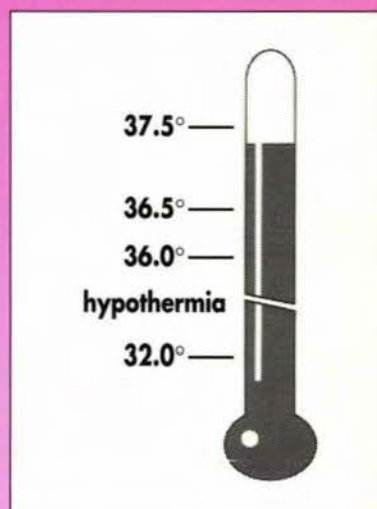
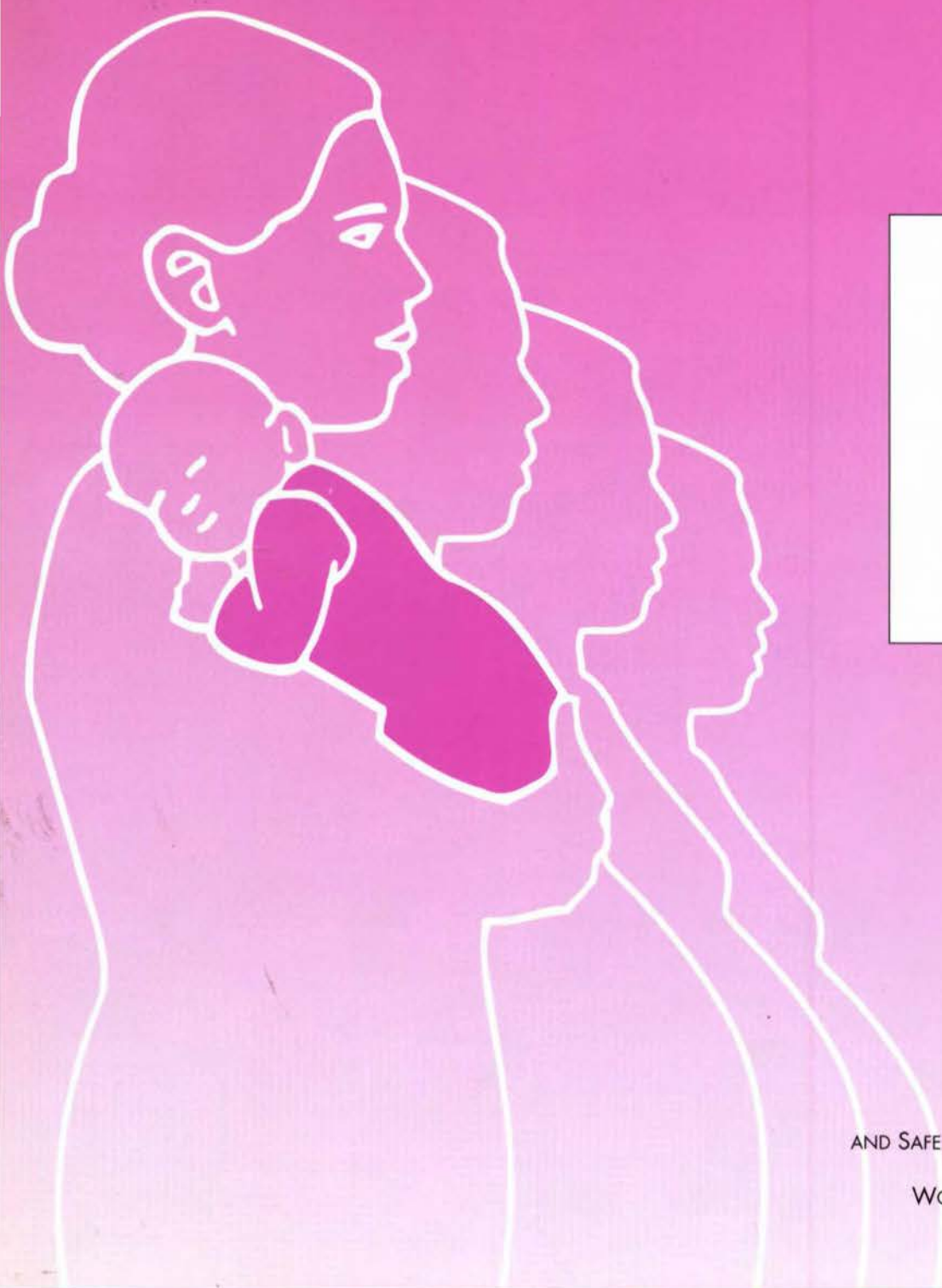


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# Thermal Control of the Newborn: a practical guide



MATERNAL HEALTH  
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# WHO Resource list

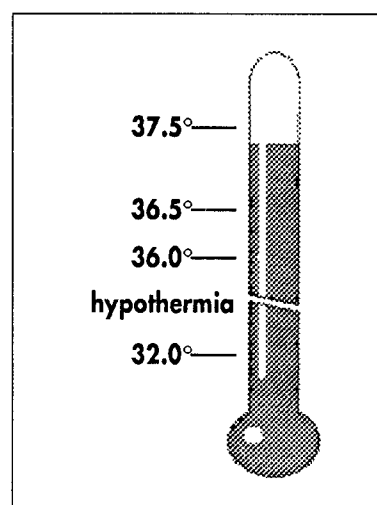
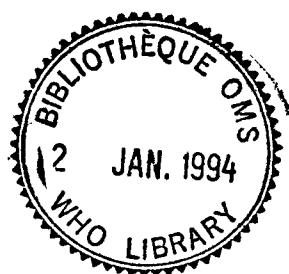
- Abortion - a tabulation of available data on the frequency and mortality of unsafe abortion.** WHO/MCH/90.14.
- Antenatal care and maternal health: How effective is it?** A review of the evidence. WHO/MSM/92.4. Available in English and French. Sw fr 15; in developing countries Sw fr 10.50.
- Coverage of maternity care - a tabulation of available information.** Second edition WHO FHE/89.2.
- Directory of funders in maternal health and safe motherhood.** WHO/MCH/MSM/92.7.
- Essential elements of obstetric care at first referral level - WHO 1991.** ISBN 92 4 1544244. Sw fr 14 or US\$ 12.60; in developing countries US\$ 9.80. Order number 1150364. Available in English. French and Spanish in preparation.
- Guidelines for introducing simple delivery kits at the community level.** MCH/87.4. Available in English. French and Arabic in preparation.
- Human resource development for maternal health and safe motherhood - Report of a Task Force Meeting.** April 1990. WHO/HRD/90.1.
- Hypertensive disorders of pregnancy - Report of the WHO/MCH Interregional Collaborative Study,** February 1991. WHO/MCH/91.4.
- Maternal and perinatal infections - Report of a WHO Consultation.** Provides a cost-effectiveness approach to the prevention and treatment of infections common to developing countries. WHO/MCH/91.10.
- Maternal mortality: A global factbook** by Carla AbouZahr and Erica Royston. ISBN 92 4 159001 7 Sw fr 50; in developing countries Sw fr 35.
- Maternal mortality: Ratios and rates - a tabulation of available information.** Third edition. WHO/MCH/MSM/91.6. This edition includes WHO's regional estimates.
- Measuring reproductive morbidity - Report of a technical working group, August 1989.** WHO/MCH/90.4.
- Midwifery education - Action for Safe Motherhood.** Report of a collaborative pre-congress workshop, Kobe, Japan, October 1990. WHO/UNICEF/International Confederation of Midwives (ICM). WHO/MCH/91.3.
- New estimates of maternal mortality.** Reprint from WHO Weekly Epidemiological Record. No.47, 1991, pp 345-348.
- Obstetric Fistulae - a review of available information.** WHO/MCH/MSM/91.5. Available in English and French.
- Preventing maternal deaths - edited by Erica Royston and Sue Armstrong,** WHO 1989. ISBN 92 4 1542497. Price Sw fr 11; in developing countries Sw fr 7.70. Available in English and French. Spanish in preparation.
- Prevention of maternal mortality - Report of the WHO interregional meeting, November 1985.** WHO/FHE/86.1.
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- Studying maternal mortality in developing countries: Rates and causes - A guidebook.** WHO/FHE/87.7. Available in English, French and Spanish.
- The Home-Based Mother's Record: A guideline for its adaptation, use and evaluation.** MCH/90.12.
- The prevention and management of postpartum haemorrhage - Report of a technical working group, July 1989.** WHO/MCH/90.7.
- The prevention and treatment of obstetric fistulae - Report of a technical working group, April 1989.** WHO/FHE/89.5.
- The risks to women of pregnancy and childbearing in adolescence - Bibliography, 1989.** WHO/MCH/89.5.
- The role of women's organizations in primary health care with special reference to maternal and child health including family planning.** WHO/FHE/WHO/88.1
- Women's health and safe motherhood: The role of the obstetrician and gynaecologist.** Report of a WHO/FIGO workshop prior to the FIGO congress in Rio de Janeiro, Brazil in 1989. Report: WHO/MCH/89.3 and Statement of key speakers: WHO/MCH/89.4.
- Women's health and the midwife: A global perspective.** Report of a WHO/UNICEF/ International Confederation of Midwives (ICM) workshop prior to ICM congress in The Hague, The Netherlands in August 1987. WHO/MCH/87.5.

Unless otherwise stated, all the above materials are available free of charge from:

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Tel 41 22 791 21 11,  
Fax 41 22 791 0746;  
Telex 27821

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# Thermal Control of the Newborn: a practical guide



MATERNAL HEALTH  
AND SAFE MOTHERHOOD PROGRAMME  
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## 1. INTRODUCTION

In the early 1900s it was realized that adequate environmental warmth was essential in the care of small infants because they could not maintain their own body heat. Due to less insulation, an infant's thermal control is more limited than that of an adult who can maintain body heat at temperatures as low as 0°C (32°F) while for the full-term infant it is between 20°C to 23°C (68-73.4°F). Hypothermia has since been recognized as a significant contributor to neonatal morbidity and mortality for all newborn infants, and has been described on every continent and even in many countries that are considered to be tropical. Although data on hypothermia in newborns are rather scarce, studies in selected countries have revealed the importance of hypothermia as a cause of death. A study in Ethiopia revealed that 67% of high-risk infants who were born outside of the hospital were hypothermic. A WHO-supported study in Nepal showed that 80% of infants born in hospital became hypothermic soon after birth. A large series of births in China found the incidence of hypothermic sclerema to be 6.7 per thousand.

In developed countries awareness of the problem has resulted in improved care of the newborn and especially of preterm and low birth weight infants. In many parts of the world, however, this is not the case and the extent and significance of neonatal hypothermia are often not fully realized. Many health personnel and mothers are not aware of the importance of keeping babies warm by simple methods such as drying and wrapping immediately after birth, avoiding harmful practices, encouraging early breast-feeding and keeping newborns in close contact with their mothers.

