World Health Organization

Indicator Sheet

NEONATAL MORTALITY RATE

MoNITOR

CONCEPT AND DEFINITION

Concept

The first 28 days of life is a vulnerable time for child survival and an estimated 2.4 (uncertainty interval: 2.3, 2.7) million newborns died in 2019 *(1)*. Although progress has been made since 1990, neonatal mortality remains a challenge in low- and middle-income countries (LMIC) where there are poor health system infrastructure and critical shortages of health personnel who are able to adequately manage and provide quality care *(1,2)*. An analysis conducted by the WHO Department of Information, Evidence and Research and the Maternal and Child Epidemiology Estimation (MCEE) group found that the main causes of neonatal mortality are due to preterm birth and intrapartum complications, and due to infections, including sepsis, meningitis and pneumonia *(3)*. The Sustainable Development Goal (SDG) agenda highlights the importance of continued momentum towards improving newborn health by setting, under SDG 3, targets aiming for all countries to reduce neonatal mortality to at least as low as 12 per 1000 live births by 2030 *(4,5)*. The neonatal mortality rate (NMR) can be considered a measure of overall development and directly reflects prenatal, intrapartum and neonatal care. Children face the highest risk of dying in their first month of life and the neonatal period accounts for a large proportion of child deaths.

Definition

Probability that a child born in a specific year or period will die during the first 28 completed days of life if subject to age-specific mortality rates of that period, expressed per 1000 live births. Neonatal deaths (deaths among live births during the first 28 completed days of life) may be subdivided into early neonatal deaths, occurring during the first seven days of life, and late neonatal deaths, occurring after the seventh day but before the 28th completed day of life *(6)*.

The number of children who died during the first 28 days of life is expressed as a rate per 1000 live births *(6)*.

Unit of measurement: Rate

Level of indicator use: Population-based global, national and subnational (first or second administrative level)

Monitoring and evaluation framework: Impact

Domain: Mortality

Continuum of care: Postnatal

MEASUREMENT GUIDANCE

Data sources

The three main data sources for this indicator are:

a. Civil registration and vital statistics (CRVS) systems

b. Routinely collected administrative data

c. Population-based household surveys.

Civil registration and vital statistics systems

A well-functioning and integrated national or subnational CRVS system will universally register and certify vital events, including live births, stillbirths and deaths that occur in the country or administrative area. Birth and death certificates should be issued as part of the CRVS system, allowing the compilation, analysis and dissemination of information through vital statistics agencies, including population characteristics (e.g. sex, date of birth or death, place of birth or death, place of usual residence) and cause-of-death information. Some CRVS systems will also register and certify other important vital events within the population, such as adoptions, marriages and divorces *(7)*.

Data from CRVS are the preferred data source for this indicator when the system freely and universally records vital events and data are recorded in a systematic manner that ensures high data quality for both the public and private health sectors and regardless of location of birth (e.g. health facility or community-based births and deaths are captured).

Key source of data: The main source of data from this indicator involves several steps and varies based on the policies and procedures of the national or subnational CRVS or other routine system within health facilities and/or within communities. Declaration of the live birth or death events are obtained through: (a) forms completed by health personnel at health facilities; or (b) community-based sources, including registration forms submitted directly by the parents of the live birth and death. Either paper or electronic forms containing this information are then submitted to the relevant civil authorities or vital statistics agencies, which have the responsibility to officially record the birth and death event and issue information about the birth and death characteristics, such as name, date and place of birth, date and place of death, nationality and names of the mother and/or father. At the national or subnational level, the civil authority or vital statistics agency issues birth and death certificates to formalize the birth and registration, respectively. National or subnational civil authorities or vital statistics agencies are responsible for reporting live births and death information specific to this indicator.

Indicator definition and calculation: The indicator is the probability that a child born in a specific year or period will die in the first 28 days of life (0–27 days) if subject to age-specific mortality rates of that period, expressed per 1000 live births. It is calculated as the number of neonatal deaths (children who died during the first 28 days of life) per 1000 live births during a specified time period.

Numerator: The number of children who died 0–27 days after birth in a specified period.

Denominator: Total number of live births (per 1000) in a specified time period.

