ASSESSING MATERNAL AND NEWBORN HEALTH HOSPITAL DATA IN CAMBODIA
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We wish also to acknowledge the contributions of staff from: the Health Information System Bureau in the Ministry of Health; the provincial health departments of Kampong Cham, Kampot, and Takeo; the Ang Roka Operational District Office; and Khmer Soviet Friendship Hospital, Kampong Cham Provincial Hospital, Kampot Provincial Hospital, Takeo Provincial Hospital and Ang Roka Referral Hospital. Their insights, views, suggestions and experiences were crucial to the implementation of the assessment.
1. Background

In 2015, Cambodia adopted its *Five-year Action Plan for Newborn Care, 2016–2020* to address preventable causes of newborn death. The Plan aims to improve the quality of childbirth and immediate newborn care through implementation of Early Essential Newborn Care (EENC) in health facilities. Indicators for monitoring and evaluation are included to track progress and assess the impact of EENC. Fifteen indicators measure impact on newborn health outcomes in hospitals (Box 1). Hospital information systems, which provide timely, reliable and accurate data, are critical for reporting these indicators.

Hospitals that have introduced EENC report hospital impact indicators on a monthly basis to the EENC Coordinator in the Ministry of Health. Inconsistencies in reported data have been identified, for example, the number of births disaggregated by birthweight not equalling the total number of births. These highlight the need to understand how data quality can be improved for decision-making. The Working Group for Newborn Care and Integrated Management of Childhood Illness under the Ministry of Health and the National Maternal and Child Health Center therefore decided to conduct an assessment of hospital data on maternal and newborn health.

2. Objectives

The objectives of the assessment were:

- to determine how data on maternal and newborn health are recorded and reported in hospitals;
- to assess reporting accuracy of EENC hospital impact indicators;
- to identify challenges to generating timely, complete and consistent data; and
- to identify actions to improve recording and reporting of maternal and newborn health data.

**Box 1. EENC hospital impact indicators**

<table>
<thead>
<tr>
<th>Live births</th>
<th>Stillbirths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthweight &lt; 2500 grams (g)</td>
<td>Preterm births</td>
</tr>
<tr>
<td>Birthweight ≥ 2500 g</td>
<td>Preterm deaths</td>
</tr>
<tr>
<td>Neonatal care unit admissions</td>
<td>Deaths with birthweight &lt; 1500 g</td>
</tr>
<tr>
<td>Sepsis cases</td>
<td>Deaths with birthweight 1500-2499 g</td>
</tr>
<tr>
<td>Sepsis deaths</td>
<td>Deaths with birthweight ≥ 2500 g</td>
</tr>
<tr>
<td>Birth asphyxia cases</td>
<td>Neonatal deaths</td>
</tr>
<tr>
<td>Birth asphyxia deaths</td>
<td></td>
</tr>
</tbody>
</table>
3. Methods

The assessment was conducted from 18 to 30 December 2016 in five hospitals: Khmer Soviet Friendship Hospital (national hospital), Kampong Cham Provincial Hospital, Kampot Provincial Hospital, Takeo Provincial Hospital and Ang Roka Referral Hospital (district hospital). These facilities were selected taking into account financial and logistical considerations as well as duration of implementation of EENC, and ensuring representation of facilities at the national, provincial, and district levels. While EENC had only been introduced in the three provincial hospitals at the time of the assessment, the national and district hospitals were included to understand data recording and reporting practices at different health facility levels. The assessment team was comprised of six members from the Ministry of Health, the National Maternal and Child Health Center, and the World Health Organization Representative Office in Cambodia and the Regional Office for the Western Pacific.

In each hospital, discussions were held with staff from the obstetrics and gynaecology (O&G) and paediatric departments as well as from the health information system (HIS) unit to understand how maternal and newborn data are recorded and reported. Reporting accuracy of hospital impact indicators was verified for the randomly selected months of July, August and September 2016 by comparing recounted values from O&G and paediatric department registers with: (1) values reported for EENC monitoring (for the three provincial hospitals), and (2) values reported in HIS for EENC indicators that were included. Following the verification, further discussions were held with hospital staff to identify reasons for any variations between counted and reported values and actions to improve data quality.

