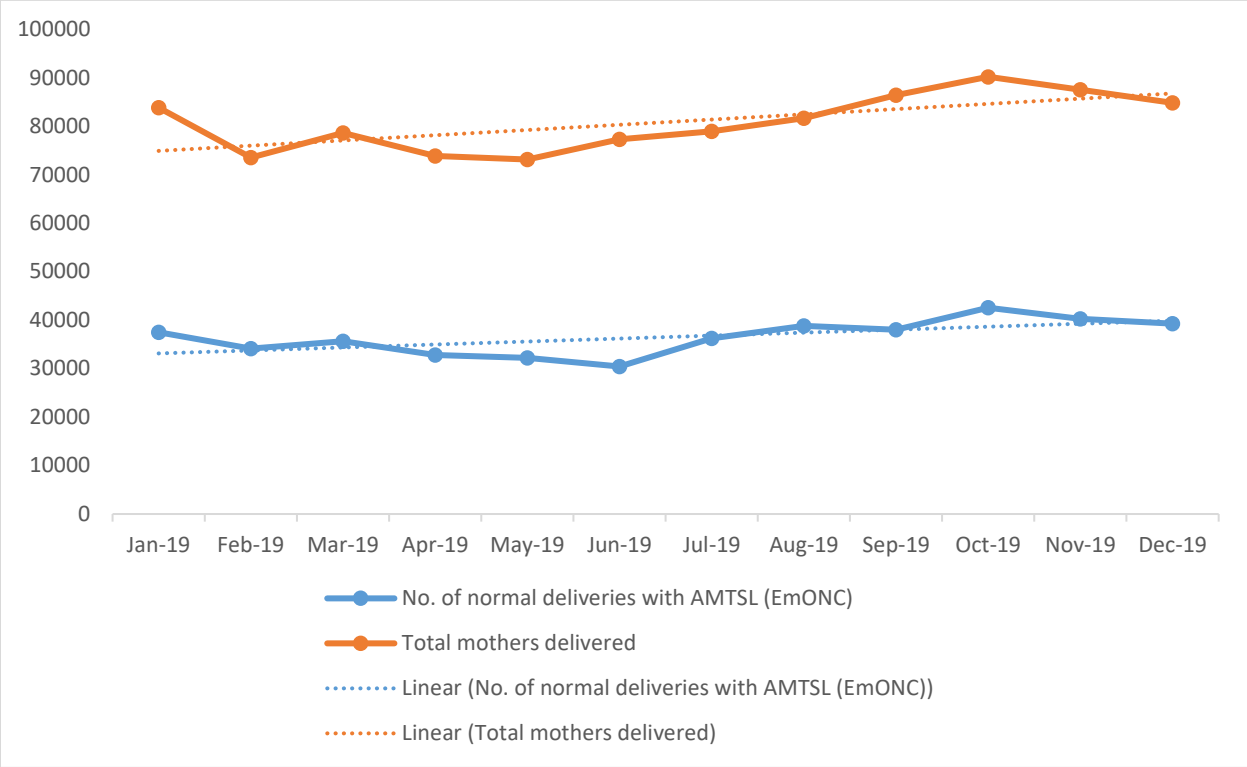


Figure 7 depicts the consistency of the numerators and denominators for the early initiation of breastfeeding. The figure shows an upward trend in both the numerators and denominators. The overall data are internally consistent over each month of 2019.

Figure 7: The consistency of the numerator and denominator values of EIBF

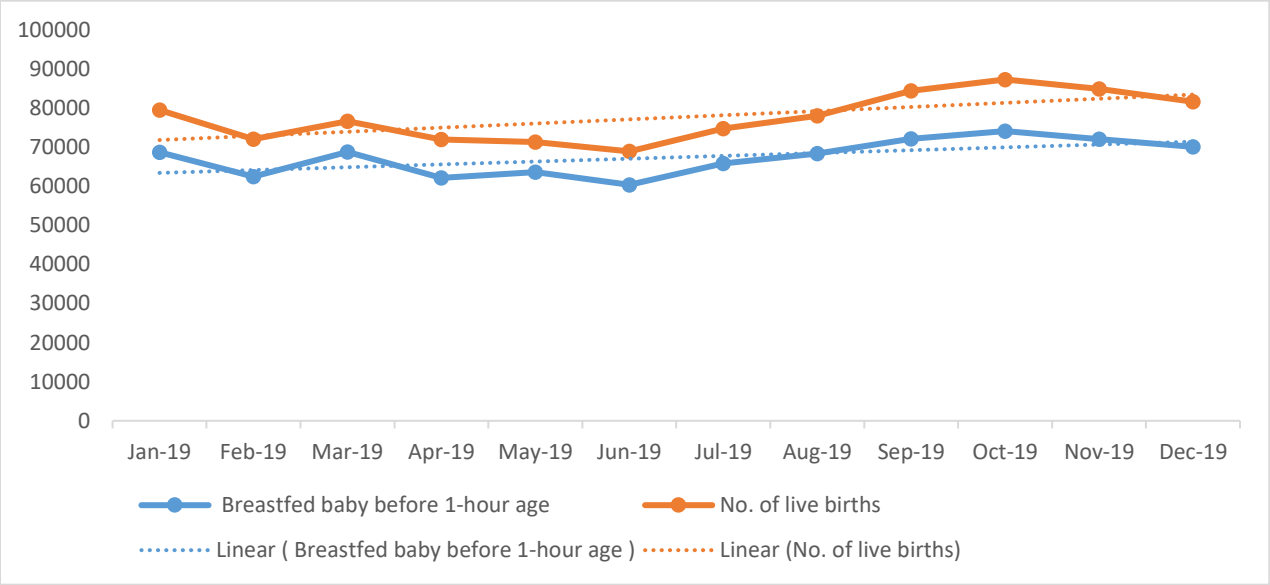


Figure 8 indicates a fluctuation in the reported number of infants receiving BMV over time. A small fluctuation is shown in the total birth numbers.

