EVERY NEWBORN ACTION PLAN METRICS

WHO technical consultation on newborn health indicators

Ferney Voltaire, France
3–5 December 2014

World Health Organization

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Contents

Acknowledgements

Abbreviations

ACS	antenatal corticosteroids
DHS	demographic and health survey
ENAP	Every Newborn Action Plan
HMIS	health management information systems
ICD	International Classification of Diseases
KMC	Kangaroo Mother Care
MICS	multiple indicator cluster survey
SARA	service availability and readiness assessment
SPA	service provision assessment
UNICEF	United Nations Children's Fund
UNFPA	United Nations Population Fund

Introduction

The Every Newborn Action Plan

The Every Newborn Action Plan (ENAP) was launched in June 2014. Its aim is to support countries in reaching the **target of fewer than 12 newborn deaths per 1000 live births and few than 12 stillbirths per 1000 births by 2030**. The plan is based on evidence published in *The Lancet Every Newborn* series and from consultation with Member States and many organizations and individuals. The Plan is supported by a World Health Assembly resolution adopted in May 2014 to support government leadership, policy-makers and programme managers to end preventable newborn deaths and stillbirths. It is closely linked to the Ending Preventable Maternal Mortality plan *(1)*.

ENAP is based on five strategic objectives (Figure 1) and includes technical guidance for refining national policy on newborn health in the context of health sector reform and wider reproductive, maternal, neonatal and child health strategies. It is a call to action to ensure that high-quality care at birth is at the heart of the continuum of care, and it lists the high-impact, cost-effective interventions required to end preventable maternal and newborn deaths and stillbirths, giving a triple return on investment (Figure 2).

Figure 1. Strategic objectives of the ENAP

1. Strengthen and invest in maternal and newborn care during labour, birth and the first day and first week of life
2. Improve the quality of maternal and newborn care
3. Reach every woman and newborn to reduce inequities
4. Harness the power of parents, families and communities
5. Count every newborn through measurement, programme-tracking and accountability

Defining and improving the metrics

Mortality must be measured in order to achieve the ENAP vision to end preventable newborn mortality and stillbirths, to determine whether the goals have been met, to monitor coverage of interventions and to ensure rapid feedback to evaluate whether the interventions are reaching those in need, especially the poorest families. To this end, 10 core indicators and 10 additional indicators were identified on the basis of the ENAP "impact framework" and published as part of both the ENAP and *The Lancet Every Newborn* series (Table 1) (2, 3). A working group was established by the ENAP steering team to set priorities and choose indicators, and the following steps were undertaken, with wide consultation:

Step 1. Choice of relevant indicators to be assessed

A large matrix was devised of all potentially relevant indicators, drawn from the Commission on Information and Accountability *(4)*, "Countdown to 2015" *(5)* and other globally relevant lists of indicators in current use. In accordance with a standard evaluation framework, more than 100 indicators were listed in terms of impact, coverage, process and input.

Figure 2. Packages in the continuum of care *(2)*
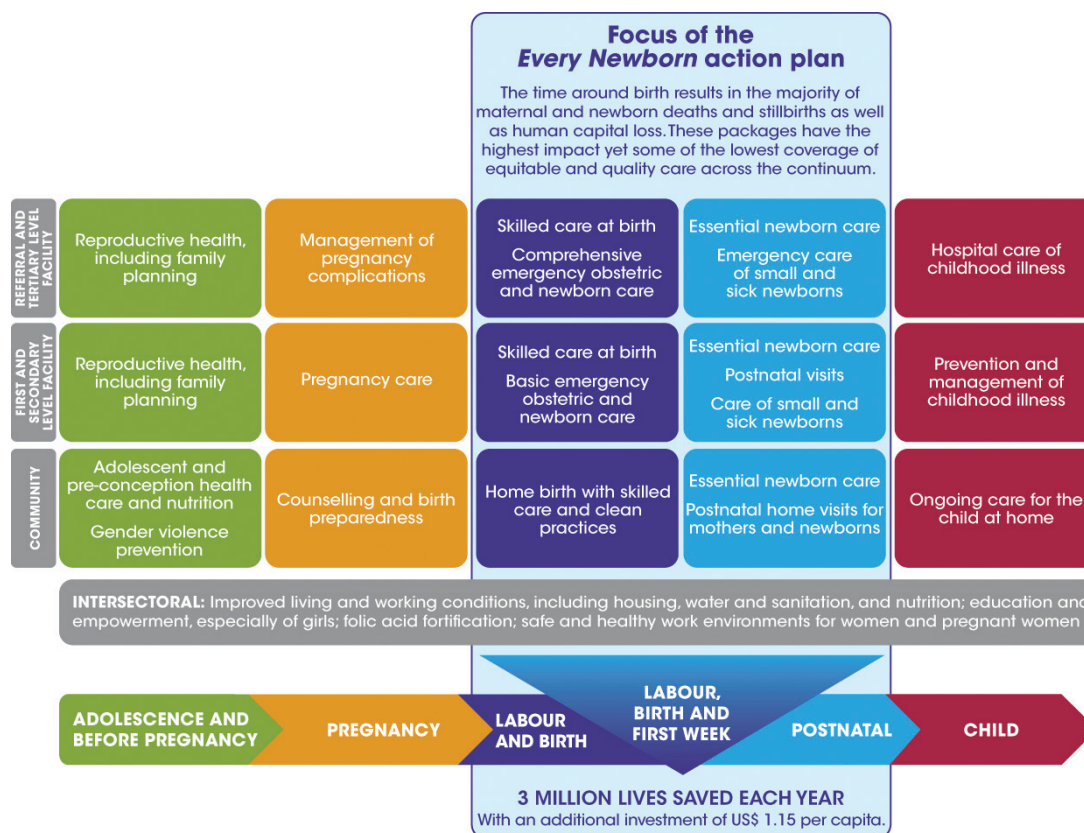
Step 2. Grading of each indicator

Indicators were graded from A to C, according to their direct importance and relevance to the ENAP targets of reductions in neonatal mortality and stillbirth rates and the five ENAP objectives (Figure 1). They were also graded from 1 to 3 on the basis of the availability of data for assessing them

Step 3. Selection of the 10 main indicators

By consensus scoring, the top 10 ENAP core indicators and an additional 10 were selected on the basis of their importance and relevance to the ENAP. As indicators were prioritized according to their relevance to the ENAP focus (category A), rather than data availability, not all the selected core indicators are currently well defined or tracked at global level.

The 10 core indicators and additional indicators are listed in Table 1, which was revised during the meeting to ensure that the measurements clearly address essential newborn care and the major gap of care for small and sick newborns.

Technical work is required to determine the current status of each core indicator with respect to its definition, data availability and the research required to find measurement tools. Table 1 is colour coded, with the indicators that require the most work identified in red. Impact indicators are shown in green; those in normal text have clear, agreed definitions, but the quality and quantity of data require improvement. Indicators of coverage of care of all mothers and newborns are shown in amber; the three identified for tracking are clearly defined, but data on the content and quality of the health care services delivered must be improved. Coverage of care for newborns at risk or with complications requires specific indictors for antenatal corticosteroid use, neonatal resuscitation,

Kangaroo Mother Care (KMC) and treatment of severe neonatal infection. These indicators are shown in red, as their measurement requires the most work, with current gaps in definitions. New research is required to validate these indicators and to assess the feasibility of their use at scale in health management information systems (HMIS). As this section represents the most substantial work, the meeting focused on these indicators, on the basis of advance work undertaken by task teams assigned to each indicator.

Table 1.   Every Newborn Action Plan indicators

CURRENT STATUS		CORE ENAP INDICATORS	ADDITIONAL INDICATORS
Definitions clear, but quantity and consistency of data poor	Impact	1. Maternal mortality ratio	
		2. Stillbirth rate	Intrapartum stillbirth rate
		3. Neonatal mortality rate	Low birth-weight rate
			Preterm birth rate Small for gestational age rate **Neonatal morbidity rates** **Disability after neonatal conditions**
Definitions of points of content clear, but data on content of care lacking	*Coverage:* Care for all mothers and newborns	4. Skilled attendant at birth 5. Early postnatal care for mothers and infants 6. Essential newborn care (tracer is early breastfeeding)	Antenatal care Exclusive breastfeeding up to 6 months
Gaps in coverage definitions, requiring validation and feasibility testing for HMIS use	*Coverage:* Care for newborns at risk or with complications	**7. Antenatal corticosteroid use** **8. Neonatal resuscitation** **9. Kangaroo Mother Care**	Caesarean section rate
		10. Treatment of severe neonatal infections	**Cord cleansing with chlorhexidine**
	Input: Service delivery packages to improve quality of care	Emergency obstetric care **Care of small and sick newborns** **Every Mother, Every Newborn quality initiative with measurable norms and standards**	
	Input: Counting	Birth registration	Death registration, cause of death

Shaded, not routinely tracked at global level
Bold red, indicator requiring additional testing to ensure consistent measurement
Indicators to be disaggregated by equity such as urban or rural residence, income and education
Adapted from *3*, *6*

The aim of the ENAP is to build on existing work on metrics to strategically identify and address the main measurement gaps at global, regional and country levels (including districts and facilities) and to increase the number of countries that routinely track ENAP core and additional indicators. A fundamental principle is intentional development of leadership in the countries with the highest burdens, so that they can improve and use the data for their programmes. The milestones in achieving these objectives by 2020 are shown in Figure 3, with the main steps for defining, refining and validating the indicators and testing the feasibility of their measurement on large data platforms.

Figure 3.   Every Newborn Action Plan: roadmap for improving measurement *(6)*
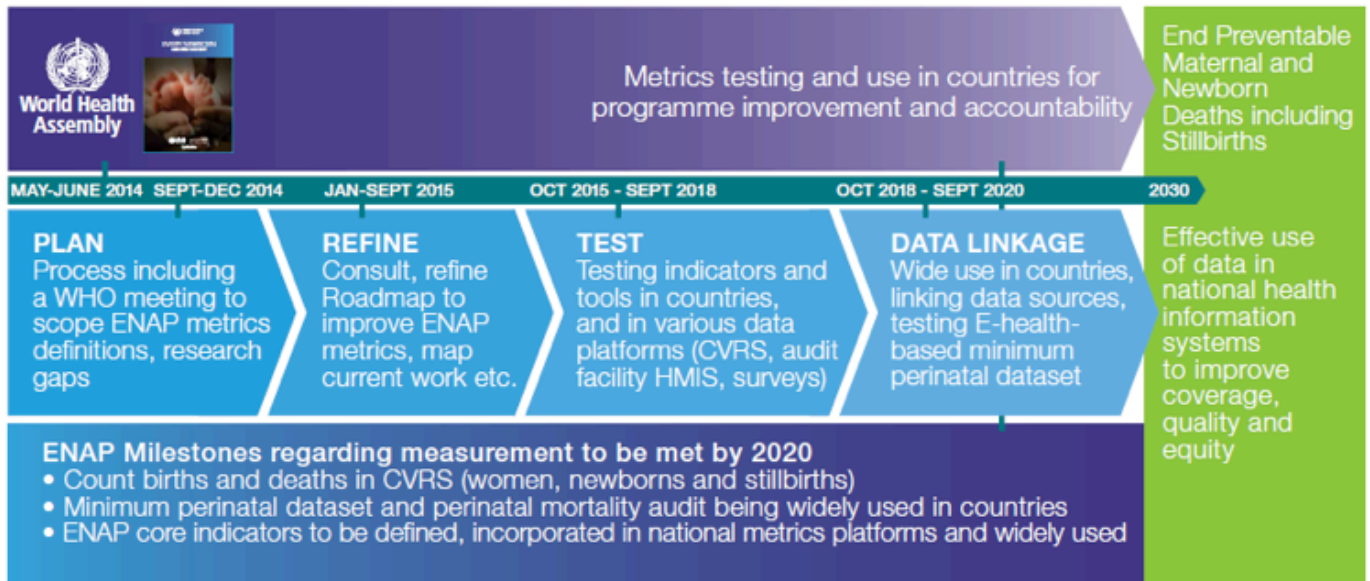
Purpose and objectives of the meeting

Objectives

The objectives of the meeting were to:

- summarize the status of measurements in newborn health,
- identify gaps and the research required to address those gaps and
- contribute to a 3–5-year roadmap for improving measurements.