Technical officers from the HIS Bureau of the Ministry of Health, as well as HIS officers from the provincial health departments (PHDs) of Kampong Cham, Kampot and Takeo, and the Ang Roka Operational District (OD) Office also contributed to discussions to understand how maternal and child health data are collected from hospitals.
4. Findings

4.1 Data reporting in the health information system

Since 2010, functioning health facilities across Cambodia have reported data for over 500 indicators to the HIS on a monthly basis through a web-based system. Hospitals report data using the HO2 form, and health centres use the HCI form. The forms collect data on diagnoses of inpatient and outpatient cases and deaths, classified by ICD-10 (International Statistical Classification of Diseases and Related Health Problems, 10th revision) codes and disaggregated by age. A new age category for newborns (0–28 days) was included when the web-based system was introduced. Specific sections on maternal and child health and birth spacing are also included to collect data on antenatal care visits, delivery complications, number of births, maternal and neonatal deaths, postpartum care and use of family planning commodities. Compared to the HCI form, the HO2 form collects additional information on referrals and includes more diagnoses (for example cancer and orthopaedic conditions). Five EENC hospital impact indicators are included in the HIS reporting forms: (1) live births, (2) birthweight < 2500 g, (3) birthweight ≥ 2500 g, (4) stillbirths and (5) neonatal deaths.

Health facilities have a designated staff member responsible for collecting and reporting HIS data into the web-based system. For rural health centres without Internet access, hard copies of the reporting form are sent to the OD office where data are then entered in the web-based system. HIS officers at OD offices and PHDs review the reported data for discrepancies, using in-built validation functions of the HIS web system, prior to submission to the HIS Bureau of the Ministry of Health. The HIS officers of Kampot PHD and Ang Roka OD mentioned also conducting visits to health facilities to verify data quality. Once health facility data are submitted to the Bureau, data are extracted into the central HIS database. The Bureau generates monthly dashboards summarizing data completeness, and also requests clarifications on data where necessary through PHDs and OD offices. Due to funding restraints, HIS Bureau officers conduct only limited field visits. Data collected are consolidated into an annual report for the National Health Congress every year.

Challenges with reporting in the HIS mentioned by officers at the central level were: frequent HIS staff turnover at the provincial, district and facility levels; lack of Internet coverage in certain areas hindering use of the web-based system; and insufficient knowledge of ICD-10 coding among hospital and HIS staff. While HIS staff in PHDs, OD offices and health facilities have been trained on use of the web-based system and completion of reporting forms, there has been no training on definitions of the actual indicators and very limited training on ICD-10 coding. At the provincial level, HIS officers stated the lack of feedback on data reported as a challenge. PHD officers in Kampong Cham, Kampot and Takeo also mentioned that they did not cross-check data in the central HIS database against the data they reported.
4.2 Maternal and newborn health data recording and reporting in hospitals

Systems for recording and reporting maternal and newborn health data were similar across the five hospitals with a few differences in sources used for reports, methods of tallying data and the number of reports completed. Recording and reporting is paper-based in all hospitals, but the final EENC and HIS reports are submitted electronically.

Maternal health data

Detailed data on a woman who delivers at the hospital are recorded in her patient chart, based on which key data are summarized in the: (1) maternity register, in which data are recorded on admission to the delivery ward and after delivery; (2) delivery register, which is completed following delivery; and (3) postnatal register, which captures key details on postnatal care. Standardized Ministry of Health registers are used (Fig. 1). In Ang Roka Referral Hospital, no postnatal register was used. Similar data are recorded in the maternity and delivery registers, with the sole distinction that delivery registers also include information on the newborn (such as sex, birthweight, care given). In addition to these four main sources, all hospitals also maintained a separate register for HIV-positive mothers, a register for information on the Mother-Baby Friendly Hospital Initiative, and one register for the government delivery incentive programme. The patient chart is completed by doctors and midwives, while data entry in registers is normally done by midwives.