Figure 8: The consistency of the numerator and denominator values of BMV

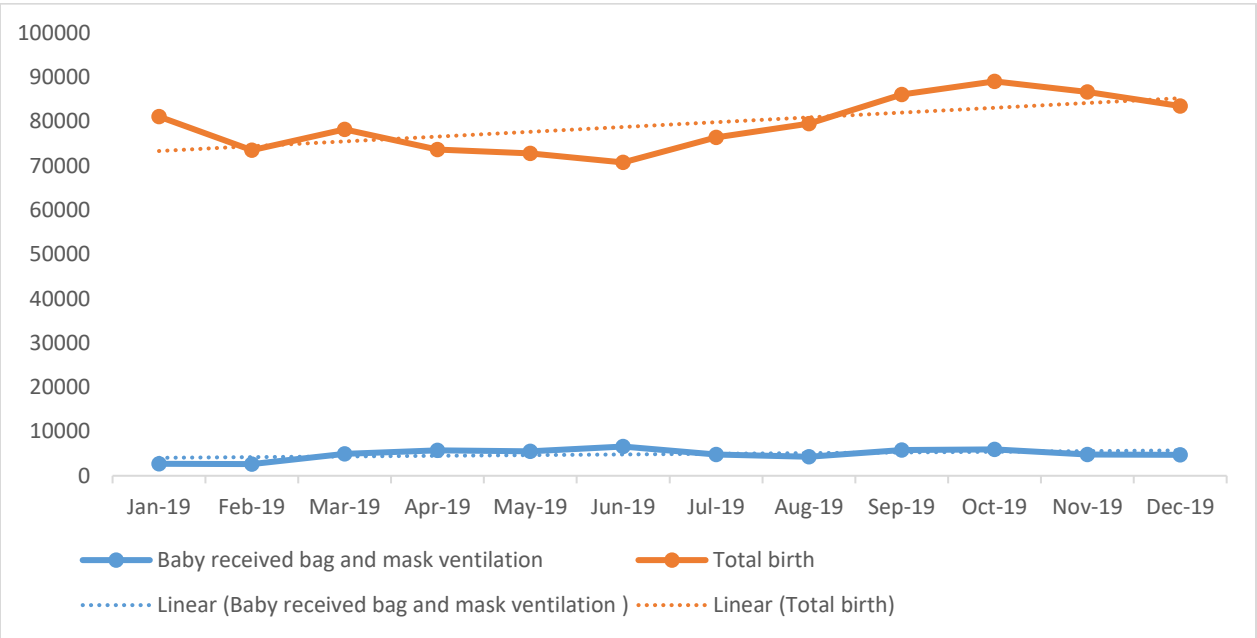


Figure 9 shows how the number of newborns initiated on facility-based KMC changed over time. A fluctuation can be observed in the number of newborns who received KMC during September and November 2019.