In health facilities where managers have not received training concerning hypothermia, policies, procedures and equipment for the maintenance of an optimal thermal environment for the newborn are lacking and the risk of neonatal hypothermia is greatly increased.

A World Health Organization (WHO) consultative group<sup>1</sup> on Thermal Control met in Geneva, 8-10 April 1992 to address this issue and propose appropriate guidelines for intervention. The Maternal and Child Health Programme of the WHO is issuing these draft guidelines to help programme managers and health workers understand the principles and methods for preventing and treating hypothermia.

This guide represents the collective wisdom of a group of international experts and is, therefore, a summary of currently available knowledge in the field of thermal control of the newborn. It is hoped that it will enable health personnel at all levels to be adequately informed about neonatal hypothermia, its recognition, management, prevention and control. The World Health Organization welcomes comments and feedback from others working in the field and would be glad to receive documentation on the subject from other experts. Slides and presentation notes based on this guide are currently being field-tested and evaluated. The results of that evaluation, together with other input received, will be incorporated into a second edition of this guide.

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<sup>1</sup> The participants are listed in Annex 1.

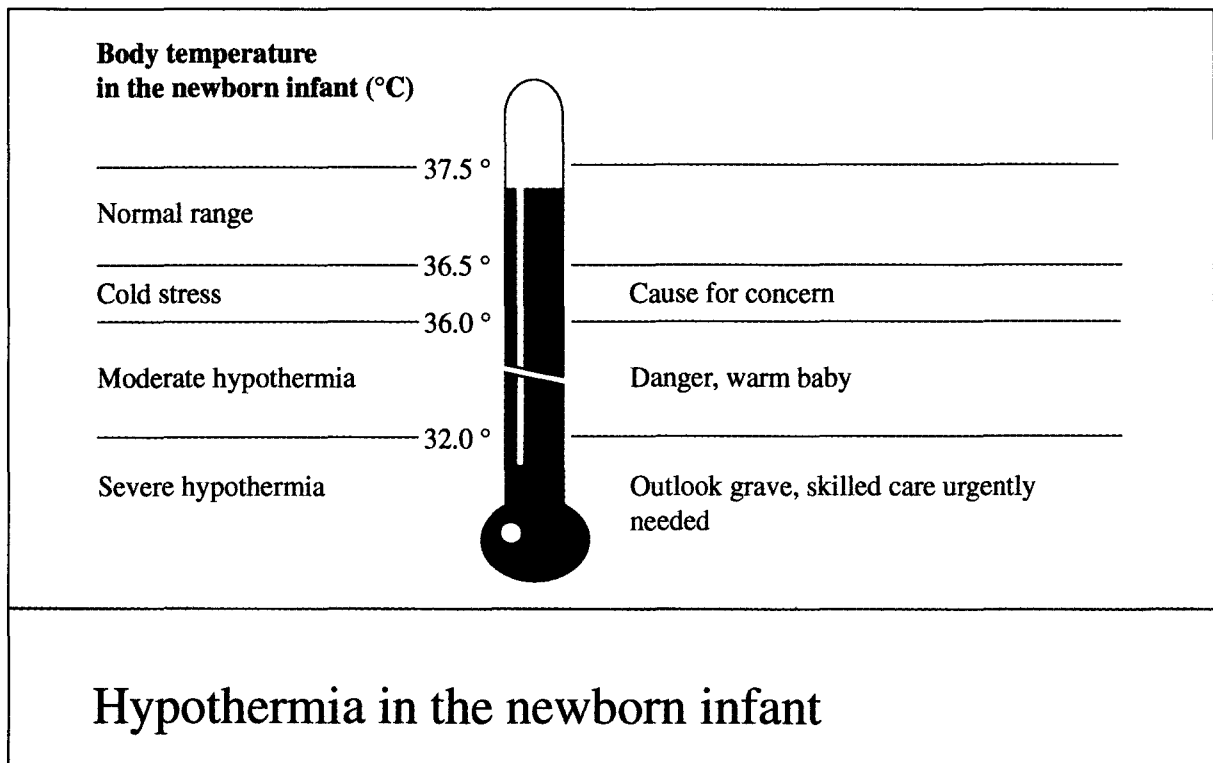




## 2. HYPOTHERMIA IN INFANTS

### 2.1 Definition

Hypothermia occurs when the body temperature drops below 36.5°C (97.7°F), the lower limit of the normal range of 36.5-37.5°C (97.7-99.5°F). The newborn infant with a body temperature of between 36.0-36.4°C (96.8-97.5°F) may be under cold stress which gives rise to concern. An infant with a temperature of 32.0-35.9°C (89.6-96.6°F) has moderate hypothermia, while a temperature below 32°C (89.6°F) is considered to be severe hypothermia.



### 2.2 Signs of Hypothermia

Early clinical signs which should arouse suspicion of cold stress due to hypothermia are:

- the feet are cold to the touch (they become cold before the body is cold);
- weak sucking ability - inability to nurse;
- reduction in activity - lethargy; and
- a weak cry.

**IF HYPOTHERMIA IS SUSPECTED -  
IMMEDIATE ACTION IS NEEDED.**

If hypothermia persists there is a risk of neonatal cold injury developing, in which case the infant usually becomes lethargic, with slow, shallow and irregular respiration and a slow heart rate (bradycardia) corresponding to the degree of fall in body temperature. Hypoglycaemia and metabolic acidosis may develop. *There is a real risk of death.*

The face and extremities may have a bright red colour while the rest of the body is pale; central cyanosis may be present. Sclerema, a hardening of the skin, associated with reddening and oedema is seen mainly on the back and the limbs but may cover the whole body.

### 2.3 Effects of Hypothermia

A baby who is cold immediately after delivery will become acidotic and hypoglycaemic, have abnormal clotting and will be at increased risk of respiratory distress. Unless prompt action is taken, the baby will die. The baby which becomes hypothermic and is not with the mother is less likely to feed properly, which will increase the risk of prolonged hypothermia due to lack of heat production and continued heat loss. This baby will be at increased risk of infection and of developing cold injury.

Prolonged cold injury leads to: oedema, sclerema, general haemorrhage (especially pulmonary haemorrhage) and jaundice. Impaired cardiac function and impaired growth have all been found in babies who developed neonatal hypothermia.

There is ample evidence that sick babies admitted to neonatal units with hypothermia are more likely to die than those admitted with normal temperatures. Randomized controlled trials undertaken to compare the effects of management of preterm babies in warm conditions with those in standard conditions have all suggested that hypothermia is linked to increased mortality.

Although short periods of mild cold stress in the later neonatal period may prepare the infant for eventual exposure to cold, there is no evidence that marked cold stress has any beneficial effect immediately after delivery. On the contrary, there is a large body of evidence to support the belief that immediate postdelivery hypothermia is harmful.

### 2.4 Causative Factors

Lack of awareness of the importance of drying the baby immediately after birth, of placing the newborn in direct skin-to-skin contact with the mother as a source of heat, of wrapping the baby and mother warmly, and of providing a warm environment for delivery and the aftercare of the newborn are the principal factors responsible for the high incidence of hypothermia.

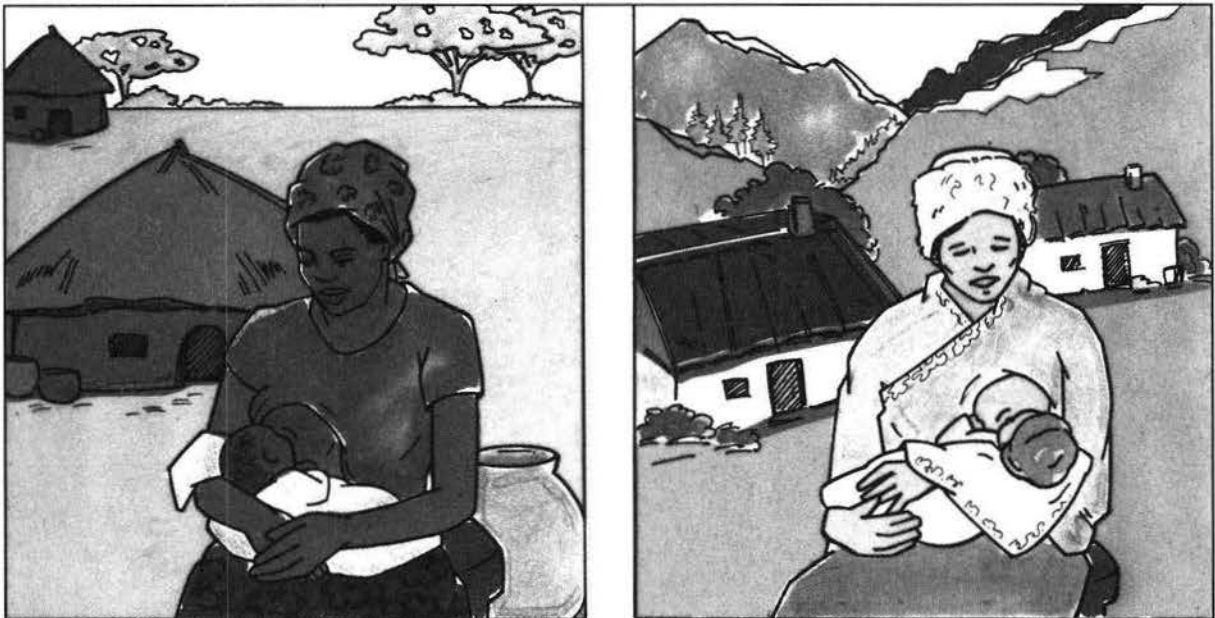
## 2.5 General Risk Factors

The most important factors influencing the occurrence of hypothermia in newborn infants include:

- incorrect care of the baby immediately after birth;
- separation of mother from baby after birth;
- the weight and gestational age of the infant;
- the place of delivery and environmental conditions;
- the age of the infant at the time of transport;
- inadequate warming procedures before and during transport of the infant; and
- asphyxia, hypoxia, or other illness of the baby.

## 2.6 Distribution and Incidence

Neonatal cold injury occurs throughout the world, even in warm climates.



Hypothermia is a risk for the newborn in any climate, whether in the tropics or in cool mountainous areas.

In one hospital during an 8-year study in Ethiopia, 67% of low birth weight and high-risk infants admitted to a special care unit from outside were hypothermic.

In a hospital in India, hypothermia on admission to the special care unit was associated with a mortality rate twice that of infants admitted with a normal temperature.

In Nepal, primarily during the winter months, over 80% of the infants born became hypothermic after birth and 50% remained hypothermic at 24 hours. The labour and postnatal wards were cold, at around 20°C (68°F), and this was a significant factor in the development of hypothermia.

In a study from England of a group of infants born before arrival at the hospital, hypothermia was found to be the commonest form of morbidity.

In a large series of births in the provinces in China the incidence of sclerema was 6.7 per thousand. High-risk factors were prematurity and low birth weight. Another high-risk factor was low room temperature during childbirth. It was found that when infants were born in a room with a temperature less than 20°C (68°F), it took at least 14 hours to rewarm them to a temperature of 36°C (96.8°F). When the room temperature was above 20°C (68°F) only 3-4 hours were needed.