In all hospitals, two main reports were completed by the O&G departments: (1) a daily report on patient movements (such as patient admissions, discharges, bed occupancy) for sharing at the daily hospital morning meetings and submission to senior management; and (2) a monthly HO2 report submitted to the HIS unit. The HO2 report is completed based on data from patient charts, and the delivery or maternity registers depending on the hospital. In the three provincial hospitals that have introduced EENC, monthly reporting of EENC hospital impact indicators was done in Excel sheets developed by the Ministry of Health. In Kampong Cham and Kampot Provincial Hospitals, the EENC monthly report was based on data in the delivery register. In Takeo Provincial Hospital, data for both EENC and HO2 reports were derived from the maternity register. Except for reporting on patient movement, formal tally sheets were not used in any of the hospitals to aggregate monthly data. Of the three provincial hospitals, only Takeo Provincial Hospital cross-checked EENC and HIS reports for data consistency of common indicators.

Obstetrics and gynaecology department staff mentioned the following main challenges to recording and reporting data:

- significant time spent;
- duplication of efforts in recording similar data in the maternity and delivery registers;
- use of incorrect indicator definitions in the HO2 report as no training was conducted, including:
  - Neonatal deaths were subtracted from live births in one provincial hospital.
In the provincial and district hospitals, neonatal deaths reported under the indicator “neonatal deaths < 24 hours” were also not counted under “total neonatal deaths”.

In one provincial hospital, indicators on delivery type and maternal diagnoses were considered mutually exclusive. For example, if a woman delivered prematurely by caesarean section and then experienced postpartum haemorrhage, her case was only counted under the indicator “deliveries by caesarean section”, and not also under “number of preterm deliveries” or “number of postpartum haemorrhage cases”. A doctor noted that this under-reporting has resulted in forecasting problems for medicines.

- inadequate support to clarify definitions of maternal and newborn health indicators as HIS officers would not have the technical knowledge;
- lack of feedback on data reported; and
- inadequate data analysis skills; that is, staff wanted to analyse and use the data to improve service delivery, but did not know how, and the paper-based systems also made it difficult to collate and review data.

Newborn health data

Data on newborn babies who remain with their mothers in postnatal wards are recorded in their mothers’ patient charts in all five hospitals. Babies requiring additional care (referred either from the maternity ward or from outside the hospital) are admitted to the paediatric ward.
Paediatric departments in the five hospitals generally recorded data in three main sources: (1) the patient chart, (2) the paediatric register, and (3) the neonatal register (Fig. 2). The patient chart is initiated on admission of the newborn baby at the paediatric ward. Standard Ministry of Health paediatric registers are used to summarize key data (such as age, sex, diagnosis on admission, diagnosis on discharge, and duration of admission) from patient charts. For newborn babies, a neonatal register is also completed with similar data to the paediatric register in addition to details such as mode of delivery, birthweight and gestational age. No standard neonatal register has been developed. The Kampot and Takeo provincial hospitals were using registers developed through support from the East Meets West foundation/Thrive Networks, while the three other hospitals had created their own. Data entry in the patient chart and registers is done by doctors or nurses.

Across the five hospitals, three main reports were submitted (Fig. 2) with additional reports completed depending on the hospital. As with O&G departments, a daily report is completed on patient movements and a monthly paediatric HO2 report submitted to the HIS unit. The HO2 report is based on data in the paediatric register and the daily reports on patient movement. Data for EENC hospital impact indicators in the three provincial hospitals are derived from the neonatal register. No formal tally sheets are used in any hospital to complete reports; doctors and nurses maintained their own notebooks to summarize data on a daily basis.

Fig. 2: Recording and reporting of newborn health data
In addition to the lack of a standardized neonatal register, paediatric staff mentioned the following challenges to recording and reporting data:

- significant time spent;
- difficulties in entering data on newborn cases and deaths in the HO2 form due to confusion on how to enter neonatal diagnoses; very few diagnoses listed in the form relate to the neonatal period (neonatal ICD-10 codes have not been assigned), therefore, staff report the majority of neonatal cases and deaths under the category "other"; and
- lack of feedback on data reported.