Figure 9: The consistency of the numerator and denominator values of KMC

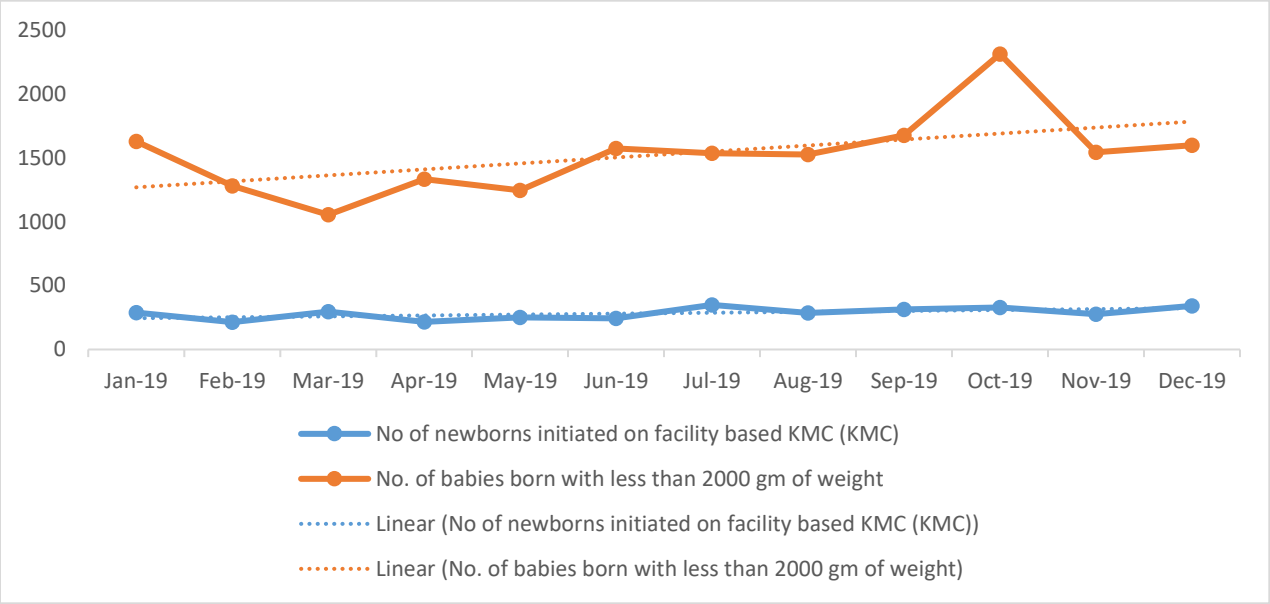
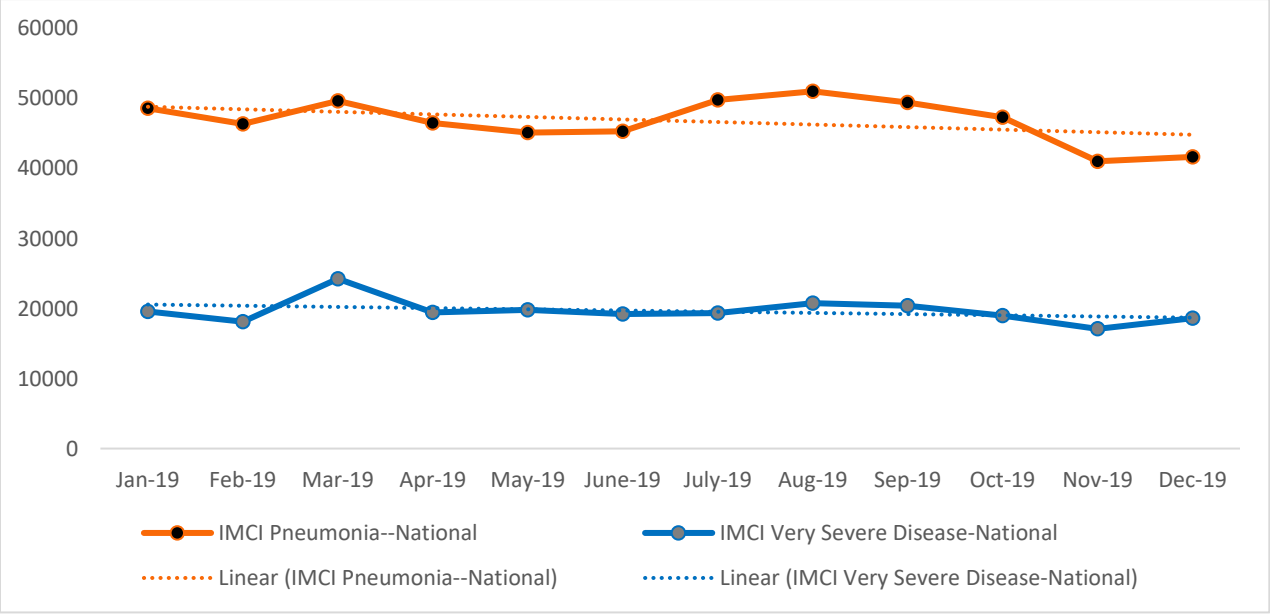


Figure 10 indicates a monthly consistency in the values of very severe diseases; however, the number of pneumonia cases indicates fluctuation over time.

Figure 10: The consistency of the values of pneumonia and very severe diseases derived from IMCI as a denominator of the treatment of neonatal infection



Timeliness

The timeliness of reporting/reporting rate on time by month for the selected reports is shown in **Figure 11**.

Emergency obstetric and newborn care. The reporting rate for the time of EmONC varied according to the month. The lowest on-time reporting rate was 54% for both May and July, 2019, and the highest was 71%, observed in November.

Kangaroo mother care. The on-time reporting rates for KMC ranged from 15% to 25%. The lowest reporting rate was observed in January and the highest was observed in November.

Integrated Management of Childhood Illness. The on-time reporting rate for IMCI by month was approximately 90%. The lowest on-time reporting rate was 86% (May) and the highest was 92% (November). The IMCI report performed better by month in terms of timeliness compared to other selected reports.