To compute the rate per 1000 births, the numerator is divided by the denominator and multiplied by 1000.

Frequency of measurement: Within CRVS systems, this indicator is generally monitored at a national or subnational level on an annual basis. The data can be compiled and aggregated subnationally to provide national-level data.

Disaggregation: By timing of death (early neonatal death = 0 to 6 days; late neonatal death = 7 to 27 days), gestational age in weeks and days, birthweight, sex, place of birth, place of residence (e.g. urban, rural) and type of reporting source (e.g. health facility, community).

Missing values: Missing values are usually not known. To ascertain missing data, estimates of the total number of live births in a country or administrative area can be compared with the absolute number of live births in the same period.

Routinely collected administrative data

Data from routinely collected and compiled administrative data sources will provide information as recorded in medical charts/ records or registers and are entered into national and/or subnational health information systems:

- Health information management system (HMIS) and/or
- District Health Information Management System (DHIS2).

Data from health information systems may collect information on neonatal deaths among all live births in a health facility. Routinely collected administrative data and health facility statistics are the preferred data source in settings without an established CRVS system and when there is a high utilization of health facility services and data are recorded in a manner that ensures good data quality for both the public and private health sectors.

Key source of data: Administrative data sources include health facility and health services data abstracted from obstetric and neonatal medical records. Relevant information is recorded about the fetal/

newborn status at the time of delivery – including live births for all newborns delivered at health facilities – on paper forms completed by health personnel and/or through an electronic medical record. Admissions, re-admissions, or transfers of care within the first 28 days of life are captured in a similar manner, which would be the source of capturing neonatal deaths occurring from 0 to 27 days of birth. Data from paper or electronic sources are ideally entered or abstracted into a database or registry and are compiled and analysed within the national and/or subnational HMIS. The Ministry of Health (MoH) and/or National Statistical Offices (NSO) are usually responsible for the reporting of this indicator.

Indicator and calculation: The indicator is calculated as the number of newborns who died during the first 28 days (0–27 days) of life per 1000 live births in health facilities during a specified time period.

Numerator: Number of newborns who died during the first 28 days (0–27 days) of life in health facilities during a specified time period.

Denominator: Total number of live births in health facilities during a specified time period.

To compute the rate per 1000 births, the numerator is divided by the denominator and multiplied by 1000.

Frequency of measurement: The indicator can be calculated on an annual basis or may be tracked on a more frequent and ongoing basis (e.g. monthly, quarterly), depending on facility, subnational and national processes for data entry, compilation and analysis. As a guide, the recommended frequency of measurement based on reporting level is outlined below:

- *Facility level:* Monthly, quarterly, or as needed based on the country and/or facility need
- *Subnational (first and second administrative) level:* Monthly or quarterly
- *National level:* Annually (data can be aggregated to provide national-level data).

Disaggregation: By timing of death (early neonatal death = 0 to 6 days; late neonatal death = 7 to 27 days), gestational age in weeks and days, birthweight, sex, place of birth, level of facility and place of residence (e.g. urban, rural).

Missing values: Missing values or deaths occurring outside of health facilities are usually not known or not reported.

Population-based household surveys

The main source of data for this indicator has been through population-based household surveys collected through nationally or subnationally representative and statistically sound questionnaires, such as:

- Demographic Health Surveys (DHS) *(8)*
- Multiple Indicator Cluster Surveys (MICS) *(9)*
- Reproductive Health Surveys (RHS)
- Other household surveys with a similar methodological design.

Population-based household survey data are the preferred data source in settings without an established CRVS system and where there is a low utilization of health facility services or where private health sector data are excluded from routinely collected administrative data sources.

Key source of data: Eligible women of reproductive age (15–49 years) are identified in the household survey for inclusion and interviewing using an individual women's questionnaire. Women are considered eligible for survey interview if they are either usual residents or visitors of the household who stayed there the night before the interview.

Calculations for this indicator are based on having the interviewer complete a full birth history, whereby eligible women are asked to report the names and relevant information for all live births they have had in their lifetime.[1] The birth history does not include stillbirths, miscarriages, or abortions. For each of the children the woman has given birth to, they are asked to record in chronological order from first to last birth: the sex (male or female), multiple births (singleton or multiple), the date of birth (day, month and year), if the child is currently alive (yes or no), and if no longer alive, the age at death in days, months, or years.