4.3 Reporting accuracy of EENC hospital impact indicators

Reporting accuracy was measured through the verification factor (VF) (recounted number of events from register/reported number of events). A VF above 1 suggests under-reporting and below 1 over-reporting of data. Factors above 1.1 or below 0.9 suggest systematic under- or over-reporting, respectively, and inaccuracies in data transfer.

Of the five indicators common to EENC and HIS reporting, accuracy in data transfer (VF between 0.9 and 1.1) was noted for the indicators: live births, birthweight < 2500 g and birthweight ≥ 2500 g for the period assessed (Table 1). For stillbirths, reported and recounted values were an exact match in Takeo Provincial Hospital and Ang Roka Referral Hospital. In the other three hospitals, there was consistent under- or over-reporting of stillbirths due to incomplete recording in registers leading to errors in tallying and reporting. Takeo Provincial Hospital had the same data for all indicators except neonatal deaths for EENC and HIS reporting as cross-checking is done.

Table 1: Average verification factors for five newborn indicators common to EENC and HIS reporting for July–September 2016 in five hospitals

<table>
<thead>
<tr>
<th></th>
<th>Khmer Soviet 1</th>
<th>K Cham 1</th>
<th>Kampot 1</th>
<th>Takeo 1</th>
<th>Ang Roka 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EENC</td>
<td>HIS 2</td>
<td>EENC</td>
<td>HIS</td>
<td>EENC</td>
</tr>
<tr>
<td>Live births</td>
<td>ND</td>
<td>1.05</td>
<td>0.97</td>
<td>1.00</td>
<td>0.99</td>
</tr>
<tr>
<td>Birthweight &lt; 2500 g</td>
<td>ND</td>
<td>1.06</td>
<td>0.97</td>
<td>1.14</td>
<td>1.00</td>
</tr>
<tr>
<td>Birthweight ≥ 2500 g</td>
<td>ND</td>
<td>1.04</td>
<td>1.00</td>
<td>0.94</td>
<td>1.01</td>
</tr>
<tr>
<td>Stillbirths</td>
<td>ND</td>
<td>1.84</td>
<td>0.78</td>
<td>0.67</td>
<td>0.97</td>
</tr>
<tr>
<td>Neonatal deaths</td>
<td>ND</td>
<td>3.5</td>
<td>1.19</td>
<td>8.00</td>
<td>1.28</td>
</tr>
</tbody>
</table>

1 Khmer Soviet Friendship Hospital, Kampong Cham Provincial Hospital, Kampot Provincial Hospital, Takeo Provincial Hospital, Ang Roka Referral Hospital
2 Average for July and August, as registers were incomplete for September and count could not be verified.

ND = No data as the hospital had not yet introduced EENC at the time of the assessment and was therefore not submitting EENC hospital impact indicator reports.
Excluding Ang Roka Referral Hospital where no neonatal deaths took place over the period assessed, neonatal deaths were mostly under-reported. Verification factors for EENC reporting ranged from 0.83 to 1.28. Under-reporting was significant in the HIS, where a total of three neonatal deaths were reported across the four hospitals compared to a total of 56 deaths recounted from registers an underestimation of 95%. This underestimation is explained by three factors:

- Departments within Kampong Cham Provincial Hospital are using the old (pre-2010) HO2 report template where there is no column to report data on newborn deaths. Newborn data submitted to the HIS are based on “informed guesses” from data reported under the category “0 to < 5 years”. The old template is being used because the hospital has not yet developed new forms to report on HO2 data.

- A review of the HO2 reports of Khmer Soviet Friendship Hospital, Kampot Provincial Hospital and Takeo Provincial Hospital showed a total of 29 neonatal deaths had actually been reported, even though the central HIS database only showed three deaths for the hospitals. The paediatric departments reported 25 deaths (86%). This suggests that the HIS database is only extracting neonatal deaths reported by O&G departments.

- The maternity section of the HO2 report has two indicators: “neonatal deaths < 24 hours” and “total neonatal deaths”. Due to use of incorrect indicator definitions, provincial hospitals are not counting deaths reported < 24 hours under total deaths. Though Takeo Provincial Hospital reported four neonatal deaths < 24 hours in the month of July 2016, the HIS database still reported no deaths as the value for total neonatal deaths is being extracted.