## **2.7 Prevention**

An important objective of appropriate care of the newborn is to avoid hypothermia from the moment of birth, by using procedures that will prevent heat loss and maintain the body temperature within the normal range, thus conserving the infant's energy for growth and development.

### 3. THERMAL CONTROL OF NEWBORN INFANTS

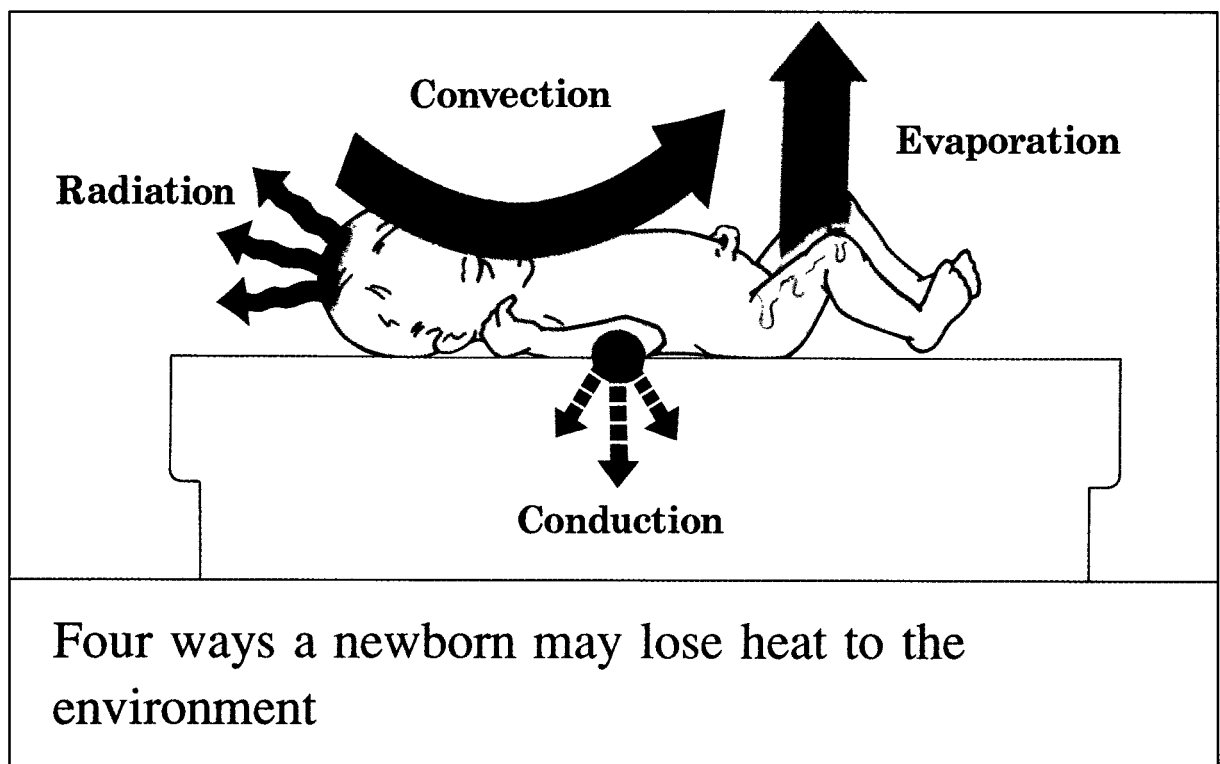
#### 3.1 Heat Production

Heat produced by the fetus *in utero* is transferred to the mother through the placenta. At birth the infant's ability to control heat production is not fully developed and the newly born, wet infant almost always experiences an immediate fall in body temperature. Heat loss in the first half hour is largely due to evaporation of amniotic fluid from the infant's body. If the baby is not dried, given to the mother for skin-to-skin contact, and covered immediately more heat will be lost.

The main reason for the fall in body temperature after delivery is that heat losses at that time are so great that they exceed the newborn infant's ability to produce heat to maintain a balance.

At the time of birth, the newborn does not respond to cold by increased metabolism. However, this response will develop provided the baby is healthy and receives food.

Sick or small infants do not have the ability to respond by increasing their metabolic rate. The amount of heat gained by crying and moving, in these infants, is minimal. Furthermore, preterm and low birth weight infants have much less 'brown fat' than full-term infants. Brown fat accounts for about two to six per cent of total body weight in full-term infants and contributes to extra heat production.

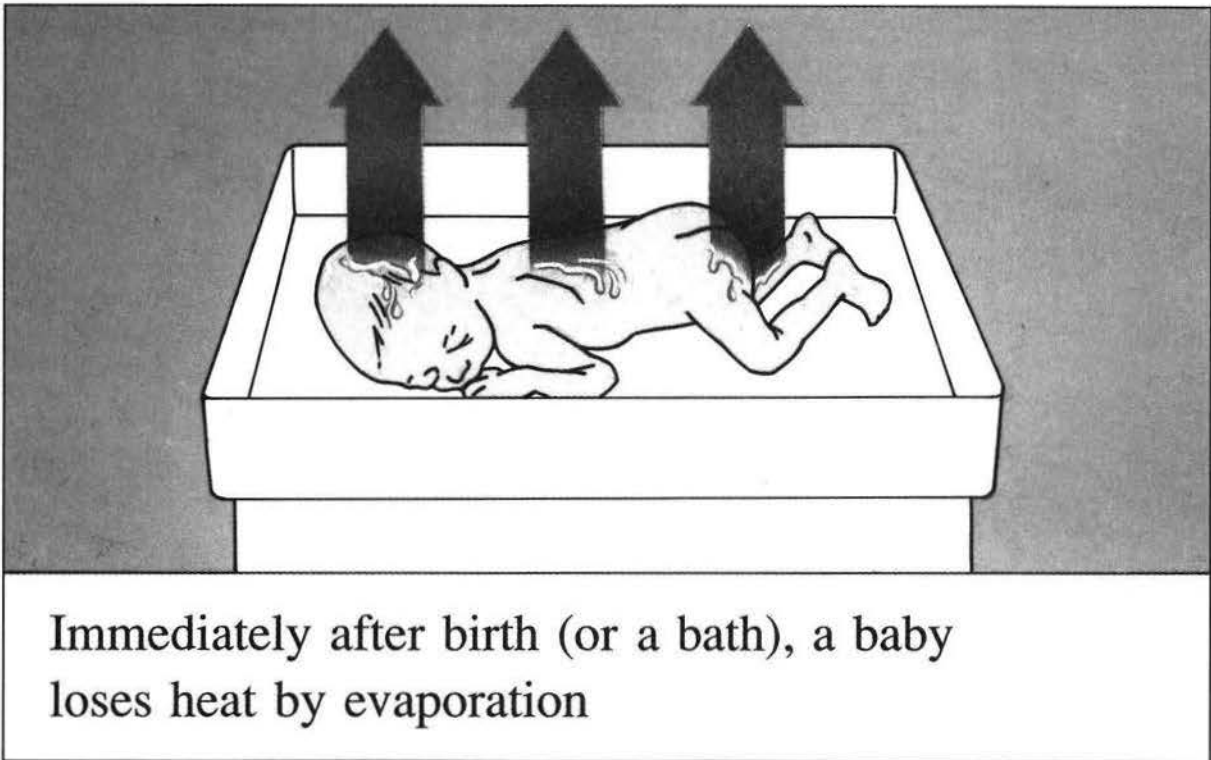


### 3.2 The Process of Heat Loss

Leaving the warmth of the mother's womb, the wet newborn infant may lose enough heat for the body temperature to fall by 2-4°C (3.6-7.2°F), the greatest amount of heat being lost in the first 10-20 minutes after birth. Continued loss of heat after birth is the starting point for the development of multiple health problems. In studies in Ethiopia and Nepal, infants have been observed to have temperatures of only 26-27°C (78.8-80.6°F) within 2 hours of birth, if not cared for properly.

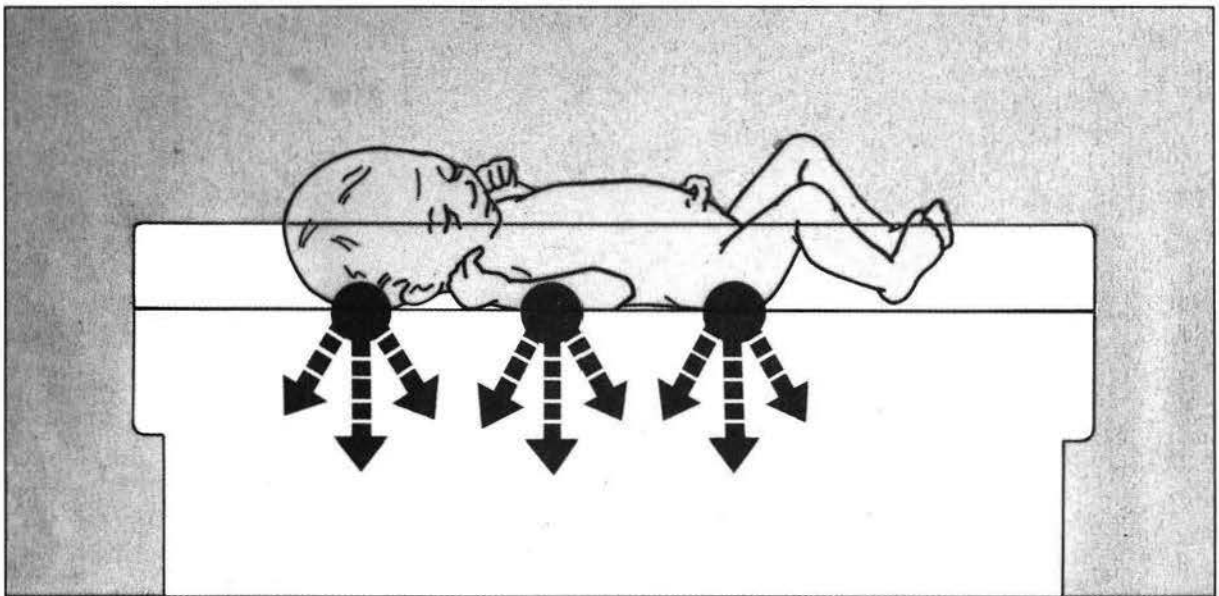
It is therefore crucial to prevent prolonged heat loss and to provide and maintain a sufficiently warm environment.

The newborn infant loses heat from the surface of the body to the environment in four different ways.