Expected outputs

1. Assessment of the status of ENAP indicators and identification of gaps and priorities for improvement in:
   - impact indicators for stillbirths and neonates;
   - coverage indicators at points of contact: skilled attendant at birth, essential newborn;
   - coverage indicators for specific treatment interventions (antenatal corticosteroids, neonatal resuscitation, KMC, treatment of severe newborn infection and cord cleansing with chlorhexidine), with, for each:
     - definitions and scope of status and feasibility of data collection for numerators and denominators (based on task team work before the meeting);
     - proposals about what can already be measured in HMIS surveys; and
     - identification of key research questions and areas requiring critical validation.
2. Draft and plan of a roadmap for improving measurement, including the quality of indicators, methods of measurement and embedding of the work in other global metrics work.
3. Identification of other relevant initiatives and linkages and proposed means for integration, particularly with work on maternal health metrics.
4. Identification of countries and sites in Africa and Asia for leadership in improving and using the data.

Overview

The technical consultation on improving ENAP metrics took place on 3 and 4 December 2014 and was attended by 69 participants, including regional and country experts and representatives of professional organizations and nongovernmental organizations working on global maternal and newborn health and of bilateral and multilateral agencies. The participants are listed in Annex 1.

The meeting consisted of a 2-day conference with workshops in the afternoons, followed by meetings of the ENAP metrics coordination team and task team leaders to decide on the next steps and summarize the outcomes. The meeting agenda is attached in Annex 2.

Day 1. Overview of global work on metrics and status of the five ENAP priority coverage indicators

At the first plenary session, global harmonization of indicators and opportunities to improve, collect and use data relevant to the ENAP were discussed. Dr Ties Boerma of WHO presented the context of the sustainable development goals and WHO's global reference list of 100 core health indicators *(7)*. It was noted that 5 of the 10 ENAP core indicators are included on the list but that the stillbirth rate, representing 2.6 million deaths, was only on an additional list. Renewed attention and investment in civil registration and vital statistics represent an opportunity to improve the counting of births and also of neonatal deaths and stillbirths.

In the next session, the ENAP was reviewed with respect to improving and using the metrics for action. ENAP milestones were reiterated, including a commitment to ensure that the core indicators would be measureable in countries by 2020. The five priority coverage indicators in the ENAP core list were then presented by the task teams that had been appointed before the meeting and had undertaken background work on: antenatal corticosteroids (ACS), newborn resuscitation, KMC, neonatal sepsis case management and cord cleansing with chlorhexidine.

Working groups then discussed the indicators of treatment coverage and use of chlorhexidine. The comments on each indicator are summarized below, under "Outputs", which also includes data review and consensus after the meeting.

Task teams for coverage of indicators of treatment interventions

Task teams were convened before the meeting to review definitions and propose feasible, measurable coverage indicators, with an agenda for improving them. The work of the teams was based on that of collaborations such as the technical reference teams of the United Nations Commission on Life-saving Commodities on neonatal infections, neonatal resuscitation, ACS and use of chlorhexidine. The groups were selected to represent expertise in both maternal and newborn health. With the support of the ENAP metrics coordination group, the task teams carried out reviews and consultations to propose indicators that could feasibly be measured with existing data collections (usually process indicators) and to define the research priorities on coverage metrics, including options for numerators and denominators. The participants in the task team breakout groups are listed in Annex 3, with the leaders. The terms of reference of the task teams are given in Annex 4.

Important cross-cutting issues were brought up, including the determination of exact denominators for all the specific treatment indicators for coverage of newborns at risk or with complications.

Day 2. Overview of other ENAP indicators related to impact and points of contact and drafting an agenda for measurement improvement

An approach to quality of care—the Every Mother, Every Newborn quality initiative—was presented, with the proposed standards and their refinement and testing. The coverage, content and quality of care for mothers and newborns, particularly intrapartum and postnatally, including revision of emergency obstetric care indicators, were also presented. The next session dealt with impact indicators for neonatal mortality and stillbirths and preterm births and possible severe bacterial infection.

A session was devoted to embedding the agenda in global work on metrics, with reflections on experience in coordination of global metrics, such as for malaria and HIV infection. The participants discussed the proposed work on coordination of maternal and newborn health measurement and linkage with the ENAP measurement improvement roadmap and other initiatives.

In the afternoon, the participants met in four technical working groups:

- Impact: neonatal deaths and stillbirths
- Impact: morbidity, impairment and child development
- Coverage of content and quality of care: intrapartum care
- Coverage of content and quality of care: postnatal care

In accordance with the objectives of the consultation, the participants drafted a "Measurement improvement roadmap" (Annex 6), with four parts: (i) core definitions, (ii) metrics status and testing needs, (iii) tools for improvement and development and (iv) strategies for multi-country testing and capacity-building in high-burden settings. The roadmap provides an overview of the current status of each indicator, what can be measured, what can be improved and gaps in knowledge, tools, funding or support. Cross-cutting issues that affect several parts of the plan are discussed in the plan and at the end of this report. On the last day, the ENAP metrics coordination group and the coverage task team leaders reviewed the meeting outcomes for further discussion on the roadmap and the meeting outputs.

This meeting report is presented in accordance with the structure of the measurement improvement roadmap, according to the standard evaluation framework: impact, coverage and process (Table 1). The decisions taken during the 3 days are summarized below.

Outputs

Impact: core indicators 1–3

All three of the core indicators of impact and one of the additional impact metrics have established definitions (Annex 5); six have been estimated systematically *(6)*. The poor status of the overall data was discussed, and a number of significant gaps were noted.

Table 1a. Every Newborn Action Plan core and additional indicators (impact)

CURRENT STATUS	LEVEL	CORE ENAP INDICATOR	ADDITIONAL INDICATOR
Definitions clear, but quantity and consistency of data poor	*Impact*	1. Maternal mortality ratio	
		2. Stillbirth rate	Intrapartum stillbirth rate
		3. Neonatal mortality rate	Low birth-weight rate
			Preterm birth rate
			Small for gestational age rate
			Neonatal morbidity rates
			Disability after neonatal conditions

Shaded, not routinely tracked
Bold, indicator requires additional evaluation for consistent measurement
Sources: *2* and *3*

Core indicator 1. Maternal mortality ratio

Current status of definition

This indicator is clearly defined and currently tracked in world health statistics, as the number of maternal deaths per year during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy *(8)*. According to WHO, a maternal death is a death from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes). See the table of core definitions in Annex 5.

Current status of data and availability

The maternal mortality ratio was an indicator of Millennium Development Goal 5, and it is expected to remain a sustainable development goal indicator. Vital data are currently used as reported in over 50 countries; for all the remaining United Nations member states, estimates with time series are modelled on the basis of vital registration, maternal mortality surveillance and household surveys.

How could measurement be improved?

Countries must improve the input data, especially in vital registration, and linkage to maternal death surveillance and confidential enquiries. Because of gaps in vital registration data, modelling will remain necessary for the foreseeable future in many countries, especially those with the highest

rates; work is required to improve estimation methods and precision. Country consultations should be held to improve the quality of the input data and the interpretation and use of estimates. Work should be consolidated in order to reduce dependence on estimated data by ensuring routine civil and vital registration of deaths in all countries, irrespective of income.

Core Indicator 2. Stillbirth and intrapartum stillbirth rates

Current status of definition

WHO *(9)* recommends that stillbirths be reported according to the definition of the International Classification of Diseases 10th edition (ICD-10) of late fetal deaths, as all infants "born with no signs of life with a weight of > 1000 g or after 28 weeks' gestation or 35 cm length", to allow international comparison. The participants noted that these data are not collated routinely at global level in United Nations data reporting systems, although estimates were undertaken by WHO in 2011 *(10)*. Many countries that report stillbirths do not use the WHO definition; in many high-income countries, lower gestational age cut-offs are commonly reported, as neonatal intensive care allows survival at 23 or 24 weeks of gestational age *(11)*.

Intrapartum stillbirths are fetal death at a viable gestational age, after the onset of labour but before full expulsion. "Fresh" stillbirth or non-macerated skin is frequently used as a surrogate *(11)*.

Current status of data and availability

About 100 countries collect vital registration data on stillbirths, but only about 50 have high-quality data. Even fewer report data that can be analysed in accordance with the WHO definition. Only one set of official WHO estimates has been completed, for 2009 *(10, 12)*, and stillbirths are not counted in international global mortality estimates such as the global burden of disease *(11)*. While many countries have data on stillbirths, there are few data on intrapartum stillbirth rates, even in high-income countries. This is a problem for measuring maternal and newborn health, as the intrapartum stillbirth rate has been proposed as an indicator of the quality of care intrapartum *(13)*. The participants agreed that documentation and tracking, particularly of fresh stillbirths, should be included in all HMIS and should obtain sustainable investment and support to ensure that it is part of routine reporting.

Weight and gestational are not equivalent, the stillbirth rate being about a 30% higher when the definition includes a gestational age of 28 weeks rather than 1000 g *(11)*. ICD-10 was published 30 years ago, when there was less evidence about the role of gestational age, and has not been updated. Countries use gestational age more frequently, even when birth-weight is routinely recorded, and most of the world's births and even fewer stillbirths are weighed. Gestational age is often derived from the last menstrual period, which has a wide range of uncertainty but is likely to be easier to collect than stillbirth-weight. The participants agreed that gestational age is the preferred measure for the definition of stillbirth in the ICD to ensure comparable stillbirth rates.

How could measurement be improved?

The participants emphasized the importance of institutionalizing global systems for the collection and routine reporting of overall data on stillbirth rates; major work is required to improve the quantity and quality of data on rates of intrapartum stillbirth. The stillbirth rate is not on the proposed global reference list of 100 core health indicators and appears only on an additional list. The counting of stillbirths globally should be advocated.

Effective communication should be established with the WHO ICD unit, which is revising require-ments for information on death certificates and could contribute to discussions on classification of perinatal deaths. Stillbirth is included in the WHO verbal autopsy tool as a cause of death, and further causal categories and methods should be developed.

WHO technical guidance on maternal death surveillance and response *(14)* is a good model for integrating perinatal death tracking. Auditing tools for monitoring the numbers, causes and avoidable factors linked to perinatal deaths are being prepared by WHO to help understand and analyse gaps in causes of death and diagnostic challenges. How these systems can best be linked to ENAP metrics is being assessed, with the collation of evidence on effective health system support and strengthening.

Core Indicator 3. Neonatal mortality rate and causes of death

Current status of definition

The neonatal mortality rate is defined as the number of deaths per 1000 live births in the first 28 days after birth *(15)*. This rate is routinely tracked in world health statistics. (See the table of core definitions in Annex 5.) The causes of neonatal deaths are identified in ICD-10, although detailed classifications are rarely used, except in high-quality vital registration systems.

Current status of data and availability

Fewer than 70 countries have high-quality vital registration systems from which neonatal mortality rates can be taken directly. In the remaining countries, estimates of the neonatal mortality rate are often derived from retrospective household surveys. The United Nations Interagency Group for Child Mortality Estimation releases estimates of neonatal mortality rates in 195 countries annually *(15)*. For these estimates, data from countries with high-quality vital registration systems are used directly, while models are fitted for countries with poor quality or no vital registration. The models are fitted to national survey data, primarily from household surveys such as demographic and health surveys (DHS) and multiple indicator cluster surveys (MICS), and smoothed to estimate time series from 1990 *(15)*.