Figure 11: The timeliness of reporting by month

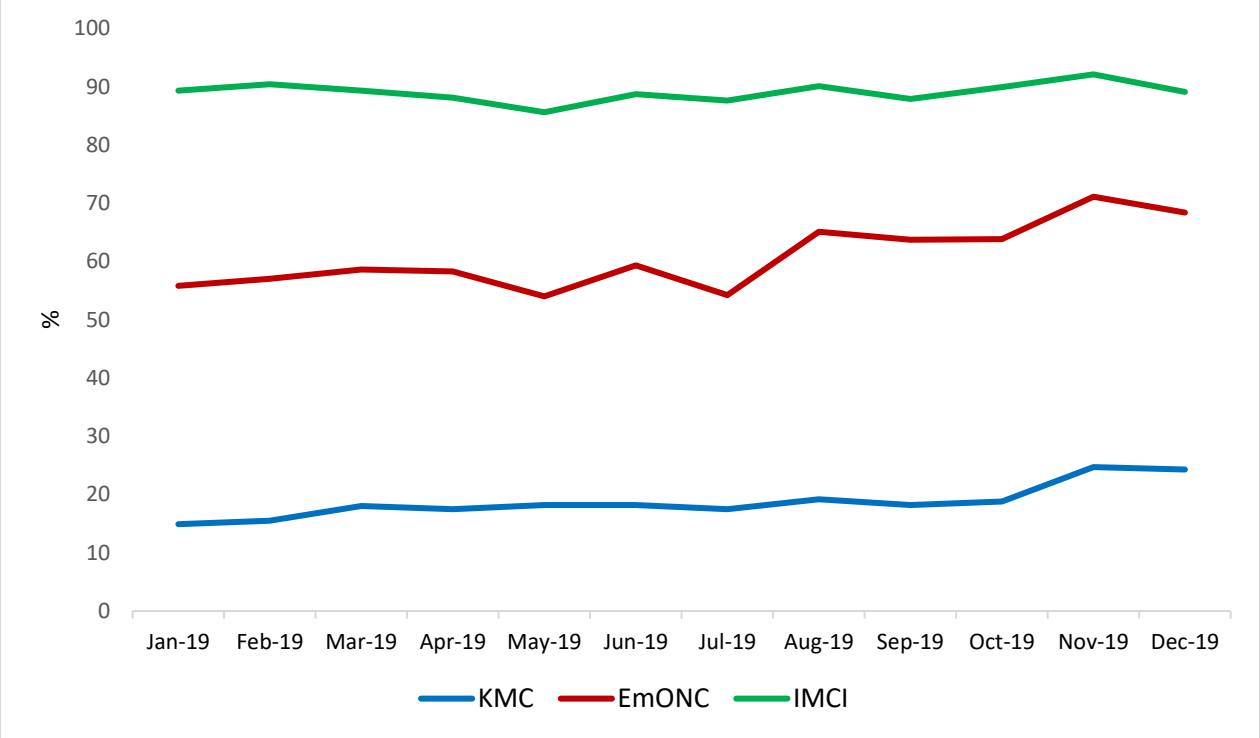


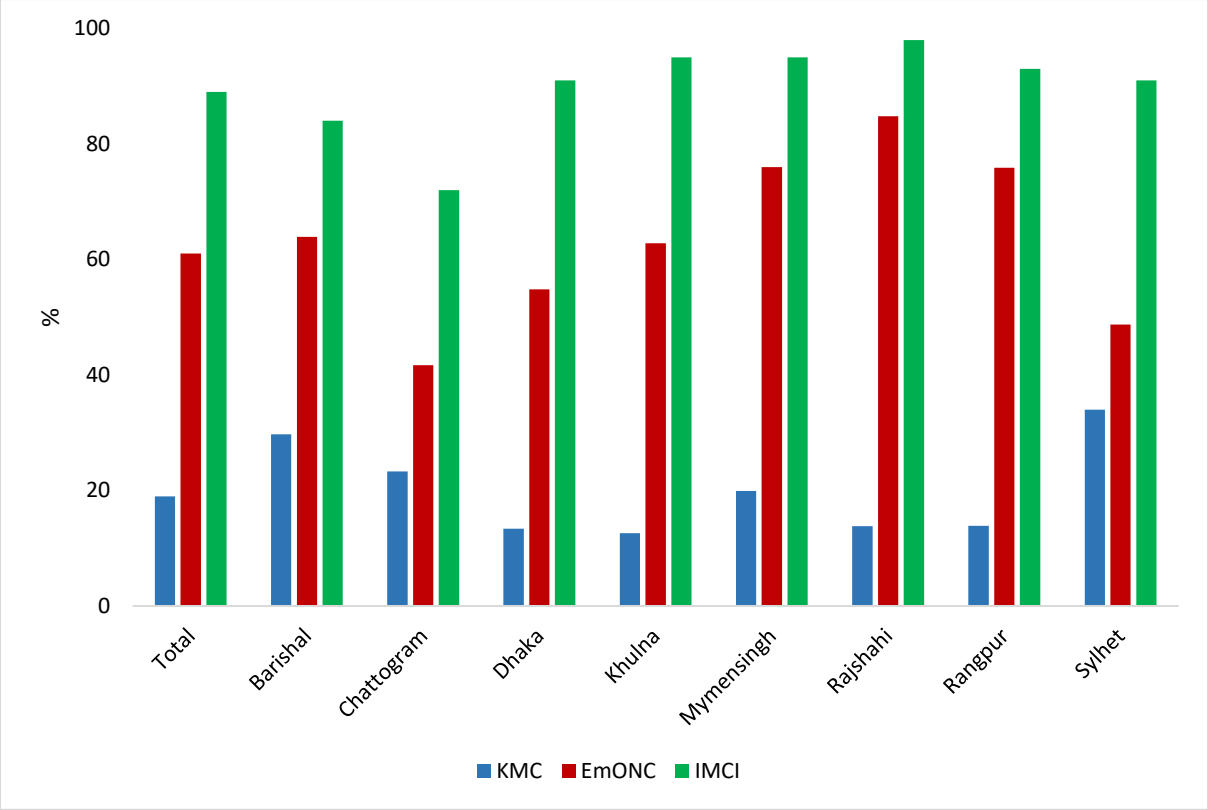
Figure 12 presents the timeliness of reporting by division for KMC, EmONC, and IMCI.

Emergency obstetric and newborn care. The on-time reporting rate for EmONC varied across divisions. The lowest on-time reporting rate was 42% (observed in Chattogram) and the highest was 85% (in Rajshahi).

Kangaroo mother care. The on-time reporting rate of KMC by division was 13%–34% across divisions. The lowest on-time reporting rate was observed in both Dhaka and Khulna and the highest was observed in Sylhet.

Integrated Management of Childhood Illness. The on-time range of reporting rate for IMCI was 72%–98% across divisions. The IMCI reports showed better performance by division in terms of timeliness compared to other considered reports.

Figure 12: The timeliness of division-based reporting



Completeness

Figures 13 shows the completeness of reporting/reporting rate by month for the EmONC, KMC and IMCI reports.