#### *Evaporation*

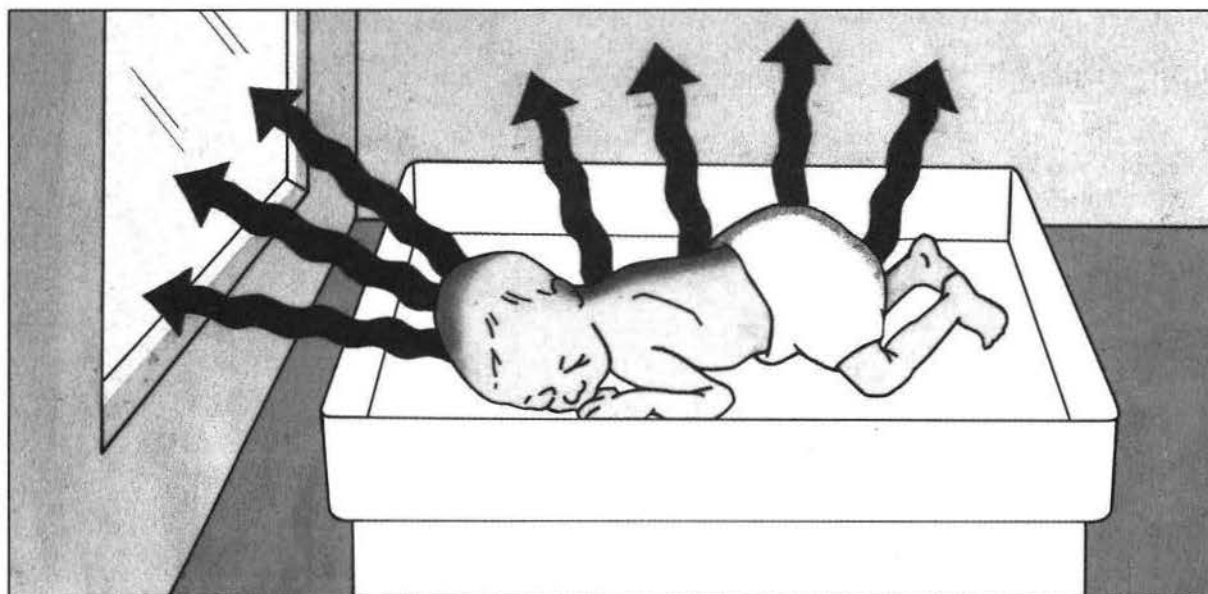
Heat loss by evaporation occurs when fluid (amniotic fluid, water) evaporates from the wet skin to the air. This happens if the infant is not dried immediately after birth. It also happens later during bathing, but if the infant is dried immediately and thoroughly heat loss by evaporation is greatly reduced.



A newborn will lose heat by conduction if placed naked on an uncovered table - never do it

*Conduction*

Loss of body heat by conduction occurs when there is direct contact of the skin with a cooler object or surface. For example, if the infant is placed in direct contact with a cold surface - a table, weighing scale, or rubber sheet - heat will be lost to the cold surface, particularly if the surface is metallic.

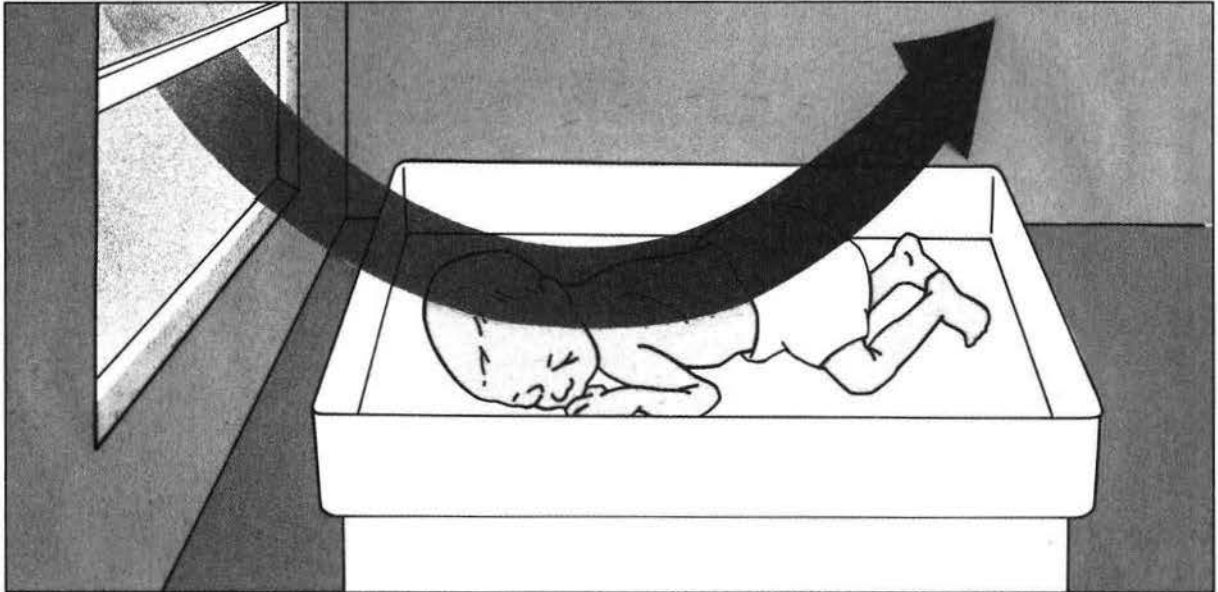


A baby will lose heat by radiation to colder surfaces such as windows and walls

#### *Radiation*

Heat loss occurs by radiation from the infant to cooler objects in the vicinity, even though they are not in contact with the infant, for example if an infant in a cot is placed close to a cold wall, a window or other cold object. The colder the object or the closer it is to the infant, the greater the loss of heat by radiation.





A draught may cause a newborn to lose (or gain) heat through convection

### *Convection*

Convective heat loss occurs when the infant loses heat to the cooler surrounding air. This happens when a naked infant is exposed to a room temperature of 25°C (77°F), even though this is comfortable, and still more heat will be lost if the temperature is below 25°C (77°F). Convective loss increases with air movement and even at a room temperature of 30°C (86°F) heat loss can still occur if there is a draught.

#### **3.2.1 Additional risk factors for heat loss**

Certain characteristics of newborn infants put them at increased risk of heat loss, namely:

- Infants have a large body surface area in relation to their weight. The ratio of surface area to body weight is two to three times greater than in the adult.
- An infant's head is large in proportion to the body, and in newborns as much as 75% of body heat loss may be from an uncovered head.
- Preterm and low birth weight infants have less subcutaneous fat for insulation, and thus lose heat more easily through their thin skin.

The infant's ability to withstand cold depends upon a number of factors including age, adequate food provision and growth. This ability is reduced in a starving or sick baby.

### 3.3 The Process of Heat Gain

The mechanisms which result in heat loss may act in reverse and cause the infant to become too warm (hyperthermia).

#### *Conduction*

Heat will be gained if an infant is placed on a warm surface - the mother, a warm blanket, a bed or a warm water mattress. If placed on a hot surface - e.g. a hot water bottle - an infant may become overheated and develop burns, with consequent serious injury or even death.

#### *Radiation*

An infant will gain heat by radiation from the mother, from the warm rays of the sun or from a heater, and may become overheated in an incubator (hyperthermia).

**THE TEMPERATURE OF THE SURFACE UPON  
WHICH AN INFANT IS PLACED SHOULD  
NEVER BE MORE THAN 39°C (102°F).**

#### *Convection*

Heat may also be gained through warm air currents over the baby.

### 3.4 Environmental Conditions for Preventing Hypothermia

A draught-free room temperature of 25°C (77°F) is necessary to provide optimal thermal conditions for most cot-nursed, clothed, healthy, full-term infants. However for smaller infants higher temperatures are required. For example, a room temperature of 31°C (88°F) may be necessary for a cot-nursed 1.5 kg infant. Generally, for sick and smaller infants a higher room temperature is required.

### 3.5 Thermal Control in Practice

Thermal control comprises the implementation of the procedures needed to achieve and maintain a normal body temperature for the newborn, whether the need is to keep infants warm, or to cool them down if the body temperature exceeds 37.5°C (99.5°F).

Thermal or heat control considerations are high priority when planning for the care of the newborn. This is true for full-term infants but is of critical importance for preterm and low birth weight infants, because of the increased risk of illness and death. Heat loss from the healthy infant can be controlled most of the time through nursing or health care interventions. Appropriate measures, equipment and training are therefore

needed at all levels of the health services - at home, in health centres, maternity wards, clinics, local and regional hospitals and medical centres.

Ensuring the heat balance of the newborn, and particularly of preterm and low birth weight infants, and preventing hypothermia requires the involvement of a wide range of health care providers, including family members and relatives, for example:

- midwives, traditional birth attendants (TBA), maternity nurses, nursing aides;
- hospital and public health physicians;
- community health nurses, village health workers, health visitors; and
- family members (mothers and fathers, older children).

### **3.6 Measuring the Temperature of the Newborn**

Proper measurement of body temperature is important in the assessing an infant's heat balance. A low-reading thermometer should be used for all measurements. (An ordinary thermometer only reads down to 35°C/95°F and will not detect significant hypothermia, low-reading infant thermometers go down to 25°C/77°F.)

#### **3.6.1 Axillary temperature**

Taking the axillary temperature is recommended because of safety, hygiene and ease. It involves no risk to the infant and if properly done reflects body temperature, although it takes a little longer than taking rectal temperatures. It has been found that there is not sufficient difference between axillary and rectal temperatures to justify the risks, however small, associated with taking the temperature rectally. To take the axillary temperature:

- the infant should lie on the back or side;
- the thermometer should be shaken down to below 25°C (77°F);
- the clean thermometer should be placed high up in the middle of the axilla, and the arm then held against the side of the infant firmly but gently for at least five minutes;
- the skin in the axilla must come in full contact with the bulb of the thermometer, with no air pockets between it and the thermometer;
- throughout this time keep the baby in skin-to-skin contact with the mother and properly covered.

#### **3.6.2 Rectal temperature**

Rectal temperature measurement is widely used but it does carry a risk for the neonate. *Rectal perforation* is a rare but serious risk, which can be avoided completely if the procedure is undertaken correctly:

- the infant should lie on the back or side;

- the thermometer should be shaken down below 25°C (77°F);
- place the clean thermometer in the rectum to a maximum depth of 3 cm where it should be held firmly but gently for three minutes. The baby should not be left alone.

### 3.6.3 Frequency of measurement

The following minimum schedule for taking the temperature of the newborn is recommended:

- immediately after completion of initial care of the newborn; and
- upon arrival in the nursery or postnatal ward.

For healthy babies with their mothers, no further routine measurements are required. However, it should be explained to the mother that if the baby's feet feel cold, the temperature should be checked.

For sick, high-risk infants and those in warming devices a more frequent schedule is recommended.

All infants under radiant heaters must have their temperatures taken and recorded every 30 minutes.

Having identified that an infant is at risk, appropriate nursing measures should be taken immediately.

## 3.7 Special Risk Factors

The following conditions will increase the risk of a newborn infant developing hypothermia. Health staff need to be alert to this risk so as to be able to take preventive or corrective action in good time.