Estimates of neonatal causes of death are published by WHO. The distribution of causes is used as reported for 65 countries with high-quality vital registration systems; for the remaining countries, distribution time series of neonatal causes of death are modelled from 2000 with multinomial models *(16)*, which are run separately for countries with low and high mortality rates, with different input data in each model. The input data for the low-mortality model are vital registration data from low-mortality countries with high-quality vital registration, while those for the high-mortality model come mainly from studies in which verbal autopsy methods are used to estimate causes of death. Most such studies are not, however, nationally representative and are often small. Studies were the basis for input data in only 36 of the 80 countries in which the high-mortality model was used *(16)*.

How could measurement be improved?

Neonatal mortality rates and causes of death should be tracked globally by routine data collection systems (e.g. civil registration and vital statistics systems and HMIS), rather than relying on periodic retrospective household surveys or verbal autopsies. Further development and investment in testing tools to improve capture of both numbers and causes of death are needed, including, for the minimum perinatal dataset, perinatal audit tools and verbal autopsy. These platforms should be harmonized, with innovations for use of the data in different systems. Standardized application of ICD codes and reporting stratified by gestational age, sex and socio-economic status would result in more comparable, programmatically useful data as a basis for policy and improvements in care and services.

Additional indicator. Low birth-weight rate, differentiating preterm and growth restriction

Current status of definition

Low birth-weight is defined as a live-born infant weighing < 2500 g. This simplistic cut-off does not cover the continually changing risk of newborns attributable to their birth-weight and gestational age *(17)*. The definition of "preterm" (any infant born < 37 weeks of pregnancy *(18)*) also does not represent the steep increase in risk with increasing prematurity. Birth-weight is recorded on birth certificates in most countries that have operational civil registration and vital statistics systems. Low birth-weight may result from a shortened gestational period (preterm birth), being small for gestational age (birth-weight below the 10th centile) or a combination of the two *(19)*.

Current status of data and availability

Data on low birth-weight are reported by UNICEF in *The state of the world's children (20)*. Most of these data are based on adjusted data from DHS and MICS, which are limited, relying on the proxy of maternally perceived size at birth for most infants included in such surveys; about half of infants in low-income countries are not weighed at birth *(20)*. Furthermore, even when newborns are weighed, weighing practices are frequently suboptimal, with no scale calibration, no universal use of digital scales, weighing of partially clothed infants and "digit preference" for 2000 g and 2500 g *(21)*. Gestational age is often not assessed or is poor in low- and middle-income countries, especially where there is limited access to antenatal care or women present for care late in pregnancy *(22)*. Access to ultrasound scanning in the first trimester is poor in many low- and middle-income countries, and, while pregnancies can be dated from the last menstrual period, recall is often inaccurate *(22)*.

How could measurement be improved?

The difficulties in monitoring and data collection for low birth-weight rates are associated with those for measuring birth-weight and gestational age. Participants identified several areas for improvement, and the measurement improvement roadmap proposes review and testing of tools, including the minimum perinatal dataset. The quality of assessment of both birth-weight and gestational age has significant gaps, and better techniques and systems are required to ensure that every newborn is weighed at birth, with accurate assessment of gestational age and accurate recording. This was identified as an important research topic to ensure safe programme implementation. Further research is required to find reliable, feasible means for assessing gestational age and improving the reliability of birth-weight recording. The roadmap also foresees a shift to use of facility-based data collection tools, with further testing of options for population surveys.

Additional indicator. Rates of neonatal morbidity and disability after neonatal conditions

Current status of definition

The participants determined that further work is required to find consistent definitions for the various types of neonatal morbidity (such as preterm birth, intrapartum morbidity, jaundice and infections) and non-fatal outcomes.

Current status of data and availability

The definitions of neonatal morbidity and data collection are not standardized even in high-income countries, and data collection is inconsistent, with data that are difficult to compare geographically and over time. This indicator is not routinely tracked globally, and additional evaluation is required for consistent monitoring *(17)*.

How could measurement be improved?

Exposure and outcomes must be defined and tested from existing data sets to allow standardization of a minimum data set that can be used in different settings. Extensive mapping of tools and activities would allow definition of minimum acceptable standards of care and follow-up for infants at risk for long-term morbidity. Agreement on standardized, cross-cultural development assessment tools would facilitate identification of affected infants and follow-up in specific perinatal risk registries. Substantial work is required to build metrics systems for newborn morbidity and disability after newborn conditions. Consensus is required on definitions of the relevant exposures and outcomes. Tools identified for initial review include a minimum data set and standardized tools for short- and long-term follow-up. Work could also be conducted to assess the usefulness of household surveys for data collection on these exposures and outcomes. This work will help in defining the next steps for the measurement improvement roadmap.

Coverage: Care for all mothers and newborns; core indicators 4–6

The participants discussed essential intrapartum, newborn and postnatal care and the three core points of contact (see Table 1b). The indicators of coverage at these points of contact ensure that ENAP metrics capture the coverage of three important maternal and newborn health services (Table 1b) for the care of all mothers and newborns. All three core points of contact (and the additional contact points) have established definitions, with minor differences between data platforms *(6)*.

Table 1b. Every Newborn Action Plan core and additional indicators of coverage at points of contact

CURRENT STATUS	LEVEL	CORE ENAP INDICATOR	ADDITIONAL INDICATOR
Definitions clear, but data on content of care poor	*Coverage:* Care for all mothers and newborns	4. Skilled attendant at birth 5. Early postnatal care for mothers and infants 6. Essential newborn care (tracer is early breastfeeding)	Antenatal care Exclusive breastfeeding up to 6 months

Sources: *2, 3, 6*

Core indicator 4. Skilled attendant at birth

Current status of definition

A skilled birth attendant is described by WHO as:

> an accredited health professional (such as a midwife, doctor or nurse) educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period and in the identification, management and referral of complications in women and newborns *(23)*.

Although skilled birth attendant coverage is measured, it is coded and defined differently in different settings, and there are insufficient indicators of the content or quality of care. There is no consensus about the level of training and qualification required to be a skilled birth attendant.

Current status of data and availability

Coverage of skilled attendance at birth is currently measured from household surveys, and data are available from DHS, MICS and most HMIS; coverage data are reported in Countdown to 2015 *(5)*, the Commission on Information and Accountability *(4)* and *The state of the world's children (20)*.

Reviews of emergency obstetric care, service provision assessment (SPA) and service availability and readiness assessment (SARA) include complementary process indicators on the readiness of facilities for births (Annex 5). Studies on emergency obstetric care include complementary information on the content of care, including basic and comprehensive services for the nine signal functions[1] *(24)*; however, these functions include only one neonatal component (resuscitation) and do not therefore represent the full range of necessary emergency newborn procedures. SPA and SARA also include indicators of facility readiness for births. Studies of the quality of care have been undertaken in a number of countries by organizations such as the Maternal and Child Health Integrated Program (MCHIP) *(25)*.

Current DHS and MICS do not collect extensive data on the content of care at the time of birth; these require validation of maternal recall of clinical details. HMIS require midwife recall *(26)*. The participants concluded that additional information is required about equipment, protocols, the feasibility of referral, retention of providers and other measures of quality. Furthermore, the definitions and tools should be harmonized to allow comparison across settings.

Core indicator 5. Early postnatal care for mothers and infants

Current status of definition

Early postnatal care is the contact provided to a woman and her newborn during the first 2 days after birth, in line with DHS and MICS *(27, 28)*. The current WHO recommendations, however, are that women and newborns receive postnatal care within the first 24 h after delivery in a facility and during a home visit where possible (or during an outpatient clinic appointment if not) within the first 24 h after a home birth *(29)*. Like the other points of contact, this one may differ according to national protocols and settings.

Current status of data and availability

Early postnatal care is measured in household surveys as two separate indicators: checks on the health of the newborn and of the mother. Both track coverage of postnatal contact within 2 days of delivery. The DHS and MICS indicators differ, however: that of DHS quantifies the women and newborns who receive a postnatal check, whereas the MICS indicator identifies the care pathway and type of service received by the mother and newborn within the initial 2 days. Prompts have been added to the questions on postnatal care about the practices common at this check (e.g. temperature taken, infant weighed, breastfeeding observed, asked about bleeding) to determine whether the contact represents a true postnatal care visit.

How could measurement be improved?

There is no accepted definition of early postnatal care or clear evidence for specific timing of service delivery; furthermore, evolution of the evidence and review of standard guidelines obviate maintenance of valid household survey questions. Early postnatal care comprises a package of services for identified sick and at-risk mothers and newborns rather than one intervention; the indicator must therefore capture coverage, with a measure of content and quality. Both DHS and MICS questionnaires have recently been adjusted to ensure that the data are reliable and relevant *(30)*. Variations in the definitions of intervention and their indicators should be avoided to reduce data inconsistencies and coding errors.

Further improvements in early postnatal care metrics will require the development of leadership to ensure that the maternal and neonatal health communities use the same metrics. Work on metrics should be disseminated, including the results of subnational surveys of metrics of the content of

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[1] Administer parenteral antibiotics; administer uterotonics; administer parenteral anticonvulsants for pre-eclampsia and eclampsia; manually remove the placenta; remove retained products; perform assisted vaginal delivery; perform basic neonatal resuscitation; perform surgery (e.g. caesarean section); perform blood transfusion

postnatal care by the Newborn Indicators Technical Working Group *(31)*, which is designing an indicator of the content of postnatal care visits rather than the check itself.

Core indicator 6. Essential newborn care

Essential newborn care is measured as early initiation of breastfeeding and exclusive breastfeeding at 6 months as a marker of completion. This indicator was selected because there is strong evidence that newborn mortality and morbidity are reduced by early initiation of breastfeeding, especially decreased rates of infection *(32–34)*. Another component of essential newborn care is skin-to-skin care, which is recalled accurately by mothers and may be useful as a tracer *(26)*. Data on this component are, however, not widely available, and further testing is required to ensure that survey respondents accurately distinguish routine skin-to-skin care from KMC. Preventive and supportive care required for all newborns includes warmth, cleanliness, breastfeeding, cord and eye care, vitamin K and vaccination *(35, 36)*.

Current status of definition

Early initiation of breastfeeding is enshrined in step 4 of the Baby-friendly Hospital Initiative, which advises that mothers should receive help in initiating breastfeeding within 0.5 h of the birth *(37)*. WHO recommends exclusive breastfeeding for the first 6 months of life, in which infants receive only breast milk and no alternative food or water, unless medically indicated *(38)*. Data collection platforms differ, however, in the metrics used for early and exclusive breastfeeding.

Current status of data and availability

MICS, DHS and other national household surveys collect data on the coverage of early initiation of breastfeeding *(39, 40)*, which is reported in Countdown to 2015 *(5)* and *The state of the world's children (15)*. Both MICS and DHS contain questions on feeding in the 24 h before the survey, encouraging accurate recall of exclusive breastfeeding; however, these may not capture breast-feeding practices throughout infancy.

How could measurement be improved?

Validation studies of the indicators of exclusive breastfeeding show poor specificity; this is exacer-bated for the linked indicator on early breastfeeding, which was found to have low specificity in household surveys in identifying women who breastfeed within the first hour after delivery *(26)*. The questions in both MICS and DHS on exclusive breastfeeding focus on feeding behaviour within 24 h of the survey, which ensures more accurate recall but may not capture individual breastfeeding practice throughout the infant's life span.

