

## REVIEW ARTICLE

## Neonatal Hypothermia: Causes, Consequences, and Prevention Strategies

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## ABSTRACT

The World Health Organisation (WHO, 1997) states that a newborn is considered normothermic if its body temperature falls between 36.5°C and 37.5°C. The three classifications are mild hypothermia (36.0–36.4°C), moderate hypothermia (32.0–35.9°C), and severe hypothermia (<32.0°C) based on a newborn's core temperature being below 36.5°C as assessed by skin temperature in the axilla. Numerous risk factors that fall under the categories of environmental, physiological, behavioural, and socioeconomic variables make newborns susceptible to hypothermia in the early postnatal period. Babies born by caesarean section are more vulnerable to hypothermia. Three major procedures are used to treat hypothermia: prenatal and postpartum treatments in the delivery room, prenatal and postnatal therapies throughout the journey to the neonatal intensive care unit (NICU), and post-NICU interventions. Although the creation of professional standards encourages safer and more precise management of neonatal hypothermia and its effects, educated and qualified health workers reduce the risk of hypothermia in neonates.

## KEYWORDS

• Early postnatal period • Hypothermia • Neonatal mortality • Brown adipose tissue • Rewarming

## INTRODUCTION

A body temperature below 36.5°C is known as neonatal hypothermia, and it is a prevalent issue that affects babies all over the world. Approximately 2.5 million infants worldwide pass away within their first four weeks of life each year. About half of newborn fatalities

happen at home, and the majority (99%) take place in low and middle-income countries (LMICs). The most frequent cause of newborn fatalities is hypothermia.

In the first week of life, 20% of infants are thought to suffer from hypothermia, with the bulk of cases happening during the first 24 hours.

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One of the main causes of newborn morbidity and death is hypothermia. Hypothermia can happen to newborns regardless of their ethnicity, sex, or gestation. An essential part of caring for a baby is measuring and controlling body temperature. The World Health Organisation (WHO) issued thermal guidelines, including the warm chain, which consists of ten steps to lower the risk of baby hypothermia, to encourage thermoregulation and address the large worldwide burden of neonatal hypothermia (temperature  $<36.5^{\circ}\text{C}$ ). Warm birth room, skin-to-skin contact, nursing, delayed washing and weighing, couplet care, warm transportation, warm resuscitation, and pertinent training are among the procedures. In resource-rich nations, infant morbidity and death rates are lower thanks to modern technology, cutting-edge medical procedures, and evidence-based treatment. Even in high-income countries, newborn hypothermia is still widespread and has been linked to higher infant morbidity and death despite this emphasis on preventing it. Other conditions that are linked to hypothermia include hypoglycemia, metabolic acidosis, hypoxia, respiratory distress syndrome (RDS), chronic lung disease, coagulation abnormalities, intraventricular haemorrhage, sepsis, and increased insensible water loss that results in fluid and electrolyte imbalance, hypotension, and dehydration.

### Physiology of thermoregulation

Once born, the baby is exposed to an atmospheric temperature (about  $25^{\circ}\text{C}$ ) - significantly below intrauterine temperature (approximately  $37^{\circ}\text{C}$ ). This 'colder' environment, in combination with the newborn's wet body, results in a heat-loss of between  $0.1^{\circ}\text{C}$  to  $0.3^{\circ}\text{C}$  per minute and of up to  $0.2^{\circ}\text{C}$  to  $1^{\circ}\text{C}$  per minute (no precautions taken regarding neonatal thermal protection after birth. This cold shock stimulates the newborn to commence two main physiological mechanisms in order to produce heat and to maintain its temperature at normal levels.

- The first mechanism allows the newborn to activate non-shivering thermogenesis in order to produce heat by using brown adipose tissue (BAT).
- The second mechanism is peripheral vasoconstriction whereby the blood vessels located peripherally in the

newborn's body constrict in an attempt to prevent further heat loss.

### Causes and Risk Factors

Neonatal may lose up to  $2^{\circ}\text{C}$  of body temperature in the first 10 to 20 minutes after birth due to conduction, convection, evaporation, and radiation.

For infants, evaporative loss is the main source of heat loss. Therefore, if nothing is done right away after delivery, a term neonate's core and skin temperatures can drop by about  $0.1^{\circ}\text{C}$  and  $0.3^{\circ}\text{C}$  per minute, respectively, because of their risky traits, which include low subcutaneous fat, high body water content, immature skin, and a poorly developed thermoregulatory system. Newborns who are preterm or low birth weight have consistently greater rates of morbidity and death than their counterparts.