Emergency obstetric and newborn care. The reporting rate of EmONC was above 90% for each month. The range of the reporting rate was 91%–93%. The lowest reporting rate was 91% (observed in May).

Kangaroo mother care. The reporting rates for KMC ranged from 20%–27%. The highest reporting rate was observed in both November and December.

Integrated Management of Childhood Illness. The reporting rate for IMCI ranged from 93%–97%. The IMCI reports indicated better performance by month in terms of completeness compared to other considered reports.

Figure 13: The completeness of reporting by month for the year 2019

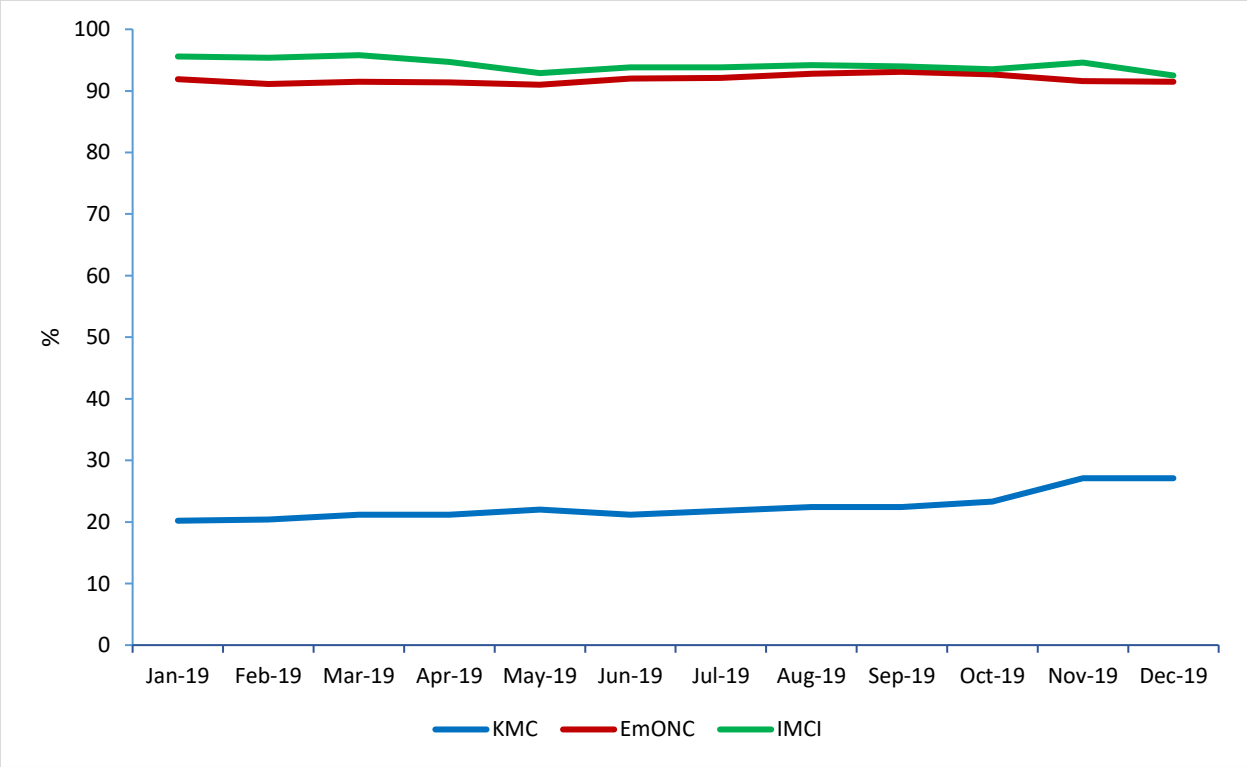


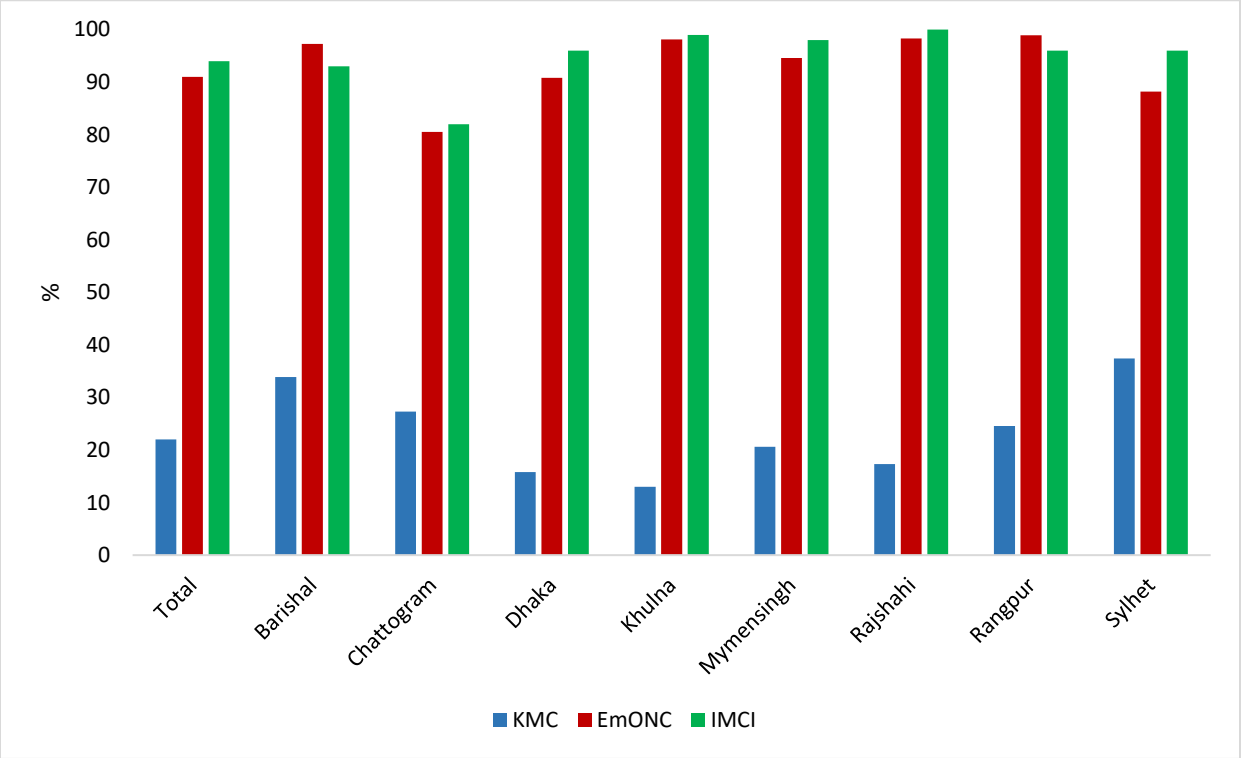
Figure 14 shows the completeness of reporting by division for 2019.