Technical work to improve the specificity of breastfeeding indicators will be beneficial, in conjunction with further evaluation of the usefulness of breastfeeding tracer indicators in measuring essential newborn care. Participants commented that global data collection platforms should be aligned, with clear leadership strategies and a coordinated global response

Coverage: Care of newborns at risk or with complications; core indicators 7–10

The task teams provided feedback on the development, testing and use of metrics for the four core and one additional interventions (Table 1c). The ENAP indicates that these interventions are not routinely tracked at global level, even though they are evidence-based with a potentially high impact in meeting the overall goal to end preventable newborn deaths by 2035. It was recognized that coverage measures for newborns have been neglected, although the newborn period contributes over 8% of all disability-adjusted life years in the global burden of disease. Stillbirth-specific interventions and metrics are also neglected, and the ENAP foresees further review of this issue.

Table 1c. Every Newborn Action Plan core and additional indicators (coverage, specific treatments)

CURRENT STATUS	LEVEL	CORE ENAP INDICATOR	ADDITIONAL INDICATOR
Gaps in coverage definitions, validation and feasibility for use in HMIS	*Coverage*: Care for newborns at risk or with complications	7. **Antenatal corticosteroid use** 8. **Neonatal resuscitation** 9. **Kangaroo Mother Care** 10. **Treatment of severe neonatal infection**	Caesarean section rate **Cord cleansing with chlorhexidine**

Shaded, Not currently routinely tracked
Bold, Indicator requiring additional evaluation for consistent measurement
Sources: *2, 3, 6*

The task teams described which data can and cannot be measured currently and the remit for the ENAP roadmap. For most of these indicators, especially for treatment, it is unlikely that data can be collected from survey questionnaires, such as recalling whether a specific injection was received (for the numerator) or distinguishing symptoms and diagnoses. This is also the case for many maternal interventions, such as coverage with magnesium sulfate for eclampsia, oxytocin in the third stage of labour or post-partum haemorrhage management. Although facility data could be used in measuring some of the life-saving interventions for mothers and newborns, HMIS are biased by the service provider's response. Additionally, in many countries, HMIS data are poor and capture few perinatal indicators, given the broad remit. The task teams and meeting participants concluded that additional evaluation is required for consistent measurement *(6)*.

The task teams considered that the denominator is the most technically difficult aspect for measurement of treatment intervention indicators, because the interventions are not targeted to the entire population and depend on the intended end user. Measurement of rates per 100 or per 1000 live births should perhaps be considered for scaling up interventions, although further testing and validation are required. When detailed data are available (for example in high- and middle-income settings), the datasets should be analysed to compare a simplified denominator per 100 or per 1000 live births with a more precise indicator (e.g. comparing a KMC rate per 100 live births to a more precise denominator with weight stratifications of < 2000 g and < 2500 g) to ascertain whether the rates are correlated and are sensitive to change over time.

Technical work will also be required to define appropriate benchmarks, which are likely to vary in view of the complex and differing causes, such as varying rates of preterm birth and of possible severe bacterial infection in different countries. Thresholds or upper and lower limits might have to be defined, as has been done for the caesarean section rate. Currently, a rough guideline threshold of 5–15% is used globally as a basis for indicating an unmet need or identifying an excess number of caesarean sections *(41, 42)*, although this threshold is controversial. Lessons from such examples could help in setting realistic, helpful benchmarks for determining whether interventions are reaching a sufficient number of newborns within safe limits and still ensure that all newborns can be counted in all settings, especially the most vulnerable populations, for which data systems are often weak. The shift towards facility-based data allowed the task teams to consider measurement of both coverage and the quality, safety and content of interventions. A harmonized approach should be taken to collecting complementary indicators of coverage and process. Technical guidance can then be provided to ensure that the indicators are standardized and technical support is given to develop facility-based indicators that are measurable, comparable and meet local and national programme needs.

Core indicator 7. Antenatal corticosteroids

Current status of definition

The WHO guidelines review committee is reviewing antenatal administration of corticosteroids. The current protocol for ACS administration is a single course for all mothers at risk of imminent preterm labour (delivery < 34 completed weeks of gestation) who are in a facility in which gestational age can be assessed accurately and a sufficient level of care is available for the mother and the newborn *(43)*.

Current status of data and availability

Data documenting the provision of ACS are collected routinely in high-income countries but are not consistently collected in current HMIS, standardized facility surveys or household surveys in low- and middle-income countries. Countdown to 2015 reports the number of countries with national policies that recommend ACS for preterm labour *(40)*. Tracking at policy level could be useful in the short term for identifying an appropriate denominator for a commodities-based indicator, but only if ACS is routinely available in all health facilities.

How could measurement be improved?

Identifying a precise indicator of coverage with correct provision of ACS requires identification of a feasible numerator and denominator. As accurate assessments of gestational age are rare in many low- and middle-income countries, it is difficult to design an indicator that covers mothers who should and should not have received ACS. Present data collection systems and capacity in most low- and middle-income countries allow measurement only of total coverage with ACS (all mothers who received one dose of ACS) and do not differentiate between those who received ACS before (true positives) and after (false positives) 34 completed weeks of gestation (Table 2). In the short term, total coverage with at least one dose of ACS for pre-term labour should be collected in all HMIS. Differentiation is nevertheless essential, as recent evidence suggests that use of ACS can be associated with adverse outcomes for women who have completed ≥ 34 weeks of gestation *(44)*.

Table 2. Provision of ACS

	< 34 + 0 WEEKS	≥ 34 + 0 WEEKS	
Received ACS	**A** True positives Aim to maximize A/A+C	**B** False positives (failure of diagnosis) Aim to minimize	**A+B** Total receiving ACS
Not received ACS	**C** False negatives or Missed opportunity Aim to minimize C/A+C	**D** True negatives Aim to be as high as D/B+D	**C+D** Total not given ACS

Datasets from high-income countries will be analysed to find and test an indicator that captures true and false positives (thereby providing coverage data that also reflect the quality and safety of the intervention) and can be recommended for HMIS in low-income settings. The analysis will test each cell in Table 2 in addition to the denominators in the table of core definitions (Annex 5) and stratify results according to gestational age range. Better assessment and recording of gestational age is required in all settings to facilitate correct provision of ACS.

Recent evidence suggests that use of ACS is associated with a risk for adverse outcomes of infants with a gestational age ≥ 34 completed weeks *(44)*. It is difficult to quantify the denominator of eligible mothers presenting in labour < 34 weeks. In low- and middle-income countries, recall of last menstrual period is often poor or inaccurate, access to ultrasonography is poor, and first-trimester antenatal care is not used routinely, all of which make gestational dating difficult. Thus, better

assessment and documentation of gestational age before and after a birth is an urgent priority, in conjunction with better tracking of safety and non-fatal outcomes after provision of ACS.

Core indicator 8. Neonatal resuscitation

Current status of definition

Neonatal resuscitation consists of interventions provided to newborns at the time of birth to assist in establishing breathing and circulation *(45)*; these should be administered to all non-macerated newborns who do not start breathing spontaneously immediately after drying, in accordance with WHO guidelines *(46)*. Effective, safe resuscitation of an infant who is not breathing requires a sequence of highly time-sensitive actions initiated within the first minute after birth: immediate universal stimulation, additional stimulation as needed and positive pressure ventilation with bag and mask if necessary.

Current status of data and availability

Data are not available on coverage with neonatal resuscitation, and there is no standardized, measurable indicator of the intervention. Use of household surveys to measure coverage has major limitations, including poor specificity of the numerator and denominator because of inaccurate maternal recall *(26)*. Neonatal resuscitation was added as the seventh signal functional sign for basic emergency obstetric care by the United Nations in 2009; therefore, data are collected in standard assessments of emergency obstetric care facilities. Both SPA and SARA cover the availability of a neonatal-size bag and mask in labour and delivery wards and training of staff in neonatal resuscitation. As neonatal-size bags and masks are on the United Nations essential commodities list, this equipment is increasingly tracked in logistics management information systems.

In the short term, the availability of a functional bag and mask of neonatal size in the delivery area of maternity services can be used as an indicator of service readiness for neonatal resuscitation; these data are already available from SPA, SARA and emergency obstetric care facility surveys (Annex 5) *(24, 47, 48)*. The presence of resuscitation equipment does not, however, necessarily indicate appropriate use, and not all newborns who do not breathe at birth require positive pressure ventilation, as they may respond to additional stimulation alone. An advantage of using the availability of a functional bag and mask of neonatal size as an interim indicator is that the data are already collected, the indicator is line with the WHO consultation on improving measurement of maternal, newborn and child care in health facilities *(13)*, it is easy to document, and it has strong negative predictive value.

How could measurement be improved?

One problem in obtaining precise data on neonatal resuscitation coverage is identifying and accurately measuring a denominator that reliably covers infants who require resuscitation. As with many treatment indicators, accurate identification of the population in need of the intervention depends on correct diagnosis and classification. Accurate classification of infants who require resuscitation is difficult everywhere, as the clinical judgement and diagnostic skills of providers may differ *(49)*. It is, however, unlikely that a health care provider would decide that an infant required resuscitation but not give it. The roadmap (see Table 4) gives the priority denominators for testing in order to compare the validity of observed with reported resuscitation practices from video-recorded data collected in Nepal.

It is also difficult to define an accurate numerator for effective, safe neonatal resuscitation coverage that is feasible to measure. Bergland and Norman *(50)* found that documentation of neonatal resuscitation was inadequate for accurate, reliable evaluation; while this evidence is for a high-income country, documentation is unlikely to be better in low- and middle-income countries. An important element of effective, safe neonatal resuscitation is careful assessment and initial stimulation, followed by bag and mask if needed, as there is evidence that inappropriate use of

positive pressure ventilation can have harmful consequences. Use of a bag and mask may, however, be easier to recall and validate than distinguishing stimulation actions from routine drying and wrapping; there is evidence that training in resuscitation results in reduced use of bag and mask *(51)*.

Core indicator 9. Kangaroo Mother Care

Current Status of definition

KMC is a method of caring for preterm and low-birth-weight newborns by direct, continuous skin-to-skin contact, in the kangaroo position, with their mother or guardian. The current evidence base indicates that KMC reduces mortality among clinically stable newborns weighing < 2000 g when initiated in a facility *(52)*.

Current status of data and availability

There are limited data on the effectiveness of KMC from facility-based surveys and HMIS in several countries, but there is no standardized definition of an indicator of coverage and no data collection. KMC programmes vary by setting, depending on health system capacity and the level of special care available for small and sick infants *(53)*. The level of facility in which KMC can be safely provided or initiated and the eligibility criteria for KMC may differ, making it difficult to compare data between settings. KMC is not measured in routine household survey platforms, such as the DHS and MICS.

In view of difficulties in immediately measuring coverage, an indicator of service readiness, such as the number of facilities in which a space is identified for KMC and where staff have received training within the past 2 years (Annex 5), could be used to collect data. This measure would be similar to that defined by WHO for measuring the quality of maternal, newborn and child health care in facilities *(13)*; the measure is also consistent with current SARA and SPA facility assessments *(47, 48)*.

How could measurement be improved?

A denominator consisting of the target group would be difficult to obtain, as nearly half of all newborns are not weighed at birth, especially in low-income countries. Where birth-weight is recorded, there is known tendency for "digit preference" at 2500 g and 2000 g *(21)*. The number of newborns initiated into facility-based KMC is counted in some facilities in HMIS or hospital admission records. The number could be measured as a rate per 100 or per 1000 live births, but this should be tested before its inclusion in national HMIS is recommended. The indicator obviates difficulties of including weight in the numerator and identifying the denominator of infants in need; however, it does not indicate whether KMC was delivered appropriately or whether the infants were truly eligible or benefitted from KMC. Preterm birth rates vary globally from 4% to 18% *(54)*. As KMC benefits predominantly preterm infants, the proportion of live births that could benefit from this intervention will vary by setting, and similar coverage rates might correspond to different unmet needs for KMC.