For children that are no longer alive at the time of the interview, women are asked the question *"How old was (NAME) when (he/she) died?"* A probing question is asked to determine the age of death by asking *"Exactly how many [days, months, or years] old was (NAME) when (he/she) died?"*

The MoH and NSO typically conduct household surveys and compile, analyse and report the results for this indicator in collaboration with the survey programme (e.g. DHS, or other survey) and funding agency.

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[1] In some instances, a shortened birth history may be implemented in the survey in order to calculate the list of all live births during a specified time period, usually five years prior to the date of the survey interview.

Indicator definition and calculation: Individual women of reproductive age (15–49 years old) are asked about the total number of live births they have had in their lifetime and for children that are no longer living, the age at death. Generally, only those births that took place in the five years preceding the survey should be included. The definition is as follows:

The percentage of children who died at age 0–27 days after birth expressed as a percentage of the total number of live births in the same period. The indicator consists of the following numerator and denominator:

Numerator: The number of children who died at age 0–27 days after birth in the five years prior to survey completion.

Denominator: Total number of live births in the five years prior to survey completion.

This indicator identifies neonatal deaths as a proportion of all live births because cause-of-death information is not captured in household surveys.

Frequency of measurement: Household surveys are typically conducted every 3–5 years.

Disaggregation at population level: Socioeconomic status (e.g. education, wealth quintile), age of woman at the time of interview, place of residence (e.g. urban, rural).

Missing values: Missing values are not allowed for any of the variables that make up the rate. In particular, the date of interview and the age of death would be key for calculation of this indicator.

INTERPRETATION AND USE

Interpretation

Neonatal mortality rates are very sensitive to the quality of data and therefore assessing data quality and sources is essential when interpreting this indicator. Mortality rates among young children are a key indicator for child health and well-being, and more broadly, for social and economic development. This indicator can be used to inform health systems planning and policy and the allocation of funds and resources for programmes and interventions aimed at improved maternal, newborn and child health and survival. However, neonatal deaths are poorly captured and more likely not to be accurately accounted for. The use of standard definitions for neonatal cause of death and accurate and timely classification of these deaths is critical for case ascertainment and global comparability. WHO applies the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) to deaths during the perinatal period – ICD-PM – which provides a framework for the consistent collection, analysis and interpretation of neonatal deaths *(10)*.

Common challenges

The quality of reporting of this indicator varies greatly between and within countries, particularly in countries without effective civil registration systems in place. Many countries lack a single source of high-quality data covering the last several decades. Data from different sources require different calculation methods and may suffer from different errors – for example, random errors in sample surveys or systematic errors due to misreporting. As a result, different surveys often yield different estimates of neonatal mortality for a given time period, and available data collected by countries are often inconsistent across sources.

Civil registration and vital statistics systems

Birth and death registration should be part of a national and/or subnational CRVS system. However, CRVS systems are either non-existent and/or the complete coverage, accuracy and timeliness of civil registration systems is a major issue in many countries worldwide. In order to assess the completeness of the CRVS system, evaluations should be conducted to ascertain the quality of the system, as recommended by the United Nation's revised Principles and Recommendations for a Vital Statistics System *(7)*.

As a result, it is common for live births to be unregistered, particularly for neonatal deaths occurring shortly after birth. This may be due to lack of a legal framework within civil authorities or vital statistics agencies requiring registration for all births, regardless of the outcome. Even in countries with functional CRVS systems and legal frameworks in place, missing or unregistered births still occur due to health professionals and/or parents not knowing about the requirement to register both the live birth in addition to the death, in the instance of neonatal death.

Data collected from administrative and other routine data systems

Administrative data may suffer from poor quality such as irregularities in report generation, data duplication and inconsistencies *(11)*. Reporting challenges exist at the facility level given data quality issues, including incomplete, inaccurate and lack of timely data due to insufficient capacity in the health system or inadequate system design.