Emergency obstetric and newborn care. The reporting rate for EmONC varied across divisions. The lowest reporting completeness was 81% (observed in Chattogram) and the highest was 99% (in Rangpur).

Kangaroo mother care. The reporting rates for KMC ranged from 13%–37% across divisions. The lowest reporting completeness was observed in Khulna and the highest was recorded for Sylhet.

Integrated Management of Childhood Illness. The reporting rate of IMCI varied across the divisions. The range of reporting rates for IMCI was 82%–100%. The reporting rate of IMCI was 100% in Rajshahi.

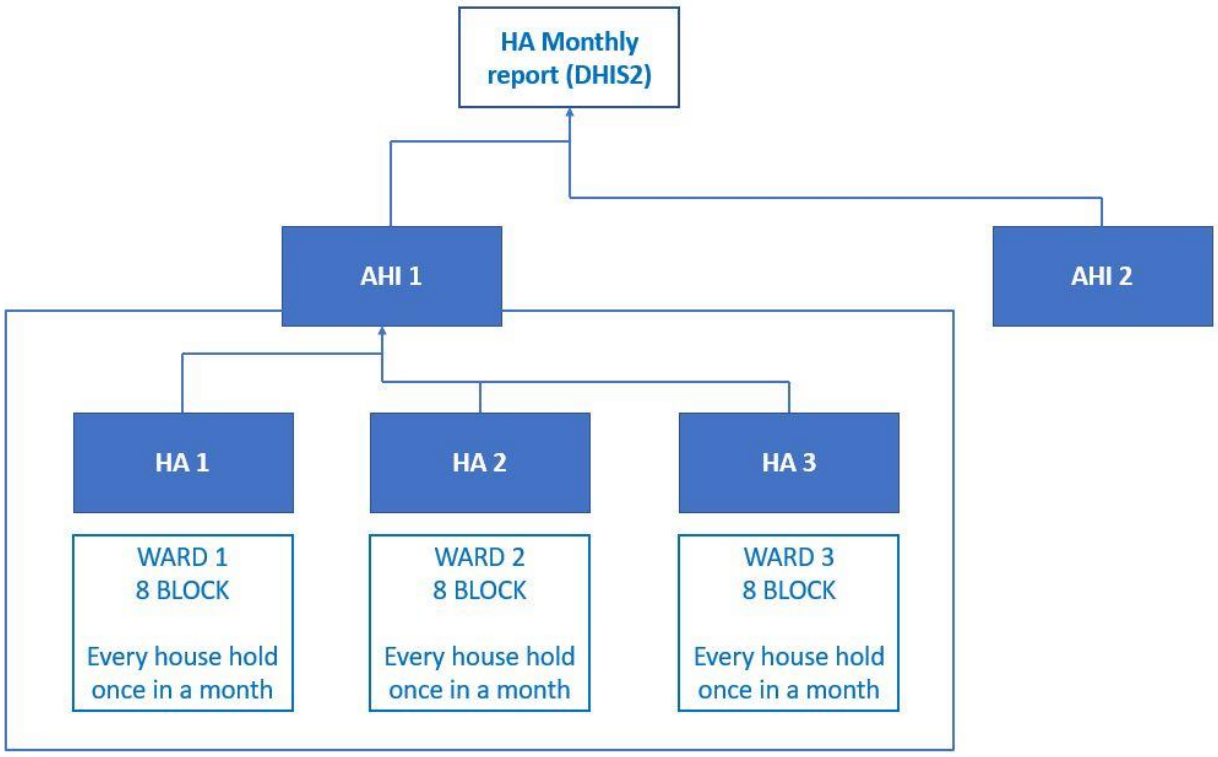
Figure 14: The completeness of reporting by division



Capturing population-based denominators

All the denominators used from the KMC, EmONC and IMCI datasets were facility-based. However, to receive the population-based indicators, we also used community-based datasets, e.g. health assistant (HA) reporting. Once a month, each HA collected data from every household in a ward covering eight blocks (**Figure 15**). HA is supposed to report, but due to the limitation the assistant health inspector (AHI) is reporting.