Improvements in the recording of birth-weight and assessment of gestational age are essential for measurement of more precise indicators of KMC, especially for coverage. In conjunction, data sets from high-income countries should be examined to assess the use of different numerators and denominators (including per 100 live births), with testing for accuracy, reliability and sensitivity to change over time.

In the longer term, it might be worthwhile to design and validate questions for household surveys, if considered cost- and time-effective. Recent work in Colombia (N. Charpak, personal communication, 2014) shows that women have good recall of the KMC they received, even years later. A limitation of household surveys for measuring KMC coverage, however, is obtaining sufficient sample sizes for statistically meaningful results, especially as the intervention is mainly for preterm infants, who represent a small sub-sample of newborns and therefore a very small percentage of the overall population. While a precise coverage indicator is being tested, an appropriate proxy

indicator of service readiness might be the number of facilities with maternity services in which there are space and trained staff for KMC (Annex 5).

Core indicator 10. Treatment of severe neonatal infection

Current status of definition

Treatment of severe neonatal infection comprises the provision of injectable antibiotics to newborns admitted for inpatient care with a possible severe bacterial infection, in accordance with current WHO treatment guidelines and diagnostic algorithms *(55)*; when immediate referral is not possible, the first dose of injectable antibiotics should be given before transfer *(56, 57)*

Current status of data and availability

Data are available from facility-based surveys (e.g. SPA, SARA) about the supplies of certain antibiotics in facilities, but the presence of a drug in a facility does not mean that it is used for possible severe bacterial infection in neonates. No coverage indicator exists, and data specifically on treatment of newborn infections are not collected in household surveys, which record only treatment of suspected pneumonia in children under 5 years of age. This indicator has its own limitations, including the accuracy of recall of medical interventions provided and capture of only partial treatment *(58)*.

How could measurement be improved?

The proposed numerator for validation is the number of newborns treated with at least one dose of an injectable antibiotic at a facility. This is likely to be applicable no matter where treatment is given.

The denominators proposed are the number of all newborns with illness presenting to facilities and the number of newborns with possible severe bacterial infection. Both are potentially useful, but the feasibility of collecting the data should be tested. One aim of the measurement improvement roadmap is to assess whether use of these denominators will yield useful information on care given at facilities, particularly on its quality.

A measurable coverage indicator provides only an initial indication of the likelihood that injectable antibiotics are given for severe neonatal infection. Another indicator will be required to measure the appropriate use of antibiotics to treat possible severe bacterial infection when clinically indicated (as with ACS). This is particularly important, as over-treatment can increase AMR, and under-treatment may be associated with case fatality *(59)*. It is essential that treatment courses be completed, which may be difficult when newborns are moved between wards or facilities. Good examples are needed from various settings of use of routine systems to track all doses given to newborns. Indicators of neonatal deaths between 3 and 28 days and of whether the newborn received antibiotics could be integrated into perinatal audit tools, although even this would not capture infants who were treated at a facility but died at home.

A proposal was made to explore the feasibility and usefulness of routine HMIS for collecting data on the coverage of antibiotic treatment for newborns. More data on treatment of severe neonatal infection at first-level facilities from which referral is not possible will become available in the five countries that are preparing to test new, simplified antibiotic regimens (Bangladesh, the Democratic Republic of the Congo, Ethiopia, Nigeria and Pakistan). These data will allow testing of the numerator and denominator options for severe bacterial infection coverage and will make it possible to plan and improve data collection on community-based treatment with injectable antibiotics; this option will require further work and testing to ensure reliable valid measurement.

Process and quality indicators will also be devised to measure the safety of antibiotic treatment. For example, gentamicin has a narrow therapeutic index and is associated with toxicity *(60)*; therefore, its safe administration in a programme or at a facility is a marker of quality of care. Extensive

validity testing of all potential indicators will be required in conjunction with feasibility testing for the proposed data collection platforms.

Additional indicator: Cord cleansing with chlorhexidine

Current status of definition

Cord cleansing with chlorhexidine involves routine topical application of 7.1% chlorhexidine digluconate (solution or gel, delivering 4%) to the cord stump within the first 24 h of life. This is currently recommended only for home births in countries with neonatal mortality rates ≥ 30 per 1000 births *(29)*.

Current status of data and availability

Data on chlorhexidine cord cleansing have been collected in some large-scale household surveys in countries in which the intervention has been scaled up (e.g. Nepal). Routine facility assessments, such as SPA, track the availability of chlorhexidine in checklists. Household surveys include the reported numbers of newborns delivered at home for whom chlorhexidine was applied to the cord stump within 24 h of birth. The denominator might be the number of live home births in the survey population.

How could measurement be improved?

Both the numerator and the denominator should be refined, with rigorous assessment of sensitivity and validity. Showing a respondent a picture of the locally marketed chlorhexidine tube or sachet during a household interview might improve recall and thus the validity of the data collected; this will be tested within the roadmap. Because of differences in national policies on the use of chlorhexidine in facilities, the validity of household survey questions on chlorhexidine cord cleansing after birth in a facility should also be evaluated; the sensitivity and specificity of these questions should be determined in situations in which cord cleansing is done away from the mother. The work in Nepal will allow sample size calculations based on the number of home births and expected use, and household survey questions will be further validated to compare observed practice with reported practice in use of chlorhexidine. Inclusion of standardized chlorhexidine coverage metrics in routine household surveys is necessary to achieve consistent coverage data.

Process indicators (service delivery packages)

Process indicators are intended to complement coverage data and indicate how well the overall service is functioning and whether high-quality care is available. The aim of this part of the ENAP is to measure the content and quality of the Every Mother, Every Newborn service delivery packages of emergency obstetric care and care of small and sick newborns. This is essential for reducing the global gap in quality. Because of the inherent difficulty of finding sensitive, feasible indicators for quality of care and because this work crosses traditional clinical boundaries and requires a multi-sectoral approach, it is the least developed component of the work on metrics for the ENAP.

Table 1d. Every Newborn Action Plan: quality and process

CURRENT STATUS	LEVEL	CORE ENAP INDICATOR
Gaps in coverage definitions and validation and feasibility of use in HMIS	ENAP service delivery packages for quality of care	Emergency obstetric care
		Every Mother, Every Newborn quality initiative with measurable norms and standards
		Care of small and sick newborns

Shaded, not currently routinely tracked
Bold, indicator requires additional evaluation for consistent measurement
Sources: *2, 3, 6*

Every Mother, Every Newborn: initiative for high-quality care around childbirth

The aim of the Every Mother, Every Newborn initiative is to institutionalize quality improvement by setting criteria and standards for facility-based maternal and newborn care. Tracking progress in meeting the standards for facilities offering care packages (see Table 3) will require simple indicators. A rights-based standard is included to reflect the experience of the care received as well as its provision. The proposed standards should be adapted in countries and included in established quality assurance mechanisms, with sustainable systems for frequent measurement of progress and linkage with national authorities for accountability.

The proposals for operationalizing Every Mother, Every Newborn care are based on experience from the Baby-friendly Hospital Initiative. Thus, the 10 standards for quality of care around childbirth follow the 12 steps in that Initiative. The initiative should cross traditional public–private boundaries, with the shared aspirational and practical target of achieving meaningful certification. The Every Mother, Every Newborn quality initiative should strengthen the links between data from different facilities and help national health systems to collate, analyse and respond.

Table 3.   Draft proposed standards for high-quality care around childbirth

1. The health facility has **management systems** to support care during labour and childbirth.
2. The health facility has **policies and processes** to support respectful, evidence-based clinical care during labour and childbirth.
3. The health facility has a **physical environment** appropriate for care during labour and childbirth.
4. The health facility has **drugs, supplies and equipment** for care during labour and childbirth.
5. The health facility has a **competent health workforce** to provide care during labour and childbirth.
6. The health facility collects, analyses and uses **data** to support and improve care during labour and childbirth.
7. The health facility provides **evidenced-based safe care** during labour and childbirth.
8. The health facility has **appropriate referral mechanisms** in place.
9. The health facility provides high-quality **postnatal care** to every mother and infant.
10. The facility collaborates with **communities** on issues related to maternal and neonatal health.

Emergency obstetric care

Current status of definition

Emergency obstetric care comprises the services and health care packages required for identifying and treating complications that arise during pregnancy and childbirth. Facility-based emergency obstetric care services are assessed on the basis of their availability to treat nine signal functions for obstetric emergencies and one signal function for neonatal resuscitation *(24)*.

Current status of data and availability

Equitable access and uptake of high-quality emergency obstetric care services are evaluated with harmonized indicators *(24, 27, 28)*, and facility needs assessment surveys are conducted by UNFPA, UNICEF and Averting Maternal Death and Disability *(61)*.

How could measurement be improved?

The participants strongly recommended a review of current emergency obstetric care signal functions, as there has been sustained evolution in most maternal and newborn health facilities since the signal functions were published. As increasing numbers of mothers are using facility care during childbirth, the quality of services for care of complications must be evaluated rather than simply quantifying their availability. More advanced techniques could be used to measure indicators to ensure that they inform local health policy and result in responsive feedback. Evaluation of the cadre and training of service providers could increase the availability and skills of clinical staff.

Newborn care is mentioned in the current signal functions only as the "availability of resuscitation". There is debate about whether newborn health care would be best served by a separate set of complementary signal functions or whether they should remain within the existing structures.

With regard to the broader quality initiative, there was consensus that advances in geographical information systems and other data collection techniques have significant implications for data collection in the field. The metrics base might be broadened to include process indicators of quality in the proposed standards of care, such as number of hours a facility is open or the availability or cadre of health care providers.

Currently, the emergency obstetric care indicator is the availability of facilities per 500 000 population; further testing and evaluation of denominators could be beneficial. As birth rates in populations vary, the workload depends on the expected number of pregnancies and births rather than on the population size.

It would be useful to harmonize the main health facility assessment tools, including emergency obstetric care, SARA, SPA and integrated maternal and child health, and WHO has already begun such work. Integrated solutions should be shared and a coordinated approach found. A maternal and newborn health reference group might be pertinent. These issues will be explored further in a meeting organized by UNFPA on emergency obstetric care indicators, tools, approaches and processes.

Care of small and sick newborns

Current status of definition

Facility-based care of small and sick newborns involves the provision of warmth, feeding support, safe oxygen therapy and effective phototherapy, with prevention and treatment of infections. Such care requires a dedicated ward space staffed by specially trained health workers. In high-income countries, facility-based care for small and sick newborns is the usual practice, as such care has been shown to reduce neonatal mortality. As preterm birth is the main cause of child deaths globally, the care of small and sick newborns is essential for achieving the mortality reductions foreseen in the ENAP. A delphi exercise showed that optimal care in a special infant care unit including KMC, provision of warmth, feeding support, safe oxygen therapy, phototherapy and infection management could avert 70% of deaths due to prematurity *(62)*. As care of small and sick newborns becomes more sophisticated, with interventions such as ventilation, surfactant therapy and parenteral nutrition, it could avert up to 90% of preterm deaths *(62)*.

Current status of data and availability

High-income countries have complex datasets, such as that of the Vermont Oxford network, which contain information on the care and outcomes of high-risk newborns, including quality management and process improvement *(63)*. There are many clinical guidelines and manuals for the care of small and sick newborns, but there are no globally agreed standards and tools for measurement.

How could measurement be improved?

As mentioned above, the only signal function for newborns currently included in emergency obstetric care monitoring is neonatal resuscitation and not the full package of care required for the care of small and sick newborns. Some signal functions have been proposed for the newborn *(64)*, but further work is required to define core competences or signal functions by level of care. Research should be conducted on the most critical signal functions that could be measured after improvements to existing systems.