### 3.7.1 Asphyxia

Infants with asphyxia at birth cannot produce any heat efficiently. The presence of asphyxia may be recognized by the absence of respiration and a slow heartbeat immediately following the birth. At birth, the infant should first be vigorously dried with a warm towel and assessed. This should only take a few seconds and the infant should be clothed and wrapped immediately and kept warm. Infants assessed in this way fall under one of three categories:

- good condition            vigorously active with lusty cry.
- fair condition            moderately asphyxiated or recovering, with a fast heart rate - above 100 beats per minute.
- poor condition            severely asphyxiated with absent respiration and slow heart rate - 100 beats or less per minute. This infant will need immediate resuscitation.

During resuscitation care should be taken to provide or conserve warmth for the baby, for example:

- Heat loss by evaporation is reduced by immediately drying and putting clothes on the infant: if resuscitation is needed the infant must be kept warm by an additional heat source (radiant heater).
- Heat loss by conduction is prevented by laying the infant on a dry, warm towel or blanket.
- Heat loss by radiation is reduced by wrapping and keeping the infant in a warm environment with no cold walls or objects nearby.
- Heat loss by convection is controlled by ensuring there are no draughts in the room, and by keeping the infant wrapped.

### **3.7.2 Preterm and low birth weight infants**

These infants have less brown fat from which heat is produced, and have little subcutaneous fat to provide insulation against heat loss by radiation and convection so that much heat is lost through their thin skin.

### **3.7.3 Infants delivered of mothers who received anaesthetic drugs during delivery**

These drugs cause a decrease in the heat response of the infant which contributes to heat loss immediately after birth.

## **3.8 Environmental Risk Factors**

A delivery area - whether at home, clinic or hospital - which has not been properly prepared may present a particular hazard so far as neonatal hypothermia is concerned, for example if it is a cool room with no adequate means of heating; if it has walls and windows that are not insulated and are cold; or if there is no separate, draught-free space in which to keep the infant warm immediately after birth and during resuscitation.

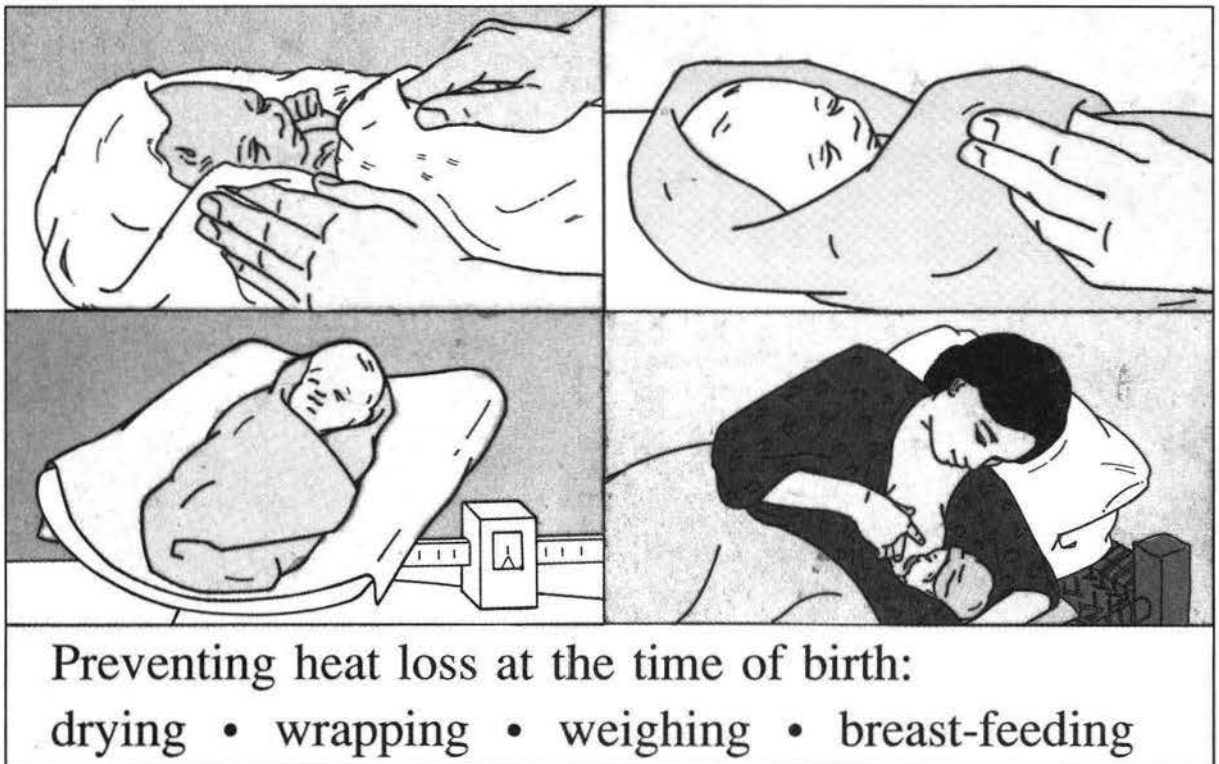
A climate where days are hot and nights are cold, as in desert areas or mountainous regions, and where there is no provision for added warmth during cold nights puts a newborn infant at risk of becoming hypothermic.



## 4. THE PREVENTION OF HYPOTHERMIA

Hypothermia can be prevented by drying the infant immediately after birth placing in direct skin-to-skin contact with the mother, and covering both with a heavy, clean blanket. However, if this cannot be done, a satisfactory arrangement is to dry and wrap babies and keep them as close to the mother as possible. Ensure that the room is warm. It is difficult to warm infants who have become hypothermic - wrapping a baby who is already cold may simply keep him/her cold. It is much easier to keep the infant warm in the first place.

### 4.1 The "Warm Chain"



The "warm chain" is a concept introduced to describe a set of interlinked procedures which will minimize the likelihood of hypothermia. Failure to implement any one of them will break the chain and increase the possibility of undesirable cooling of the infant. The links in the "warm chain" include:

- training all persons involved in the birth and subsequent care of the baby;
- preparation of the place of delivery, by ensuring a clean, warm, draught-free room. Clean and safe delivery practices require clean hands, cord cutting instruments and ties, a clean surface, drying and wrapping materials;
- immediate drying of the newborn baby;

- wrapping the baby and giving it to the mother quickly after birth;
- putting the baby to the mother's breast;
- putting a warm cap on the baby's head;
- covering the baby and mother together;
- ensuring warm, safe transport, if necessary.

## 4.2 Training

Training is necessary for all who are involved in the procedures and process of birth and the subsequent care of the newborn. The place of delivery - home, hospital or other health facility - will dictate which persons require training.

## 4.3 Preparation for Home Delivery

Careful preparation of the delivery area and the provision of suitable equipment are important.

### 4.3.1 Environment

Wherever possible, the delivery room should be warm, clean and free from draughts from open windows and doors or from air conditioning systems.

In a cold room, a small area may be blocked off by hanging up blankets or sheets and warmed with an electric heater or fire. Fires or heaters may be dangerous if placed near materials that burn, and caution is necessary. A room temperature of 25-28°C (77-82°F) is ideal for delivery, helps in reducing heat loss in the infant, and is comfortable for the mother.

If the delivery occurs on the floor (for example, cement, tiled or mud-packed) it should be covered with a waterproof material (plastic, rubber), and if possible padded underneath with several layers of blankets or with a mattress.

Select an area where animals are neither kept nor fed, since they introduce the risk of tetanus and other infections.

It is important to find acceptable ways of minimizing the harmful effects of certain cultural practices. For example, if the practice is for the woman to deliver outside "in the bush", every effort should be made to ensure that the conditions are as clean as possible.

### 4.3.2 Equipment and supplies

In certain countries it is possible to obtain "delivery kits" which contain some of the basic equipment required for the birth. A list of the equipment needed is:<sup>2</sup>

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<sup>2</sup> *Guidelines for Introducing Simple Delivery Kits at the Community Level*, Geneva, World Health Organization, 1987 (unpublished document MCH/87.4)



- soap
- nail stick or nail file
- three (3) pieces of tape or string
- half (½) razor blade
- plastic sheet (1m x 1m) or clean mat, or newspapers
- clean cloth or towels
- pieces of gauze or cotton

Additional items (for use by health personnel with a different level and training) may include:

- scissors
- eye drops
- plastic apron
- tape measure.

To keep the infant warm, the kit should include absorbent towels large enough to cover an infant's whole body and head, appropriate warm clothing (warm long-sleeved shirt and a cap), cotton or warm blankets for wrapping the infant, boiling water and heaters or a fire if the area is cold.

#### **4.4 Preventing Heat Loss at the Time of Birth**

Immediately dry the infant thoroughly with a clean, soft towel. If the first towel is wet and the infant is not yet dry use a second towel. Do not bathe babies at this time, do not expose them unnecessarily, and do not remove vernix but wrap them in a clean, dry towel ensuring that the head is covered properly.

If a scale is available, weigh the baby wrapped in a towel and lying on another towel, but remember to deduct the weight of the two towels from the weight recorded.

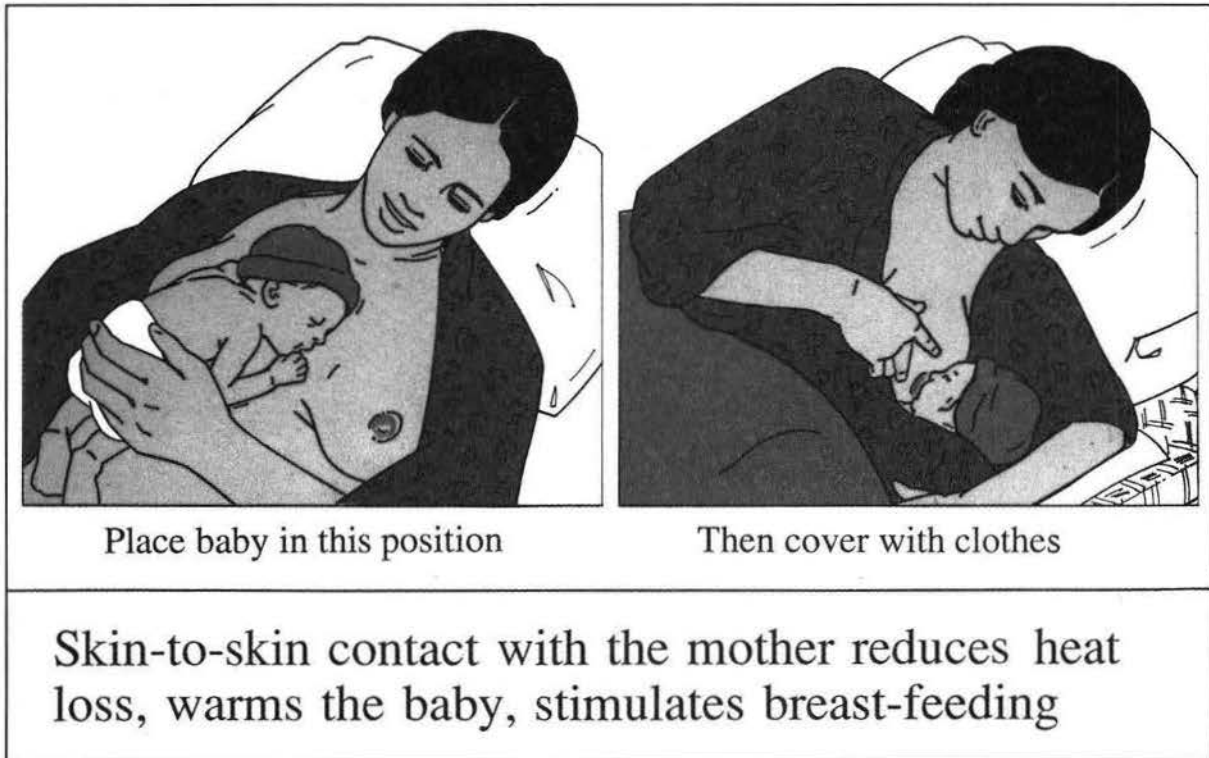
Give the infant to the mother, and cover them both. Allow the baby to be held close to the mother which will help to keep maintain warmth.