Figure 15: Flowchart of HA reporting mechanism



The following numbers were obtained from the HA report for the number of pregnancies, the number of deliveries and the number of live births for the year 2019 (**Table 8**).

Table 8: The population-based denominators

Place	Pregnant women old	Pregnant women new	Livebirth	Delivery at facility	Unskilled delivery at home	Skilled delivery at home
Bangladesh	11319884	2380439	2554194	1164821	320736	1159652
Kustia	143655	33672	36132	26811	1731	11854
Laksmipur	184848	39219	45691	15779	15562	15253

Another potential good source of newborn indicators: Inpatient module

The inpatient module can be useful in gathering data on newborn indicators. Newborn assessment and newborn treatment are the two sections that are related to newborns. Newborn assessment includes weight of baby, length of baby, body temperature etc and newborn treatment includes essential newborn care, resuscitation, antibiotic etc. Data on hospital inpatients is collected using the 'SCANU' data entry form and data elements. A total of 540 facilities (Upazila Health Complex = 427, District Hospital = 64, and Medical College Hospital=23) report on inpatient module.

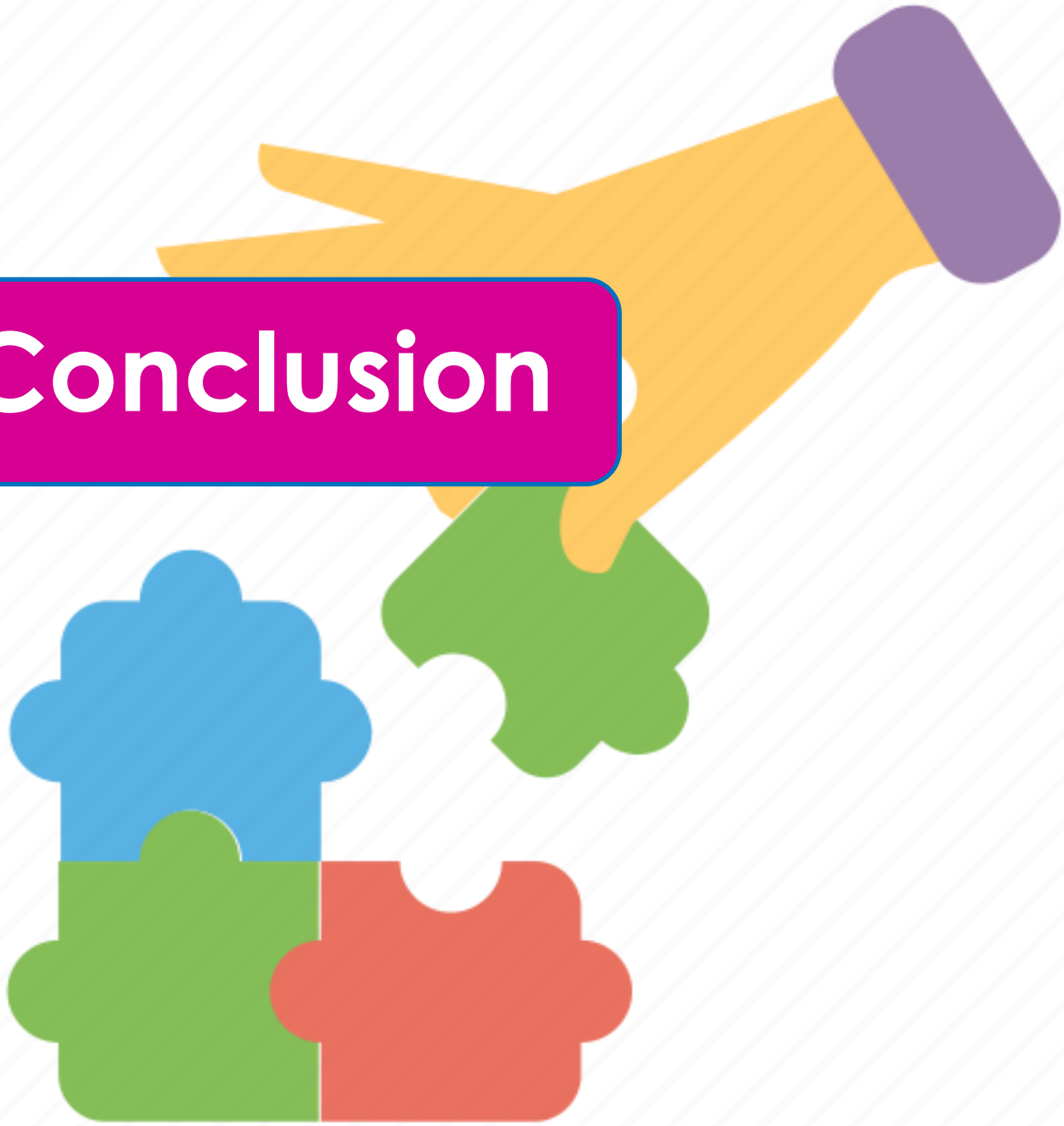
A sample of 'SCANU' data entry is provided below to demonstrate the variables covered by this module (**Table 9**).