Recommendations: roadmap for improving measurement

The roadmap

The "roadmap for measurement improvement" is a 5-year plan to improve, institutionalize and use metrics by 2020, to track and reduce neonatal mortality and stillbirths to < 10 per 1000 by 2030. It supports the roadmap issued recently at the summit on "Measurement and accountability for results in health: a common agenda for the post-2015 era" (ma4health.hsaccess.org), to increase investment in national data systems and data use. Strengthening national information systems, counting births and deaths and improving tracking of coverage, equity and quality are central to the ENAP to ensure that every newborn has a healthy start in life.

The ENAP roadmap lists the priorities for testing the core indicators, so that they can be used at scale by 2020 or before. For some, especially the treatment interventions, this will require formal validation and then testing of the feasibility of use in HMIS, especially in facilities. The ENAP roadmap includes building leadership in high-burden countries.

Testing the metrics

The roadmap lists questions for each indicator identified during the meeting, which were subsequently refined. Existing datasets can be consulted for indicators that require further definition, such as treatment indicators and the care of small and sick newborns. Field testing in various settings is required to validate some indicators, by comparing data from direct observation with recall data and testing the specificity and sensitivity of each indicator. The denominator options to be tested are presented in the table of core metrics definitions in Annex 5. Data on all denominators can be collected at a given testing site; then a precise, "true" coverage denominator can be compared with simpler ones, such as 100 or 1000 live births.

The availability, quality and accuracy of assessments of birth-weight and gestational age, both in pregnancy and during the neonatal period, must be improved for assessing both impact and coverage.

Country leadership and capacity-building

Metrics testing will be accompanied by capacity-building for data collection and use in high-burden countries and will be conducted at academic centres of excellence in countries. The International Network for the Demographic Evaluation of Populations and their Health (INDEPTH) comprises a group of independent health research centres operating health and demographic surveillance system sites in low- and middle-income countries. The interest group, coordinated by Makerere University, Uganda, involving 12 of the > 40 INDEPTH sites, will testing the questions and tools for counting births and deaths around the time of birth, including assessments of cause of death, birth-weight and gestational age. The WHO Collaborating Centre at the All-India Institute of Medical Sciences will define databases and feasible approaches for follow-up of at-risk newborns, to track and minimize disabilities such as retinopathy of prematurity.

Comparable testing in other countries could be conducted within large maternal and neonatal health projects, such as the United States Agency for International Development-funded bilateral

maternal and child survival programme and MEASURE Evaluation. UNICEF and WHO will map some of these large projects, but the process was not agreed at the meeting. A mechanism for sharing research questions and testing protocols is required, so that more institutions can conduct testing and measurement, particularly in high-burden countries. This work should be linked with wider health system reform, to empower governments to improve metrics. By creating mentorship and ownership of metrics improvement with high-burden countries, better understanding will be obtained of how to incentivise investment in metrics.

Proposed testing and research agenda

To achieve institutionalization and shift technical leadership to high-burden settings, the measurement improvement roadmap is linked to country centres of excellence and existing networks to ensure testing and use in many contexts.

Country hubs: Validation will start in test countries and then be spread to other countries:
— validation and feasibility-testing of facility-based coverage data; and
— tools such as audit, minimum perinatal dataset, simplified gestational age assessment.

Network 1: For mortality data, the INDEPTH network, with more than 50 sites in Asia and Africa:
— population-based surveillance of birth, stillbirths and neonatal deaths; and
— opportunities to validate pregnancy history modules, verbal autopsy and improve assessment of low birth-weight.

Network 2: For data "beyond newborn survival", the All-India Institute of Medical Sciences, a WHO collaborating centre for training and research in newborn care:
— follow-up of at-risk newborns by various levels of health care; and
— opportunities to validate and test the feasibility of follow-up, screening for disability and retinopathy of prematurity and models to improve care.

Institutionalization and use of the metrics on large-scale platforms

Population-based surveillance and surveys

Household surveys are widely useful, and the data generated provide population-level data on coverage and impact, allow triangulation with results from other platforms, inform interventions delivered in the community (including home births) and can be further analysed, for instance after stratification by socio-economic quintiles to determine equity. Household surveys are used to measure population indicators in most low- and middle-income countries, including the neonatal mortality rate. The use of population survey data for measuring stillbirth rates should be optimized by testing the inclusion of a full birth history in questionnaires. As the quality and quantity of data from civil registration and vital statistics systems require strengthening and improvement in many countries, household surveys will remain the main tool for collecting population-based data on maternal and newborn health.

In view of the relatively small numbers of newborns in a population that receive interventions, a large sample size is required to generate sufficiently precise point estimates of coverage, especially for stratification and sub-analyses. Maternal recall of interventions at the time of birth (often years after the event) is known to be poor, especially with regard to timing or complex diagnoses. For most newborn interventions (ACS, resuscitation, treatment of severe infection and possibly KMC), household surveys are unlikely to be useful for measuring coverage. The ENAP measurement improvement roadmap therefore recommends the development and strengthening of facility-based data collection and HMIS for these indicators.

Civil registration and vital statistics

The ENAP milestones for 2020 include linkage of facility-based minimum perinatal datasets with civil registration and vital statistics systems in order to increase registration of births and

Figure 4. Large-scale data collection platforms
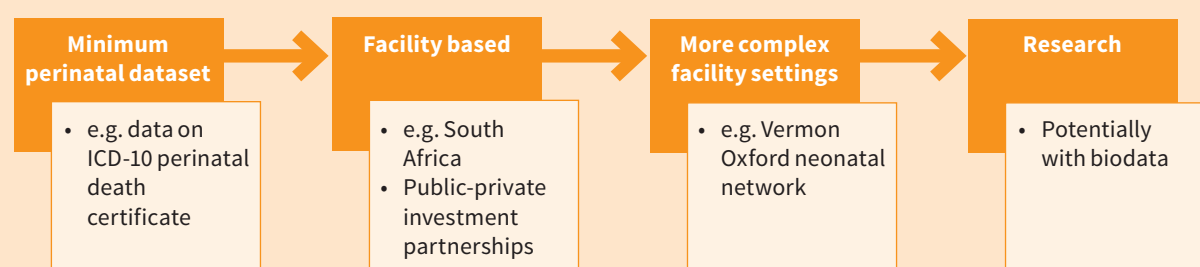
Civil and vital statistics

— Birth certificates and better coverage and quality of data, e.g. on birth-weight
— Death certificates with better data on perinatal outcomes and refined ICD codes

Facility and HMIS

— Perinatal mortality audit linked to maternal audit and death surveillance and response
— Minimum high-priority perinatal dataset collated in HMIS, possible in DHIS2
— Tracking of validated coverage indicators for quality of care at birth and care of small and sick newborns (e.g. ACS, resuscitation, KMC and treatment of neonatal infections)
— Health facility assessment tools (with standardized process and quality indicators)

Population-based surveillance and surveys (DHS2, MICS)

— Data on mortality, including recall, misclassification of stillbirths, neonatal deaths and live births
— Verbal autopsy for stillbirths and neonatal deaths, with optional social autopsy
— Better tools for assessing birth-weight, birth size and gestational age

Minimum perinatal dataset	**Facility based**	**More complex facility settings**	**Research**
• e.g. data on ICD-10 perinatal death certificate	• e.g. South Africa • Public-private investment partnerships	• e.g. Vermon Oxford neonatal network	• Potentially with biodata

deaths and birth-weight (Figure 4). In settings with a high proportion of home births, intermittent surveys or population surveillance should also be linked with civil registration and vital statistics platforms. The inclusion of stillbirth rates in reporting and accountability mechanisms, especially intrapartum stillbirths, is essential and will be a component of work to improve verbal autopsy for better estimates of the causes of death of mothers, newborns and stillbirths *(65)*. Additional indicators of newborn morbidity and disability and child development should also be validated and institutionalized so that countries can scale up neonatal intensive care services.

Facility and health management information systems

As policy recommendations for the treatment interventions identified in the ENAP (except cord cleansing with chlorhexidine) focus on facility-based administration, the task team mainly considered facility-level data collection platforms. Combined testing of the range of interventions in a number of facilities is proposed in the roadmap for more efficient testing of a range of numerators and denominators. Furthermore, each intervention can be tested with the same datasets with a range of potential options for denominators (Annex 5 gives a full list by indicator).

HMIS routinely collect and report health information directly from facilities and districts and therefore provide real-time, locally owned data for policy-making. As HMIS are less expensive than large-scale, representative household surveys and can be organized by national decision-makers, they should be strengthened. The validity of HMIS indicators should be improved, and use of these data for reviewing programme performance should be increased, especially as many areas are now using version 2 of the District Health Information software (DHIS2) *(66)*. ENAP treatment indicators

could be included in HMIS, SPA and other facility audits, in conjunction with supply management tools to monitor stocks of essential equipment and medicine. Each country will decide whether to include the ENAP treatment indicators in these systems, depending on facility levels, national data needs and resource and technical capacity, as overloading HMIS with data can limit their usefulness.

Cross-linking data streams

The participants agreed that further work is required to find efficient mechanisms for using data generated in different platforms.

Coordination and integration with maternal health metrics

Many of the participants noted that there is currently no global grouping of the many partners working on maternal and newborn metrics, despite the potential advantages of effective leadership and coordination. There are large overlaps and synergies, and efficiency could be improved at all levels of the evaluation framework (from mortality through coverage to process tracking) by better links between work on mothers, newborns and stillbirths, including guidance and support for countries. Coordination and leadership could be provided by a technical advisory group for maternal and newborn health metrics. WHO agreed to continue the discussion in the metrics groups of the ENAP and Ending Preventable Maternal Mortality *(1)*.

The measurement improvement roadmap will require support from all the partners involved and sustainable funding from both donors and national governments. Academic institutions should ensure rigour and innovation in the roadmap and set priorities for ensuring high-impact, effective programming. WHO mandates work with multiple partners, funders and stakeholders to harness the necessary capacity.

Conclusions

The purpose of the meeting was to bring together United Nations agencies, researchers and partner organizations to review data and develop a measurement improvement roadmap for the ENAP indicators, to support wider investment in HMIS. Despite progress in reducing mortality among mothers and children under 5 years of age during implementation of the Millennium Development Goals, there are still 2.7 million neonatal deaths; a further 2.6 million stillbirths were not counted in meeting the Goals *(17)*. Counting births and deaths, especially deaths around the time of birth, is at the heart of post-2015 health monitoring, accountability and action *(17)*. Tracking these vital events and measuring coverage with high-impact life-saving interventions for newborns is essential for meeting the commitments made in *Ending preventable maternal and child deaths: a promise renewed* (http://www.apromiserenewed.org/).

Measuring ENAP core indicators at scale will be essential for achieving the ENAP 2030 targets for neonatal mortality and stillbirth rates of ≤ 12 per 1000 births and will contribute to ensuring high, equitable coverage with evidence-based interventions. Although the ENAP recommends universal health care coverage during childbirth and the first week of life, many interventions are still not measured systematically. The meeting agreed that both the quantity and quality of data must be improved and that measurement of the coverage of interventions should include the content and quality of care delivered.

The participants supported strengthening of HMIS and linkage to civil registration and vital statistics systems, with investment in more sustainable, local information systems that can provide timely, high-quality data in sufficient quantity to inform efficient programme management and evidence-based policy-making. Household surveys and global institutionalization of regular mortality estimates are the basis for health policy, planning and global governance. Discussions throughout the meeting emphasized the need for innovative solutions, such as linked m-health platforms, for ready triangulation of data from surveys, civil registration and vital statistics systems and HMIS.

This report represents a call to action for sustainable investment in HMIS. The risky moment of birth is a test of health and metrics systems. Gaps in testing and use must be filled, requiring technical skills, technology and leadership. The fragmented, short-term approach is problematic, and indicators, HMIS, survey platforms and funding streams should be harmonized. This will require stronger political will. The ENAP metrics targets and investment in the measurement improvement roadmap are ambitious but could form the basis for wider, sustainable improvements in HMIS and ensure that high-burden countries can meet the targets of ending preventable stillbirths and maternal, newborn and child deaths.