### Others various factors, including:

1. **Environmental factors:** Cold delivery rooms, inadequate warming devices, and exposure to cold air or surfaces.
2. **Maternal factors:** Preterm birth, low birth weight, and maternal infection or illness.
3. **Newborn factors:** Premature or low-birth-weight infants, infants with congenital anomalies, and infants who experience respiratory distress.
4. **Large Surface Area to Body Mass Ratio:** Heat loss occurs rapidly through the skin.
5. **Inadequate Thermoregulation:** Immature nervous systems limit the ability to generate and retain heat.
6. **Medical Interventions:** Procedures like resuscitation, bathing, or prolonged exposure during transport.

### Classification on Neonatal Hypothermia

The World Health Organization (WHO) classifies neonatal hypothermia into three categories based on the axillary temperature:

1. Mild Hypothermia (Cold Stress):  $36.0 - 36.4^{\circ}\text{C}$  ( $96.8-97.6^{\circ}\text{F}$ )
2. Moderate Hypothermia:  $32.0 - 35.9^{\circ}\text{C}$  ( $89.6-96.7^{\circ}\text{F}$ )
3. Severe Hypothermia: Below  $32.0^{\circ}\text{C}$  ( $89.6^{\circ}\text{F}$ )

## Signs and Symptoms

Recognizing hypothermia in newborns is crucial. Key symptoms include:

- Cool extremities
- Lethargy or reduced activity
- Weak cry
- Poor feeding
- Respiratory distress or apnea
- Cyanosis (bluish skin discoloration)

## Consequences of Neonatal Hypothermia

Neonatal hypothermia can lead to a cascade of adverse effects, including:

1. **Metabolic Effects:** Increased glucose consumption, leading to hypoglycemia.
2. **Respiratory Effects:** Apnea, respiratory distress, and acidosis due to impaired oxygenation.
3. **Cardiovascular Effects:** Bradycardia, hypotension, and poor perfusion.
4. **Immune Suppression:** Increased susceptibility to infections like sepsis.
5. **Neurological Damage:** Hypothermia can lead to long-term cognitive and developmental delays.
6. **Mortality:** Severe hypothermia is a significant contributor to neonatal deaths worldwide.

## Diagnosis

The diagnosis of neonatal hypothermia is based on measuring the newborn's temperature using a calibrated thermometer. Axillary temperature measurement is commonly used in resource-limited settings, while rectal or oesophageal probes are preferred in intensive care units for greater accuracy.

## Prevention Strategies

Several evidence-based strategies can prevent neonatal hypothermia:

1. **Environmental modifications:** Maintaining room temperatures between 25–28°C (77–82.4°F) and minimizing exposure to cold air or surfaces can help prevent hypothermia.
2. **Immediate Drying:** Drying the newborn thoroughly to prevent evaporative heat loss.
3. **Kangaroo mother care:** Placing the newborn on the mother's chest promotes warmth and bonding.

4. **Warm baths:** Warm baths can help raise the newborn's body temperature.
5. **Warming devices:** The use of warming devices, such as radiant warmers or incubators, can help maintain a stable body temperature.
6. **Appropriate Clothing and Wrapping:** Using warm blankets, hats, and socks.
7. **Delayed Bathing:** Postponing the first bath until the baby's temperature stabilizes.
8. **Transport in Warm Conditions:** Using transport incubators or thermal wraps during transfer.

## Management of Neonatal Hypothermia

Treatment involves the following steps:

**Rewarming:** Gradual warming is critical to avoid complications like apnea or acidosis. Methods include:

Skin-to-skin contact (kangaroo care).

Radiant warmers or incubators for moderate to severe cases.

**Monitoring:** Continuous monitoring of temperature, glucose levels, and vital signs.

**Treating Underlying Causes:** Address infections, hypoglycemia, or other contributing factors.

**Parenteral Fluids and Oxygen:** Supportive care for severely hypothermic neonates.

## Global Perspective

Neonatal hypothermia disproportionately affects resource-poor settings, where home births and inadequate access to healthcare facilities are common. WHO and UNICEF emphasize simple, cost-effective interventions, such as skin-to-skin care, training birth attendants, and raising awareness about thermal protection.

## CONCLUSION

Neonatal hypothermia is a preventable and manageable condition that poses a significant threat to newborn survival. Implementing evidence-based strategies and ensuring access to adequate healthcare resources can drastically reduce its incidence and improve neonatal outcomes globally.

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