Table 9: SCANU inpatient data entry form

Registration	
Date of Admission	2021-03-11
Registration no	418/1
Patient Name	B/O Khadiza
Sex	Male
Date of birth	2021-03-11
Age in year	0
Indoor word no	
Mobile no	
Type of service	SCANU
District	
Upazila	
Unions – Wards	
Fathers Name	
Mothers Name	
Husband Name	
Guardians Name (if guardian is not father/mother/husband)	
National ID	
Birth ID	
Health ID	
Diagnosis and outcome	
Outcome	Discharge on risk bond (DORB)
Main diagnosis	P700 Syndrome of infant of mother with gestational diabetes
Others diagnosis 1	P550 Rh isoimmunization of foetus and newborn
Others diagnosis 1	
Cause of death	
Date of discharge/death	2021-03-27
Newborn assessment	
Weight of baby on admission (KG)	2.97
Length of baby in admission	49
Low body temperature	Yes

Fever	
Severe chest in drawing	Yes
Movement in stimulus	
Umbilical redness	
Not able to feed	Yes
Fast breathing	Yes
History of convulsion	Yes
Newborn Treatment	
Essential newborn care	Yes
Resuscitation	
Thermal care with radiant warmer	Yes
Thermal care with Incubator	Yes
Tube feeding	Yes
Antibiotic	Yes
Kangaroo mother care	
Phototherapy	
Others	Yes
Delivery/abortion related information	
Mode of delivery	Caesarean section
Delivered/aborted by	Doctor
Number of live birth (current delivery, usually 1)	3
Number of still birth (current delivery)	
Gestational age	
Birth weight (gm)	3010
Abortion of mother	Yes

Conclusion



Conclusion

This study assessed the quality of the core ENAP indicators reported for national tracking through the DHIS2 and addressed the gaps and challenges involved in obtaining a national-level estimate for the selected indicators. The coverage of uterotonics for third-stage labour, the early initiation of breastfeeding, BMV and KMC were 45%, 87%, 6% and 19%, respectively, based on DHIS2 data for 2019. In terms of the coverage of the available indicators, the Chattogram and Sylhet divisions showed high coverage for the early initiation of breastfeeding, KMC and the active management of AMTSL.

The data reporting rate using the DHIS2 was 98% as of February 2019 [15]. Though this rate is adequate, the DHIS2 data quality is poor and incomplete in general. Overall, IMCI is the timeliest dataset compared to EmONC and KMC. The timeliness of KMC was surprisingly low. The reporting rates of IMCI and EmONC were approximately similar. However, KMC showed a lower completeness level using these reporting rates. The overall data for the numerators and denominators of these indicators were internally consistent with selected observed fluctuations. The linear trends showed an upward tendency for the data over time regarding the numerators and denominators.

We acknowledge some limitations for maintaining quality DHIS2 data. Data from remote health institutions can take up to three months to reach a central office [16]. Case Study Bangladesh, conducted by UNICEF, highlighted that the duplication of indicators in the register and programme, a lack of coordination, gaps in capacity development, inadequate utilisation and monitoring of measurement and data entry process and lacking infrastructures were the key challenges of routine health information systems [16].

Bangladesh DHIS2 can consider several options for improving its infrastructure. It is important to leverage innovative technologies as a means to strengthen systems. New technological advancements may provide possibilities for managing individual-level data, sharing data across systems, and developing innovative ways in which to visualise and disseminate data. However, leveraging the potential of innovative technologies is a complex process and this requires significant time and resources with appropriate government support [17]. Regular refresher training and incentives for increased performance can help to make systems more user-friendly. A national electronic health strategy and implementation framework can create the practice of using DHIS2 data for planning, setting priorities, and decision-making among stakeholder groups [13].

To capture the population level denominators health assistant report is a good source. However, due to limited accessibility the data quality assessment could not be conducted in this study. Furthermore, we

should also explore the opportunity to use the inpatient module for getting newborn indicators in our future efforts.

Our research contributes to the growing body of evidence demonstrating the use of DHIS2 data for the local and real-time monitoring of maternal and neonatal healthcare. However, to report on ENAP core coverage indicators, the availability and quality of each data element require improvement. Our assessment suggests that it is not yet appropriate to report on the indicators using the current available DHIS2 data. To improve the on-time capturing and reporting of existing data and ensure an optimum data flow, routine monitoring, evaluation and the assurance of regular maintenance of the DHIS2 by competent data scientists, coordinated activities at different levels of the healthcare system are needed. This can be initiated by deploying data managers/programmers and the use of data by local-level managers with a cultural shift.

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Annex

Table 1: The numerator and denominator values of the selected available indicators by division

	Numerator	Denominator
Indicator: The proportion of mothers giving birth in a facility who received a uterotonic immediately after giving birth		
Total	437805	969748
Barishal	21011	48723
Chattogram	77293	127127
Dhaka	104642	313558
Khulna	57829	123957
Mymensingh	37205	59485
Rajshahi	50712	123114
Rangpur	40247	99295
Sylhet	48866	74489
Indicator: The proportion of breastfed newborns before the age of one hour among live births		
Total	808991	931723
Barishal	39884	46362
Chattogram	112797	119270
Dhaka	264727	301563
Khulna	111512	121662
Mymensingh	51870	55901
Rajshahi	89628	117956
Rangpur	70385	96092
Sylhet	68188	72917
Indicator: The proportion of babies who received bag and mask ventilation		

Total	58615	951411
Barishal	1168	47605
Chattogram	8331	123070
Dhaka	30088	306198
Khulna	4588	123173
Mymensingh	2190	58770
Rajshahi	4014	119862
Rangpur	2974	98188
Sylhet	5262	74545
Indicator: The proportion of newborns initiated on facility-based KMC		
Total	3406	18304
Barishal	138	1547
Chattogram	752	2031
Dhaka	1287	7649
Khulna	461	1362
Mymensingh	179	982
Rajshahi	114	1762
Rangpur	147	1768
Sylhet	328	1203

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