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Joy Lawn
Matthews Mathai

Coordination group

Agbessi Amouzou
Kim Dickson
Suzanne Fournier
John Gove
Allisyn Moran
Lara Vaz

Coordinators of task teams on treatment coverage

Sarah Moxon, Juan-Gabriel Ruiz
Group work presented by J. Lawn and M. Mathai
Barbara Rawlins, Sayed Rubayet
Steve Hodgins
Steve Wall

Other

Hannah Blencowe
Naill Conroy
Manoj Kurian

Annex 2
Agenda

WEDNESDAY 3 DECEMBER 2014		
09h00–09h30	*Plenary session 1:* Welcome and introductions Expected outcomes of the meeting	Rajiv Bahl Matthews Mathai
9h30–10h00	*Plenary session: Chair* **Global context for indicator harmonization, noting opportunities to improve, collect and use data relevant to ENAP** WHO core indicators list and WHO quality of care indicators Data collection platforms (civil registration and vital statistics systems, health information management systems, surveys) Linkage to wider health systems and universal coverage metrics	Rajiv Bahl Ties Boerma
10h00–10h30	**Every Newborn: improving and using the metrics for action** ENAP milestones regarding metrics, what have we committed to on ENAP indicators; current status and improving data consistency, collection and use	Joy Lawn (on behalf of ENAP metrics coordination group)
10h30–11h00	Plenary discussion especially on linkages	
11h00–11h20	**Refreshment break**	
11h20–13h00	*Plenary session: Chair* **Overview of five priority coverage indicators in ENAP core list** Kangaroo Mother Care Newborn resuscitation Treatment of neonatal infection/sepsis Antenatal corticosteroid use Chlorhexidine cord cleansing	Shams El Arifeen Juan Ruiz/Sarah Moxon Barbara Rawlins/Rubayet Sayed Steve Wall Metin Gülmezoglu Steve Hodgins/Penny Dawson
13h00–13h45	**Lunch**	
13h45–15h45	**Working groups for five priority coverage indicators** Kangaroo Mother Care Newborn resuscitation Treatment of neonatal infection/sepsis Antenatal corticosteroid use Chlorhexidine cord cleansing	
15h45–16h00	**Refreshment break**	
16h00–17h00	*Plenary session: Chairs* **Summary feedback from working groups** Kangaroo Mother Care Newborn resuscitation Treatment of severe neonatal infection Antenatal corticosteroid use Chlorhexidine cord cleansing	Joy Lawn, Matthews Mathai
18h00–19h00	Webinar update on ENAP working groups	

THURSDAY 4 DECEMBER 2014		
09h00–09h15	*Plenary session: Chair* *Brief summary of day 1 progress, expectations for day 2*	Joseph de Graft Johnson Suzanne Fournier
09h15–09h55	**Every Mother, Every Newborn quality initiative** Content, countries, metrics issues	Every Mother, Every Newborn team Kim Dickson/ Bernadette Daelmans
09h55–10h45	**Overview of coverage, content and quality of care for mothers and newborns particularly regarding intrapartum and postnatal care, including revision of emergency obstetric care indicators** Overview of relevant work and research questions also drawing on Johns Hopkins research on maternal recall of intrapartum and essential newborn care practices	UNICEF Agbessi Amouzou
10h45–11h15	**Refreshment break**	
11h15–12h05	*Plenary session: Chair* **Impact indicators for stillbirths and newborns: status and improvement** • Mortality (neonatal and stillbirths) • Morbidity (preterm, possible serious bacterial infection, etc.) • Disability and development outcomes Data improvement in civil registration and vital statistics systems, facility HMIS and survey platforms/Verbal autopsy	Zulfiqar Bhutta Colin Mathers with Hannah Blencowe/ Joy Lawn
12h05–12h30	**Embedding this agenda in global metrics work** Reflection on previous experiences of global metrics coordination such as with malaria and AIDS. Discussion on possible mechanisms related to maternal and newborn health metrics Improvement agenda Introduction to working groups for ENAP metrics	John Grove and Allisyn Moran
12h30–13h15	**Lunch**	

13h15–14h45	Technical Working groups for ENAP metrics improvement agenda:
	1. Impact
	   A. Neonatal deaths/stillbirths (*facilitators: Colin Mathers and Joy Lawn*)
	   B. Morbidity, impairment and child development after perinatal complications (*facilitators: Ashok Deorari, Hannah Blencowe, Bernadette Daelmans*)
	2. Coverage, content and quality of care
	   A. Intrapartum care (*facilitators: Matthews Mathai and Alisyn Moran*)
	   B. Postnatal care (*facilitators: Agbessi Amouzou and Lara Vaz*)	

14h45–15h00	**Refreshment break**	
15h00–16h00	*Plenary session: Chair* Feedback from working groups and discussion	Joy Lawn and Matthews Mathai
16h00–17h00	Next steps Summary and closure	Joy Lawn and Matthews Mathai

Annex 3
Participants in breakout groups

KANGAROO MOTHER CARE	CHLORHEXIDINE CORD CLEANSING	SEVERE NEONATAL INFECTION
Juan Ruiz	Steve Hodgins	Steve Wall
Sarah Moxon	Kristen Yee	Carolyn Maclennan
Elizabeth Sutherland	Penny Dawson	Hannah Blencowe
Gulnara Semenov	Niall Conroy	Eugene Statnikov
Jim Litch	Shams El Arifeen	Jennifer Heys
John Grove	Anneke Schmider	CC Lee
Ashok Deorari		Bernadette Daelmans
Frederik Froen		Tanya Marchant
Agbessi Amouzou		Peter Waiswa
Elizabeth Mason		

ANTENATAL CORTICOSTEROIDS	NEONATAL RESUSCITATION	NEONATAL DEATHS AND STILLBIRTHS
Metin Gülmezoglu	Barbara Rawlins	Colin Mathers
Joy Lawn	Sayed Rubayet	Barbara Rawlins
Kate Somers	Suzanne Fournier	Bob Pattinson
Kate Kerber	Christabel Enweronu-Laryea	Jon Dorling
R Bahl	Jon Dorling	Kristen Yee
Severin von Xylander	Kathleen Hill	Penny Dawson
Allisyn Moran	Susan Niermeyer	Eugene Statnikov
Dilip Thandassery	Zulfiqar Bhutta	Kate Kerber
Matthews Mathai	Joseph de Graft-Johnson	Peter Waiswa
Josh Vogel	Linda Wright	Shams El Arifeen
Bob Pattinson	Kim Dickson	Anneke Schmider
		Olav Poppe

MORBIDITY, IMPAIRMENT	INTRAPARTUM (POINTS OF CONTACT)	POSTNATAL CARE (POINTS OF CONTACT)
Ashok Deorari	Matthews Mathai	Lara Vaz
Bernadette Daelmans	Sayed Rubayet	Agbessi Amouzou
Hannah Blencowe	Elizabeth Sutherland	Gulnara Semenov
Christabel Enweronu-Laryea	Kathleen Hill	Susan Niermeyer
Elizabeth Sutherland	Joseph de Graft-Johnson	Steve Hodgins
Juan Ruiz	Femi Oladapo	Sarah Moxon
ACC Lee	Allisyn Moran	ACC Lee
Carolyn McClennan	Tanya Marchant	

Annex 4
Terms of reference of the task teams

Responsibilities of the ENAP metrics task teams

The first task teams to be established are for the four core indicators of coverage with high-impact, newborn-specific interventions for which data on coverage are not available (KMC, resuscitation, ACS and management of sepsis). Chlorhexidine was included as an additional indicator, as it is associated with specific targets in the ENAP.[1]

The task teams shall seek to represent both the maternal and the newborn health communities and reflect multiple stakeholders, such as nongovernmental organizations, United Nations organizations professional associations and research institutions, especially from the South.

The expectation is for your group to propose and then consult more widely, with consensus on:

A. The "ideal" indicator for population based **coverage**.

B. Feasible indicators for coverage for use now or with testing in

    i.   Household surveys (if possible – if not say why not possible to measure in household surveys or what should be tested with respect to this)
    ii.   Facility surveys
    iii. HMIS

C. Additional indicators for content or programmatic focus

The indicators proposed should include an ideal indicator and then an indicator that is feasible to be linked to household surveys (if possible and appropriate), facility-based data collection and HMIS platforms. Work can then be identified for testing and piloting of data collection tools as appropriate and they should build on work and work with the Newborn Indicators Technical Working Group community. It is important to note that for some indicators it will not be possible to collect true coverage, for example for neonatal resuscitation it is not possible to collect accurate numerator or denominator data and a surrogate or a close process indicator will be required.

Tables to be filled by coverage task teams

Intervention considered by your team: ……………………………………………………………………… .

A.   IDEAL indicator for measurement of true coverage

i.e. denominator being those who need the intervention and numerator being those who received it.

e.g. for neonatal resuscitation with bag and mask the ideal or true denominator would be those neonates who "need to be resuscitated" with bag and mask and numerator being those who were resuscitated with bag and mask.

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[1]   Although there is other important metrics work, these newborn-specific interventions have a high impact, are central to the ENAP and no data on population-based coverage are available. They are therefore the priorities for technical work. Subsequent work will address the impact, contact/content (in intrapartum and postnatal care), Every Mother, Every Newborn and small infant care.

Numerator	
Denominator	
Comments on data collection	

B. PROPOSED coverage indicator for pragmatic use (possible to start data collection in the near term)

Consider alternatives, such as a rate per 100 live births, especially If the true denominator will not be feasible to measure (e.g. neonatal rhesus where those "who need rhesus" is subjective) or composite

e.g. for ACS where it would be per all pregnancies <34 weeks completed gestation and with indications for use of ACS) or hard to get valid data (e.g. sepsis case management where parental report of PSBI is similar to the issues already described with parental report of possible pneumonia.

i. Household survey (NB: for some indicators it will not be possible to collect data through household survey, in this case tables can be filled with "not applicable")

Proposed definition of indicator	
Proposed numerator	
Proposed denominator	

ii. Proposed indicator for facility based survey

Proposed definition of indicator	
Proposed numerator	
Proposed denominator	

iii. Proposed indicator for health management information systems

Proposed definition of indicator	
Proposed numerator	
Proposed denominator	

C. OTHERS EG PROGRAMMATIC OR QUALITY

The team can also propose up to three additional indicators focused more content, programmatic aspects or for quality of care

i–iii

Definition of indicator	
Numerator	
Denominator	
Proposed data collection method	

Annex 5
ENAP core definitions

	CORE		NUMERATOR	DENOMINATOR[a]	DATA SOURCES	DEFINITION SOURCE
Impact	1	Maternal mortality ratio	Number of maternal deaths per year during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy. Defined as a death from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes)	100 000 live births	Civil registration and vital statistics and registries (when high coverage and quality)	ICD-10. For more details see WHO/UNFPA/UNICEF estimates 2014 (1)
	2	Stillbirth rate	For international comparison: Number of infants per year born with no sign of life and weighing ≤ 1000 g or after 28 weeks' gestation (ICD-10 recommends the inclusion of fetal deaths ≥ 22 weeks or ≥ 500 g)	1000 total live and stillborn births	Surveys or facility or health management information systems or estimation modelling	ICD-10.[b] See Lawn et al. 2011 (2) for details of variations
	3	Neonatal mortality rate	Number of live born infants per year who die before 28 completed days of age	1000 live births		ICD-10. See Lawn et al., 2014 (3) for discussion of reporting of definitions

Shaded, not currently routinely tracked at global level

Bold, indicator requires additional evaluation for consistent measurement

[a] The period is usually calculated per year.

[b] ICD-10 assumes that weight and gestational age are equivalent, which they are not (see Lawn et al., 2011 (2)).