Full-term infants showing no signs of distress may be dressed with several layers of loose clothing, and their head covered with a clean cap. Trapped air is a very efficient insulator, keeping the warmth in and the cold out, so avoid a tight wrapping which may restrict breathing and reduce the efficiency of heat retention and insulation. If the infant is small, sick or already cold, use skin-to-skin contact first.

##### **4.4.1 Skin-to-skin contact (the Kangaroo method)**

Skin-to-skin contact is one of the most appropriate methods to be used in caring for the small infant since it:

- assists in maintaining temperature of the infant;
- facilitates breast-feeding;
- helps to increase the duration of breast-feeding;
- assists in prolonging the duration of lactation.



The father or another member of the family should be encouraged to participate. Infant, mother and father all seem to benefit psychologically when this procedure is used, strengthening the commitment between all three. All infants need to be kept warm and to be breast-fed. This method may also be used for some low birth weight infants showing no signs of distress or extreme prematurity.

- This method is appropriate only for infants who are not experiencing other health problems, i.e, babies should be breathing regularly, exhibit no signs of cyanosis or neurological deficits.
- The infant is naked, except for a nappy (diaper), and is held against the skin of the mother, between her breasts.
- The mother covers the infant with her own clothes and an added blanket. She may cover herself and the infant with the blanket if she wishes. If the mother is wearing clothes, a belt around the waist and snug clothes will help keep the infant in good position.
- This position allows the mother to breast-feed the infant frequently and easily. She will also know immediately when the infant moves and will be able to attend to his/her needs more quickly.
- The mother may not be able to keep the infant in skin-to-skin contact all the time. During those times the infant must be wrapped in several layers of warm clothing, covered with blankets and kept in a warm place.



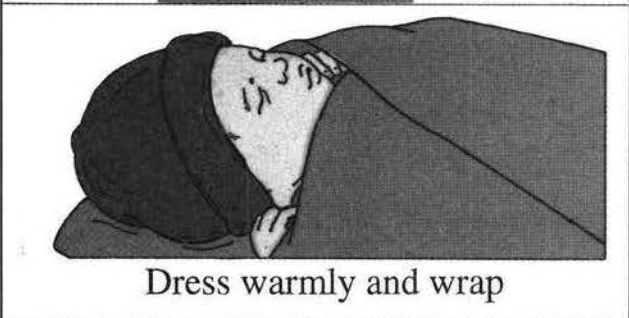
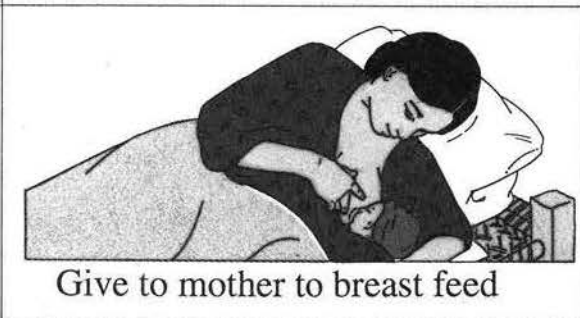
#### 4.4.2 Breast-feeding

Help mothers initiate breast-feeding within a half-hour of birth. Encourage early mother-infant skin-to-skin contact, which will keep the baby warm. The first milk, called colostrum, provides increased energy and is high in antibodies, therefore protecting the newborn from certain illnesses. It is all the nourishment and liquid a baby needs. Let the baby suckle at the breast whenever and as long as he or she wishes. A mother should have access, if needed, to guidance from trained personnel, for example a health worker or lactation counsellor, on proper positioning of her baby and other breast-feeding management techniques.

#### 4.4.3 Warming the infant

If there is no thermometer, feel the feet - if they are cold the infant is cold. Wrap the infant as indicated and keep him/her close to a heat source - that is, held by the mother or other person in a warm room or close to a heater or fire. Never leave an infant unattended near a heater or fire. It is dangerous to use hot water bottles (rubber), heated stones, bricks or plastic bottles filled with hot water as they may burn the infant. Alternative methods particularly skin-to-skin contact should be used.

#### 4.4.4 Bathing the infant

	
<p>Warm room • warm water</p>	<p>Dry quickly and thoroughly</p>
	
<p>Dress warmly and wrap</p>	<p>Give to mother to breast feed</p>
<p>Bathing the infant - if his temperature is normal not before 2-6 hours after birth</p>	

It is best to postpone washing or bathing. If cultural practices in some areas demand bathing, or if the baby is particularly soiled with blood or meconium, washing 2-6 hours after birth is permissible so long as the baby's temperature is normal. When the bath is given the midwife or birth attendant:

- warms a small area or corner of the room;

- uses warm water tested with her elbow, sits close to the heat source and undresses the infant on her lap;
- bathes the infant quickly and gently;
- immediately wraps the infant in a dry warm towel, and dries thoroughly from head to toe;
- quickly dresses and wraps the infant, remembering to place a cap on the baby's head;
- places the infant close to the mother and allows breast-feeding.

#### **4.4.5 Nursing care**

When nursing care is given, such as changing the nappy (diaper), care should be taken not to unduly expose infants to a cold environment, doing all procedures rapidly and keeping the baby covered as much as possible.

#### **4.4.6 Applying oil to the skin**

Applying "oils" to the infant's body is a common practice in some areas of the world. In preterm infants, it may hinder water evaporation, especially from small babies with a thin skin, and reduce the amount of evaporative heat loss. Although it is not certain how much the regular use of these oils helps in reducing such heat loss, their application in these cultural settings should neither be condemned nor approved until more evidence is available.

### **4.5 During the Neonatal Period**

All the measures mentioned above may be used during the neonatal period to ensure the infant is kept warm, but all health workers must be on the alert for preventing neonatal cold injury (see section 2.4) and recognising the signs of hypothermia (see section 6.1). As the infant grows, the need for careful warming and added warmth will diminish.

### **4.6 Preparation for Delivery in a Maternity Unit**

The general principles of maintaining good thermal control in maternity units at hospitals, clinics, or maternity centres are the same as those described for a home delivery. In an institutional setting there will be additional facilities which may include:

- a resuscitation table with an overhead heater;
- low-reading infant thermometers (down to 25°C/77°F) - an ordinary thermometer only reads down to 35°C (95°F) and will not detect significant hypothermia;
- improved methods for keeping the delivery room warm, and other devices for warming the baby (see section 5);
- facilities for both internal and external transport;

- facilities for the treatment and management of preterm infants;
- opportunities for teaching health personnel about the "warm chain".

However, there are disadvantages to delivery in an institutional setting, with consequent risks to both mother and child as a result of:

- overconfidence in and overdependence on equipment, which may be poorly maintained;
- a general lack of appreciation that a thermally "comfortable" room for health staff can be dangerously cold for a newborn;
- the usual routine of separating mother and baby which makes it more difficult to keep the baby warm, and has an adverse effect on bonding and breast-feeding;
- the special risks to infants delivered in theatre, particularly if the mother is anaesthetized and cannot receive the child;
- increased risk of hospital-acquired infections.

#### **4.7 Transporting the Baby**

The period when a newborn is transported is a potential weak link in the "warm chain". In general, a hypothermic infant should not be moved until warmed unless there is a high risk of death.

##### **4.7.1 High-risk infants**

Whenever possible, assessment of high-risk pregnant women should identify those who should be transferred to a higher level of care before birth. The uterus still is the safest way to transport a baby.

On occasion, it is necessary to take a newborn infant to an appropriate medical facility. Infants at high risk and likely to need a higher level of care or to be moved to the intensive care area within a hospital include:

- preterm infants;
- small-for-dates infants;
- infants with respiratory disease including asphyxia or hypoxia;
- those with infectious disease or serious congenital conditions.

##### **4.7.2 Before transport**

If an infant is transported to the hospital soon after birth because he/she is too small or too sick to remain at home or in the rural health facility, there is a real risk that dangerous cooling will occur that will make effective treatment at the hospital difficult or impossible.

First, allow the infant to recover from the stress of birth. Prior to transport, babies should be warmed for 2-6 hours until the hands and feet are as warm as the central parts of the body. During this time suitable transport may be planned. *Exceptions to this are infants whose condition is critical or deteriorating and who would probably die without immediate medical attention.*

Precautions must also be taken when transporting an infant from the delivery room to an intensive care area within the same hospital. When this is needed, certain procedures should be followed.

#### **4.7.3 Preparation for transport**

If possible, place the infant in skin-to-skin contact with the mother between her breasts, or with any other person. This is the best way to provide extra warmth when there are no facilities. Wrap the infant with an extra blanket and cover the head with a cap.

Avoid undressing the infant for cleaning, weighing or examination. Postpone it until the infant is warm.

If possible, take the infant's temperature. If it is below 36°C (96.8°F), extra heat will have to be provided (see section 5). If there is no thermometer and the infant's feet and hands are cold, the infant is cold and should be warmed (see section 6). Keep checking until the feet are warm.

#### **4.7.4 Keeping infants warm during transport**

Take the infant directly to the nearest hospital or health facility that has adequate newborn facilities. Depending on the circumstances at the time, any of the following methods may be used to keep the baby warm:

- Skin-to-skin contact, making sure the infant is in an upright position and is covered snugly with the person's clothes, a blanket on the outside and a cap.
- If skin-to-skin contact is not possible, the fully wrapped infant including a cap may be transported in the arms of an adult in a closed vehicle.
- The "Silver Swaddler" thermal blanket has been shown to be effective in minimizing radiant and evaporative heat loss. It is made of flexible plastic/aluminium sheeting. Where this is not available, a body covering of plastic under the blanket coverings would reduce evaporative losses. Bubble plastic, if available, has the added benefit of insulation.
- A home-made box, padded and insulated on all sides with plastic and blanket material, with holes for ventilation and a hard plastic window.
- A non-electrical transport thermal control device based on the use of a hot water reservoir and insulating walls. These devices have advantages over the incubator in that
  - they do not require electricity,
  - hot water is used for warming the device,
  - they warm up quickly,

- they are easy to clean and maintain, are not noisy and can easily be transported on a trolley or stretcher,
- they are more readily available than transport incubators in many countries.