Many HMIS databases or registries are event-based and only births and deaths that occur in health facilities are included. Administrative data should be interpreted with caution in settings where data quality is poor and the percentage of births at public and private sector health facilities is low, or where data from the private health sector is not compiled within the HMIS reporting.

In settings where routine HMIS data lack information on pregnancies and/or births or deliveries that occur outside the public sector – for example, in homes, in the community, or in private sector facilities – the total number of births in the HMIS should not serve to estimate the denominator for this indicator. Where data on the total numbers of live births for the entire population for the denominator are unavailable, evaluators can calculate total estimated live births using census data for the total population and crude birth rates in a specified area (total expected live births = estimated population x the total crude birth rate).

Data collected through household surveys

The systematic recording of live births, stillbirths and deaths in many countries remains a serious challenge. In the absence of reliable CRVS systems or administrative data, household surveys have recently become the source of data to monitor levels and trends of stillbirths. In many low- and middle-income countries, such surveys represent the sole source of this information. However, in many cultures and countries in the world the appropriateness of asking about stillborn infants is very sensitive and accuracy of reporting these events in household surveys is compromised due to difficulty in disclosure and also the complexity of probing to be able to properly identify the difference between a live birth, stillbirth (fetal death) and neonatal death.

GLOBAL MONITORING

Neonatal causes of death by country are monitored and tracked by the United Nations Inter-agency Group for Child Mortality Estimation (UN IGME). Nationally representative estimates of neonatal mortality are derived from several different sources, including civil registration and sample surveys. Demographic surveillance sites and hospital data are excluded as they are rarely nationally representative. The preferred source of data is a civil registration system that records births and deaths on a continuous basis. If registration is complete and the system functions efficiently, the resulting estimates will be accurate and timely. However, many low- and middle-income countries do not have well-functioning CRVS systems, and household surveys, such as the MICS supported by the United Nations Children's Fund (UNICEF), the DHS supported by the United States Agency for International Development (USAID), and periodic population censuses have become the primary sources of data on mortality among children under age 5, including newborns. UN IGME estimates are based on nationally representative data from censuses, surveys, or vital registration systems. UN IGME does not use any covariates to derive its estimates; it only applies a curve fitting method to good-quality empirical data to derive trend estimates after data quality assessment *(1)*. More information about the data repository for neonatal mortality estimates by country can be found at: http://www.childmortality.org/ and https://data.unicef.org/topic/child-survival/neonatal-mortality/.

Key initiatives

Countdown to 2030 – Women's, Children's, and Adolescents' Health: http://countdown2030.org/

Every Newborn Action Plan (ENAP): http://apps.who.int/iris/bitstream/10665/127938/1/9789241507448_eng.pdf

Global Reference List of 100 Core Health Indicators (plus health-related SDGs), 2018: https://www.who.int/healthinfo/indicators/2018/en/

Global Strategy for Women's, Children's, and Adolescent's Health (2016-2030): http://www.who.int/life-course/partners/global-strategy/en/

United Nations Sustainable Development Goals (SDGs): https://sustainabledevelopment.un.org

ADDITIONAL RESOURCES

Global Health Observatory (GHO) Data – World Health Statistics: http://www.who.int/gho/publications/world_health_statistics/en/

Making Every Baby Count: Audit and review of stillbirths and neonatal deaths: http://www.who.int/maternal_child_adolescent/documents/stillbirth-neonatal-death-review/en

MEASURE Evaluation: Family Planning and Reproductive Health Indicators Database: Neonatal mortality rate (NMR): https://www.measureevaluation.org/prh/rh_indicators/womens-health/nb/neonatal-mortality-rate-nmr

Sustainable Development Goals (SDGs) Indicators – Metadata repository: https://unstats.un.org/sdgs/metadata/

The WHO application of ICD-10 to deaths during the perinatal period: ICD-PM: https://apps.who.int/iris/bitstream/handle/10665/249515/9789241549752-eng.pdf

UNICEF Data: Monitoring the Situation of Children and Women: Neonatal mortality: https://data.unicef.org/topic/child-survival/neonatal-mortality/

UNICEF – Multiple Indicator Cluster Surveys: http://mics.unicef.org/tools

The DHS Program: https://dhsprogram.com

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