Coverage: Care for all mothers and newborns

CORE	NUMERATOR	DENOMINATOR	DATA SOURCES
4 Intrapartum care tracked by the point of contact with a skilled attendant at birth	Number of women aged 15–49 years who were attended by skilled health personnel during their most recent live birth [MICS (4) 2 years before the survey] Number of live births assisted by a skilled provider (doctor, nurse midwife, auxiliary nurse/midwife) [DHS (5) 5 years before the survey]	Number of women aged 15–49 years with a live birth in the 2 years before the survey [MICS (4)] or all li(ve births within the past 5 years [DHS (5)]	Household surveys (e.g. DHS (5), MICS (4)) or national facility data/HMIS or DHIS
5 Early postnatal care contact for mothers and infants	Number of women aged 15–49 years who received a health check within 2 days after delivery for the most recent live birth [DHS (5) and MICS (4) 2 years before the survey] Number of last live births with a postnatal health check in the first 2 days after birth [DHS (5) and MICS (4) 2 years before the survey]	Total number of women aged 15–49 years with a live birth in the past 2 years [DHS (5) and MICS (4)] Total number of last live births in the 2 years [DHS (5) and MICS (4)]	
6 Essential newborn care with early initiation of breastfeeding as tracer indicator Exclusive breastfeeding to 6 months	Number of live born infants (in the 2 years before the survey) who are breastfed within 1 h of birth [DHS (5) and MICS (4)] Number of living children < 6 months of age who are exclusively breastfed [MICS (4)] (MICS allows oral rehydration salts, vitamins, mineral supplements and medicines) Number of infants aged 0–5 months who are exclusively breastfed [DHS (5)] (Both MICS (4) and DHS (5) questions focus on feeding behaviour within 24 h of the survey).	Total number of live born infants in the 2 years preceding the survey [DHS (5) and MICS (4)] Total number of living infants < 6 months of age [DHS (5) and MICS (4)]	

Coverage: Care for newborns at risk or with complications

CORE		NUMERATOR	DENOMINATOR (OPTIONS TO BE TESTED AND COMPARED, ESPECIALLY WHEN TARGET POPULATION FOR COVERAGE IS DIFFICULT TO MEASURE)	DATA SOURCES
7	Antenatal corticosteroid use (ACS)	Process indicator: number of countries with ACS on the essential drug list for fetal lung maturation [As collected in the United Nations commodities commission data system and reported in Countdown to 2015 (6)] Coverage indicator (requires validation): All women who give birth in facility at < 34 completed weeks and received one dose of ACS for risk of preterm birth (Note initial focus on counting all, while testing ways to disaggregate by gestational age at birth to identify women treated who did not deliver at < 34 completed weeks)	Number of countries with data from essential medicines list policy Live births in the facility Total births in the facility (including stillbirths) Estimated births (live or total) Target population for coverage: live births in facility by gestational age in weeks, notably < 34 weeks as target population for coverage	**Facility:** Data or survey [e.g. SPA (8) or SARA (9) from national facility, potential in HMIS (initial focus of data collection in facilities). WHO guidelines are mainly for facility treatment, but additional community tracking will be required in countries with national scale up of community provision of e.g. severe neonatal infection case management. **Household surveys:** These treatment interventions are unlikely to be measureable in household surveys because of sample size and difficulty in defining denominators, especially for parental recognition and also in knowing or recalling details of numerator (e.g. ACS injection vs. oxytocin injection). KMC may be feasible after further testing and sample size calculations
8	Newborn resuscitation	Process indicator: Number of facilities with a functional neonatal bag and two masks (sizes 0 and 1) in the labour and delivery service area [as defined in WHO report (7) and collected in SPA (8) and SARA (9) facility assessments] Coverage indicator (requires validation): Number of newborns who were not breathing spontaneously or crying at birth for whom resuscitation (stimulation and/or bag and mask) was initiated	Total number of facilities with inpatient maternity services that are assessed Live births in the facility Total births in the facility (including stillbirths) Estimated births (live or total) Target population for coverage: i.e. total births in the facility not breathing spontaneously or crying but excluding macerated stillbirths (i.e. including fresh stillbirths as a surrogate of intrapartum stillbirths)	
9	Kangaroo Mother Care	Process indicator: Number of facilities in which a space is identified for KMC and where staff have received KMC training (< 2 years) Coverage indicator (requires validation): Number of newborns initiated on KMC at a facility	Total number of facilities with inpatient maternity services that are assessed Live births in the facility Total births in the facility (including stillbirths) Estimated births (live or total) Target population for coverage: i.e. total number of newborns with birth weight < 2000 g or < 2500 g	

CORE		NUMERATOR	DENOMINATOR (OPTIONS TO BE TESTED AND COMPARED, ESPECIALLY WHEN TARGET POPULATION FOR COVERAGE IS DIFFICULT TO MEASURE)	DATA SOURCES
	Treatment of severe neonatal infection	Process indicator: Number of facilities in which gentamicin is available at suitable peripheral level for treatment of severe neonatal infection [WHO quality of care (7), collected by SPA (8) and SARA (9)]	Number of facilities assessed	Facility and household survey (as indicator 7–8)
		Coverage indicator (requires validation): Number of newborns who received at least one injection of antibiotic for possible serious bacterial infection in the facility	Live births in the facility / Total births in the facility (including stillbirths) / Estimated births (live or total) / Target population for coverage: newborns with possible serious bacterial infection	Could be collected in household surveys [e.g. DHS (5) or MICS (4)], but sample size calculations and validation study required
10	*Chlorhexidine cord cleansing*	Process indicator: Number countries with chlorhexidine on the essential drug list for the purpose of cord cleansing [As collected in the United Nations Commodities Commission data system and reported in Countdown to 2015 (6)]	Countries with data from essential medicines list policy	As collected by the United Nations Commodities Commission and reported in Countdown to 2015 (6)
		Coverage indicator (requires validation): Number of newborns who received at least one dose of chlorhexidine (7.1%) to the cord within 24 h of birth	Live births in surveyed population (or at home, depending on national policy or data available)	Could be collected in household surveys (e.g. DHS (5) or MICS (4))
	Caesarean section rate	Number of women aged 15–49 years with a live birth in the X years before the survey delivered by caesarean section [Countdown to 2015 (6)]	Women aged 15–49 years with a live birth (also to evaluate option of per total births in facility per year (i.e. including stillbirths, macerated and fresh) given high rate of caesarean section among women with a stillbirth)	National facility data or facility survey, HMIS or household surveys

COVERAGE: Care for newborns at risk or with complications (specific treatment interventions)

	CORE	NUMERATOR	DENOMINATOR (OPTIONS TO BE TESTED AND COMPARED, ESPECIALLY WHEN TARGET POPULATION FOR COVERAGE IS DIFFICULT TO MEASURE)	DATA SOURCES
QUALITY: Service delivery packages for quality care	Emergency obstetric care	Number of facilities in area providing basic or comprehensive emergency obstetric care [Monitoring emergency obstetric care handbook, 2009 (10)]	Population of area by 500 000 [Monitoring emergency obstetric care handbook, 2009 (10)] (Note recent recommendation to use a denominator based on births, not population)	Facility survey or potentially from national facility data or HMIS
	Care of small and sick newborns	Definitions and measurement approach to be determined (Similar approach to emergency obstetric care (10))	Population to be defined (according to births)	Facility survey or potentially from national facility data or HMIS
	Every Mother, Every Newborn	Other norms and standards to be defined (e.g. criteria related to structure, such as water and sanitation)		

Blue cells, not routinely tracked and collated by the United Nations.

Bold italics, indicator that requires further work to ensure the availability of consistent data in routine information systems.

Red, service delivery package for which norms and standards will be defined and tracked.

All coverage indicators to be tracked in such a way that they can be broken down to assess equity, e.g. urban or rural, regional, wealth quintile.

References

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4. Multiple indicator cluster surveys (http://mics.unicef.org/).

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Annex 6

The ENAP measurement improvement roadmap for coverage indicators (1)

2020 — Effective use at scale in multiple countries

Coverage: Care of all Mothers & Newborns

Intervention		Validity Testing	Feasibility Testing	Phased Implementation
Intrapartum Care	Facility	Focus on facility assessments that measure content and quality: equipment, provider skills, referral capacity & observed care	Increase quality & quantity of facility level data collected internally (eg HMIS) & externally (eg HFA)	Integrated implementation in HMIS & feasibility evaluated, mHealth tools
	Household Survey	Refining of existing contact point coverage indicators, plus more work on content of care, with triangulation of population-based and facility data		
Essential Newborn Care	Facility	Focus on facility assessments that measure content and quality: equipment, provider training and skills, & observed care	Increase quality & quantity of facility level data collected internally (eg HMIS) & externally (eg HFA)	Integrated implementation in HMIS & feasibility evaluated, mHealth tools
	Household Survey	Refining of existing contact point coverage indicators, plus more work on content of care, with triangulation of population-based and facility data		
Postnatal Care	Facility	Focus on facility assessments that measure content and quality: provider skills, referral capacity, observed care, & community links	Increase quality & quantity of facility level data collected internally (eg HMIS) & externally (eg HFA)	Integrated implementation in HMIS & feasibility evaluated, mHealth tools
	Household Survey	Refining of existing contact point coverage indicators, plus more work on content of care, with triangulation of population-based and facility data		

Coverage: Care for Newborns at Risk or with Complications (Specific Treatment Interventions)

Intervention		Validity Testing	Feasibility Testing	Phased Implementation
Antenatal corticosteroids	Facility	Coverage: Test numerator validity PPV etc and evaluate use of various candidate denominators	Test process & quality metrics by WHO standards, feasibility testing in HMIS, refine metrics accordingly	Integrated implementation in HMIS & ongoing feasibility testing for mHealth tools
	Household Survey	Not feasible given survey recall or sample size		
Neonatal resuscitation	Facility	Coverage: Test numerator validity PPV etc. and evaluate use of various candidate denominators	Test process & quality metrics by WHO standards, feasibility testing in HMIS, refine metrics accordingly	Integrated implementation in HMIS & ongoing feasibility testing for mHealth tools
	Household Survey	Not feasible given survey recall or sample size		
Kangaroo Mother Care	Facility	Coverage: Test numerator validity PPV etc. and evaluate use of various candidate denominators / Assess validity of recall of KMC practice	Test process & quality metrics by WHO standards, feasibility testing in HMIS, refine metrics accordingly / Define & test potential survey modules, sample size	Integrated implementation in HMIS & ongoing feasibility testing for mHealth tools / Pilot testing before inclusion in DHS/MICS
	Household Survey			
Severe Neonatal Infection	Facility	Coverage: Test numerator validity PPV etc. and evaluate use of various candidate denominators	Test process & quality metrics by WHO standards, feasibility testing in HMIS, refine metrics accordingly	Integrated implementation in HMIS & ongoing feasibility testing for mHealth tools
	Household Survey	Not feasible given survey recall or sample size		
Chlorhexidine Cord Cleansing	Facility	Current WHO policy not for facility use	Process & quality: test additional metrics. Test tools for feasibility with use at scale	Include in DHS/MICS core module dependent on testing
	Household Survey	Coverage: Assess validity of cord care question in DHS /MICS, consider sample size feasibility where policy for use is not national		
Care of Small & Sick Newborns	Facility	Core competencies defined and validated	Facility assessment module developed and piloted	Module linked to EmOC and routine HMIS tracking and piloted in countries
	Household Survey	Not feasible given survey recall or sample size		

2015 — VALIDITY TESTING | FEASIBILITY TESTING | PHASED IMPLEMENTATION — 2020

DHS, demographic health survey; EmOC, emergency obstetric care; HFA, health facility assessment; HMIS, health management information systems; KMC, Kangaroo Mother Care; MICS, multiple indicator cluster survey

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