The infant cannot be put in the device naked, but must be wrapped in several layers of light-weight, warm clothing and blankets. The temperature control of the device has to be adjusted manually; therefore, the infant and internal temperatures of the device need to be monitored by health personnel who have been trained in the thermal control of infants. This device may become more widely available in the near future and will be particularly helpful in rural areas where no transport devices exist.

- Electrically heated transport incubators do not have the capacity to store heat and therefore depend upon a continuous supply of electricity from the mains supply or the vehicle. They are more complex devices requiring more maintenance and attention, and thus are used mostly for transport of infants between hospitals.




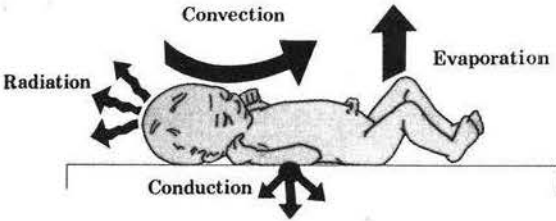
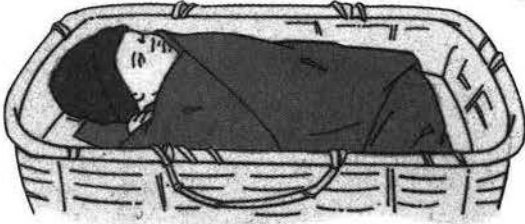


## 5. KEEPING PRETERM AND SICK BABIES WARM

To avoid hypothermia, low birth weight, preterm, and sick babies may require extra warmth over a longer period of time.

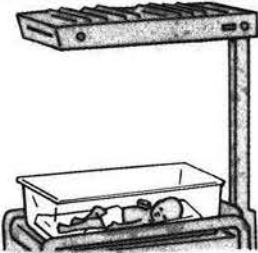
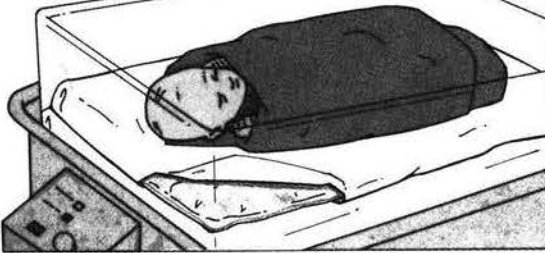
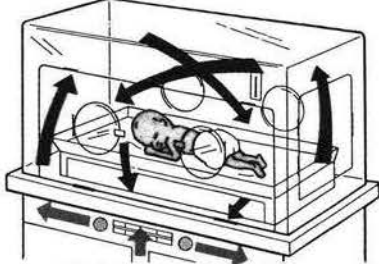
### 5.1 In the Home

The use of skin-to-skin contact (the Kangaroo method) has been shown to provide sufficient warmth for preterm babies with a birth weight as low as 1000 g. In homes as well as hospitals, this is an effective way of avoiding hypothermia. It also makes it easy for the mother to observe and feel the movements and breathing of her child, and to breast-feed.

 <p style="text-align: center;">Skin-to - skin contact</p>	<table border="1"> <thead> <tr> <th>Birth weight (kg)</th> <th>Room temperature</th> </tr> </thead> <tbody> <tr> <td>1.0 - 1.5</td> <td>34 - 35 °C</td> </tr> <tr> <td>1.5 - 2.0</td> <td>32 - 34 °C</td> </tr> <tr> <td>2.0 - 2.5</td> <td>30 - 32 °C</td> </tr> <tr> <td>greater than 2.5</td> <td>28 - 30 °C</td> </tr> </tbody> </table> <p style="text-align: center;">Warm room, fire or heater</p>	Birth weight (kg)	Room temperature	1.0 - 1.5	34 - 35 °C	1.5 - 2.0	32 - 34 °C	2.0 - 2.5	30 - 32 °C	greater than 2.5	28 - 30 °C
Birth weight (kg)	Room temperature										
1.0 - 1.5	34 - 35 °C										
1.5 - 2.0	32 - 34 °C										
2.0 - 2.5	30 - 32 °C										
greater than 2.5	28 - 30 °C										
 <p style="text-align: center;">Prevent heat losses</p>	 <p style="text-align: center;">Baby warmly wrapped</p>										
<p><b>Keeping preterm, low birth weight and sick babies warm at home</b></p>											

The mother may sit or lie down, but must support the infant's head in a slightly extended position. Both mother and baby should be covered with a blanket to protect them from the colder room temperature.

**NEVER USE HOT WATER BOTTLES,  
HEATED STONES, ETC.**

<ul style="list-style-type: none"> <li>• Skin-to-skin method</li> <li>• Warm room, fire or electric heater</li> <li>• Warmly wrapped</li> </ul>	 <p>Overhead radiant warmer</p>
 <p>Heated water-filled mattress</p>	 <p>Air-heated incubator</p>
<p><b>Keeping low birth weight and sick babies warm in maternity unit</b></p>	

## 5.2 In the Health Centre

### 5.2.1 Skin-to-skin contact

In selected cases the skin-to-skin method can also be used on the postpartum ward or in a special room of the hospital as an alternative to using radiant heaters and to incubator care. This method is widely used in developed as well as in developing countries, and is effective provided the room temperature is kept at a minimum of 25°C (77°F).

### 5.2.2 Warm rooms

The "warm room" is one that is set apart and kept sufficiently heated to meet the needs of hypothermic newborns, preterm and sick babies, but it may also be a blocked-off portion of a larger room. The room or area can be kept warm by electrical or solar heaters.

Experience has shown that warm rooms are an effective means of maintaining heat control of babies. Graded warm rooms go a step further in meeting the thermal needs of babies with different birth weights. These needs are summarized below:

- Babies who weigh 1-1.5 kg at birth need room temperatures of 34-35.5°C (93-96°F) during the first weeks of life.
- Babies of 1.5-2 kg need an initial temperature of 32-34°C (90-93°F).

- For babies of more than 2.5 kg at birth room temperatures of 28-30°C (82-86°F) are sufficient.
- A baby with asphyxia, respiratory distress or sepsis, needs a higher room temperature than a baby of the same weight but without any of these problems.

These environmental temperatures may be uncomfortably warm for parents and nursing staff, necessitating wearing light-weight clothing.

For many countries, this will be the most practical solution available.

### 5.2.3 Radiant warmers

Radiant warmers are overhead heating elements that provide a warm environment by radiant heat transfer and at the same time allow for direct observation of and free access to the infant.

For short-term use, when needed only for a few hours - as in the delivery room, during resuscitation or in surgical areas and intensive care units - a 400 W radiant warmer placed 50 cm above the baby will be sufficient. Spot lights or bulbs are dangerous because they may burn or may fall on the infant, causing injury.

Long-term radiant heat care requires expensive equipment and very skilled personnel and is suitable only for sophisticated centres of care. The equipment must have an automatic control, a manual control, or both.

When the intensity of heat is controlled manually, a low output may be insufficient to warm a cold baby and the maximum output may overheat or burn an infant, especially if the newborn is hypothermic.

The automatic control radiant warmer has a "patient probe" which is a skin temperature heat sensor. The sensor must be placed flat on the infant's skin (usually the abdomen) and fixed to the skin. The automatic system increases the heat supply when the infant's heat sensor indicates a lower temperature than the one desired and turns it off when the infant's temperature reaches the high point set on the automatic control.

On some radiant warmers the manual and automatic knobs and controls are the same, and it is easy to make a mistake.

**UNDER RADIANT WARMERS, THE INFANT'S AXILLARY TEMPERATURE MUST BE TAKEN WITH A THERMOMETER EVERY 30 MINUTES. DO NOT DEPEND ON THE SKIN TEMPERATURE HEAT SENSOR. THE TEMPERATURE PROBES CAN BECOME DETACHED, BE INACCURATE OR DEFECTIVE.**

Hazards to the infant when using this type of heating include:

- Mechanical failure of the controls.
- Skin temperature sensor becoming dislodged.
- Inaccurate monitoring of the infant's condition.
- Overheating and underheating, either of which can be fatal.
- Increased evaporative heat loss. The increase in evaporation must be made up by increasing the infant's fluid intake. The high water loss can be reduced by covering the baby with a plastic shield.
- Damage to the infant's eyes.

#### **5.2.4 Light-bulb heated cots/beds**

Another method that is commonly used for the thermal control of newborns is the light-bulb heated cot. These cots consist of a separate enclosed compartment which is fitted with 3-6 light bulbs (60 W each) and lies directly underneath a frame upon which the mattress lies. The frame has holes in it which allows the heat from the bulbs to rise up to the mattress. The light bulbs can be turned on and off individually to allow some degree of heat control.

Although this device is temptingly simple to make, it is not considered safe for the following reasons:

- the heat cannot be accurately regulated;
- this type of construction may constitute a fire hazard.

These devices are therefore not recommended and whenever possible other methods such as the warm room or skin-to-skin contact should be used.

#### **5.2.5 Heated water-filled mattress**

The heated water-filled mattress is a relatively new method of keeping babies warm and is manufactured in Sweden. The mattress is placed in the cot/bed and filled with five litres of water. An electric heating plate fits into a compartment in the bottom of the mattress and warms the water to 36.5-37°C (97.7-98.6°F). The infant is kept clothed and covered with a blanket in the cot.

Unlike other heating devices dependent on electricity, the mattress can be used for several hours without power after being heated to the optimum temperature. The temperature of the water falls very slowly. This device has been tested extensively and functions well as an alternative to incubators, when there is no need to observe the baby naked.

#### **5.2.6 Air-heated incubators**

Air-heated incubators are now widely used to provide a clean, warm environment with control of temperature and humidity and an oxygen supply. Humidity is achieved

with a water reservoir. They allow adequate observation of the naked infant and isolation when needed. Newer models are furnished with double walls to maximize their ability in maintaining a stable environmental temperature. Two main types of air-heated incubator are available:

- one depends on convection for the internal distribution of warmed air, the air currents being produced naturally by the heater in the incubator without the use of the fan;
- the other circulates warm air by a fan with a small heating element within the incubator.

Control of the temperature of the heated air is either manual or automatic:

*Manual control without thermostat*

The older types of incubator without thermostat rely on manual control for maintaining the temperature which is adjusted by turning a knob for more or for less heat. Heat output cannot be regulated accurately and it is very difficult to maintain a constant safe temperature. These devices are therefore not recommended for newborn care.

*Automatic control with thermostat*

In one type of incubator, the desired air temperature is set (e.g. 32.4°C/90.3°F), and the thermostat automatically adjusts the heat up or down to maintain this temperature.

In another, the baby's skin temperature is used, and a heat-sensitive probe is attached to the infant's abdomen and set at a predetermined temperature (for example, 36.2°C/97.2°F). Heat output in the incubator is automatically adjusted either up or down according to the changes of the skin temperature to maintain the temperature chosen. The original enthusiasm for this method has diminished and most users have returned to the use of automatic air temperature control.