Of the remaining 10 EENC hospital impact indicators, VF s for neonatal care unit admissions and birth asphyxia cases suggest consistency in recording to reporting of the indicators (Fig. 3). Under- or over-reporting is noted for preterm births and deaths, deaths by birthweight, sepsis cases and deaths and birth asphyxia deaths. Staff attributed reporting inaccuracies to use of incorrect indicator definitions, incomplete recording (namely for gestational age to count preterm births and deaths) and babies born outside of the hospital being counted by error (indicators measure outcomes for babies born in the hospital only). In one hospital, staff were counting sepsis cases based on the primary diagnosis, thereby excluding newborns who had sepsis as a secondary condition. In two hospitals, staff mentioned that recounted values for sepsis and birth asphyxia deaths were inaccurate because the final cause of death might have changed and this would not have been corrected in the registers.
Another issue that was highlighted during discussions with staff on data quality was the inconsistency in newborn birthweight and gestational age data between maternity and paediatric wards. When newborn babies are transferred to the paediatric ward, their weight is taken again and gestational age estimated based on paediatric methods. Data reported for EENC indicators from the paediatric ward are based on these birthweights and gestational age estimations, rather than those indicated in the baby’s referral slip from the maternity ward. As a result, there were data inconsistencies. For example, for some months, the number of neonatal care unit admissions of babies born in the hospital of a specific birthweight exceeded the total number of live births of the same birthweight.
5. Conclusions and recommendations

The Ministry of Health has taken significant steps to track progress of EENC implementation through the monthly collection of hospital impact indicators. Since 2010, the web-based HIS also collects newborn data, including five EENC indicators.

This assessment found that 5 of 15 hospital impact indicators are accurately reported for EENC monitoring and to the HIS, while there seems to be consistent under- or over-reporting of the remaining indicators. This can be attributed to several factors: paper-based systems, which are prone to errors in data transfer; incomplete recording in registers; and use of incorrect indicator definitions. A key finding was an under-reporting of neonatal deaths by 95% in the central HIS database (three reported deaths versus 56 deaths recounted from registers) for four hospitals for the period assessed, mainly because deaths reported by paediatric departments are not being counted by the database. Other factors that are likely to influence data quality are the multiple recording sources, non-use of formal tally sheets, and insufficient feedback to hospitals on data reported that would help to identify strengths and areas for improvement in data quality. Inconsistencies in indicators common to EENC and HIS reporting were also identified due to different registers being used as the source document and lack of cross-checking of data.

Based on the assessment findings, staff across the hospitals identified the following actions to improve quality of data: (1) ensure complete recording of data, (2) designate staff for data recording and reporting in maternity and paediatric wards, (3) train staff on recording and reporting, and (4) periodically cross-check data in EENC and HIS reports for consistency.

To improve recording and reporting of hospital impact indicators and maternal and newborn data more broadly, the Working Group for Newborn Care and Integrated Management of Childhood Illness and the National Maternal and Child Health Center may consider the following national actions:
Conclusions and recommendations

EENC reporting

- developing and disseminating an EENC hospital impact indicator guide with indicator definitions;
- advising paediatric departments to report EENC hospital impact indicator data based on birthweights and gestational age estimations provided in the referral slips from maternity wards;
- providing feedback to hospital staff on data reported during EENC supervisory visits;
- including hospital HIS officers in the EENC hospital core teams; and
- conducting at least annual data quality assessments, such as during EENC annual implementation reviews.

HIS reporting

- in discussion with the HIS Bureau, addressing the error in counting of neonatal deaths in the HIS database;
- reviewing the ICD-10 codes in the HO2 form to ensure that the neonatal diagnoses included (such as neonatal tetanus) have the correct codes;
- developing a standard neonatal care unit register;
- reviewing the maternity and delivery registers to identify duplication in data collected and determining whether all data can be collected in one register; and
- assigning staff within hospitals, and HIS and maternal, newborn and child health officers at the district, provincial and national levels to review maternal and child health sections of the HO2 reports on a quarterly basis to identify discrepancies, omissions and technical errors and to provide feedback.