### 5.2.7 Incubators in developing countries

The routine use of incubators for low birth weight and premature babies in developing countries gives cause for concern for many reasons:

- The delicate and sophisticated heating systems of modern incubators require a reliable electrical supply, and trained personnel for supervision, maintenance and repair. In many developing countries, such facilities and personnel do not exist, and often the manufacturers neither assist in training technicians nor provide replacement parts.
- It is often difficult to clean and disinfect incubators regularly due to shortage of health personnel, insufficient numbers of incubators, inadequate training of personnel in disinfection procedures, and lack of suitable disinfecting materials.
- Because of insufficient numbers of incubators, more than one infant is often put in an incubator, increasing the risk of infection.

- There is a lack of trained health personnel to manage the care of infants in incubators, especially at night.
- An incubator creates a barrier between the infant and the mother, which delays bonding and makes breast-feeding difficult. Infants should therefore be taken out of their incubators for short periods and placed with their mothers in skin-to-skin contact. This provides an opportunity to clean the incubator.

Because of the need for trained staff, maintenance and backup support, incubators should only be used in hospitals where such skills are available. The use of older, second-hand incubators (donated) may be fraught with many repair problems - lack of spare parts, manuals, etc.

### 5.3 General Management of Babies in Incubators

#### 5.3.1 Monitoring the infant's body temperature

Nursing staff must monitor the infant's body temperature regularly (every 4 hours) to ensure it is being kept at the optimal level (36.5-37°C/97.7-98.6°F), even if the incubator has skin temperature heat-sensitive probes. Because of the risk of rectal perforation, axillary temperature measurement is preferred to a rectal one.

#### 5.3.2 Monitoring the incubator air temperature regularly

Nursing staff must regulate and record the incubator air temperature regularly so that the baby maintains the desired body temperature (36.5-37°C/97.7-98.6°F). In an air-heated incubator, it should be possible to regulate the air temperature between 30°C (86°F) and 37°C (98.6°F). However, in many incubators, the maximum air temperature is only 34-35°C (93.2-95°F). This will not be enough for many babies and other methods of providing additional warmth or reducing heat losses must be used.

#### 5.3.3 Opening incubators to perform nursing procedures

When the main lid or canopy is opened much of the warm air is lost and the baby is exposed to cold. Use port-holes and small inlets as far as possible.

#### 5.3.4 Loss of heat by radiation

Babies cared for in incubators may suffer more than 50% of their total heat loss from radiation because incubator walls are usually colder than the air inside the incubator. The proportion of heat lost to cold walls depends on the room temperature. If this is 25°C (77°F) or more, radiant heat loss is not a big problem, but if the room temperature is below 25°C (77°F) it is often impossible to compensate for radiant heat loss by increasing the air temperature inside the incubator.

**INCUBATORS SHOULD NOT BE USED IN ENVIRONMENTS WHERE ROOM TEMPERATURES FALL BELOW 15°C (59°F).**

To solve the problem of heat loss due to radiation, it is important to heat the room, insulate the windows, eliminate draughts and put extra clothing on the infant as necessary. If the baby must be observed naked, a plastic shield placed over the infant or a plastic tunnel can be used. Alternatively, the conductive heat supply can be increased by putting the naked baby on top of a heated water-filled mattress.

### **5.3.5 The effect of direct sunlight on babies in incubators**

Exposure to sunlight has been recommended for the treatment of neonatal jaundice. However, a baby inside an incubator which is placed in direct sunlight can become dangerously overheated and die. This is the effect of radiant heat that is experienced by an adult sitting by a window or in a car which is directly exposed to the sun's rays.

### **5.3.6 Use of phototherapy**

If phototherapy is given by fluorescent tubes above the incubator, the baby's temperature should be monitored more frequently, approximately once every hour.

### **5.3.7 Cleaning of incubators**

Incubators should be thoroughly cleaned and disinfected after each baby is discharged, and before being used again. A baby should not be cared for in an incubator for more than 2-5 days without the incubator and water reservoir being cleaned and disinfected. Special attention should be given to the incubator's water reservoir, since many infections of the newborn can be traced to this source. It can harbour harmful microorganisms unless its water is changed and it is thoroughly cleaned regularly.

Air-heated incubators will continue to play an important role in neonatal care. However, their high cost and complexity, and the separation of the baby from the mother make it necessary to restrict their use to the smallest and the sickest babies.

Where the main clinical problem is heat loss, other means of providing warmth - skin-to-skin contact, heated beds etc - are to be preferred in developed as well as in developing countries. The principal features of the different methods available for keeping preterm and sick babies warm are summarized in Table 1.

**Table 1.** Comparison of the principal methods of keeping preterm and low birth weight babies warm

Method	Cost	Effectiveness	Safety	Hygiene	Main advantages and disadvantages
Skin-to-skin contact (the Kangaroo method)	nil	+++	+++	+++	Recommended only when baby is stable, not requiring intensive care.
The warm room	low	+++	+++	++	Low cost and effective. May cause discomfort to health personnel.
Light-bulb heated cots/beds	low	++	-	+	Low cost and easy to repair. Difficult to regulate. Not safe.
Radiant warmer (non-mobile)*	high	+++	++	++	Accessibility and visibility good. High evaporative heat loss. Complex and expensive.
Heated water-filled mattress	moderate	+++	+++	+++	Accessibility good. Effective and not too expensive. Poor visibility.
Incubator Type 1**	low	+	-	-	Low cost but poor accessibility. Not possible to regulate. Not safe.
Incubator Type 2***	moderate	+	+	-	Cheap with good visibility, but ineffective and difficult to clean.
Incubator Type 3****	very high	+++	+++	+++	Very effective and safe. Poor accessibility, complex and very expensive.

\* A servo-controlled radiant warmer for stationary care.

\*\* An old-type incubator without a thermostat, manually controlled.

\*\*\* An incubator with thermostat but no fan. The maximal air temperature is 34-35°C (93.2-95°F).

\*\*\*\* A modern double-walled incubator with a fan and automatic thermo-control both of air temperature and skin temperature. The air temperature can be adjusted between 30°C (86°F) and 37°C (98.6°F), and in some devices also to higher temperatures.



## 6. REWARMING HYPOTHERMIC BABIES

### 6.1 At Home

Rewarming must start immediately in the home and continue during transport to the nearest medical centre. The most effective and the safest way to do this is by skin-to-skin contact. The infant may also be warmed by applying cloths heated over a fire or hot plate, using the following procedure:

- two pieces of multi-layered cloth or flannel are held alternately about 5 cm over a fire or hot plate;
- confirm that the cloth is not too hot by testing on the back of the hand;
- then place the cloths over the chest, abdomen and head alternately, repeatedly rewarming them, until the feet become pink and warm;
- keep the other parts well covered to prevent heat loss during this process.

Hot water bottles or hot stones should *not be used*: they may easily cause burn damage as the blood circulation in the cold skin of babies is very limited.

### 6.2 In the Health Centre

In the health centre, a diagnosis of hypothermia is confirmed by measuring the actual body temperature with a low-reading thermometer. If the temperature is 32-36°C (89.6-96.8°F) (moderate hypothermia), the baby can be rewarmed by skin-to-skin contact; in a warm room, a warm bed, or a warm bath; or in an incubator. The rewarming process should be continued until the baby's temperature reaches the normal range, the temperature being monitored every 15-30 minutes.

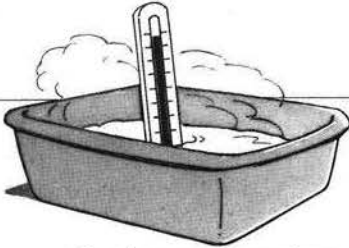
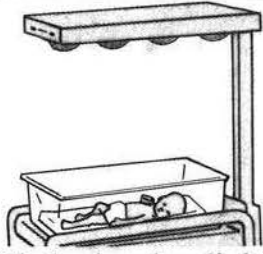
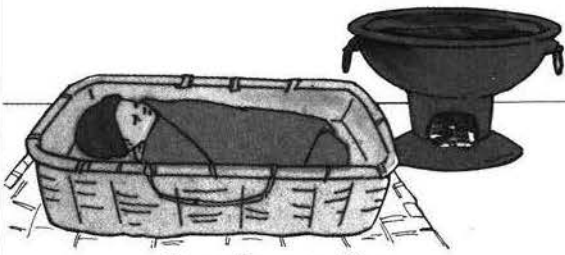
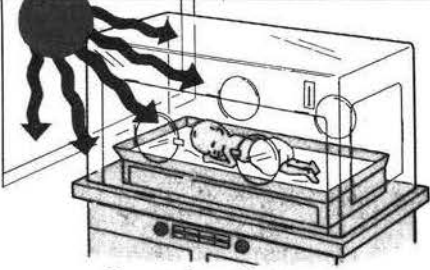
### 6.3 In the Hospital

In severe hypothermia (body temperature below 32°C/89.6°F) there have been different opinions on the process of rewarming, some recommending slow rewarming over several days and others calling for rapid rewarming over a few hours.

A recent review of the evidence concludes that rapid rewarming of hypothermic babies is preferable. This can be facilitated by using a thermostatically-controlled heated mattress set at 37-38°C (98.6-100.4°F) in addition to measures to reduce heat losses. The importance of early breast-feeding needs to be emphasized so that adequate fluid intake will compensate for the vasodilation that occurs and also to meet energy needs. Oxygen consumption is known to increase during rapid rewarming. Therefore oxygen may be administered at this time to avoid apnoea due to hypoxaemia.

If there is only an air-heated incubator available, the air temperature should be set at 35-36°C (95-96.8°F) and the body temperature of the baby checked frequently, at least every 30 minutes.

Once the baby's temperature reaches 34°C (93.2°F), the rewarming process should be slowed down to avoid overheating.

 <p>Bath water too hot</p>	 <p>Under heating lights</p>
 <p>Too close to fire</p>	 <p>In an incubator</p>
<p><b>Causes of overheating of babies - be constantly on your guard</b></p>	

## 7. CONCLUSION

If all newborn infants, including preterm and small infants, are carefully dried and given to their mother in skin-to-skin contact immediately after delivery, the risk of hypothermia is greatly reduced.

There is sufficient evidence to conclude that immediate post-delivery hypothermia is harmful to the newborn, increasing the risk of morbidity and mortality.

The temperature of the environment during delivery and the immediate postnatal period has a significant effect on the risk of the newborn developing hypothermia: the colder the environment, the greater the risk.

There are several ways to keep newborns warm, but the best is to place them in skin-to-skin contact with the mother or any other concerned adult. Breast-feeding should start as soon as possible to provide calories and stimulation which will in turn help keep the infant warm.

In certain circumstances, skin-to-skin contact is not possible. In these situations, alternative means of preventing heat loss and providing warmth will be necessary. The various methods available have been described.

The information presented provides a basis from which managers and health care providers can develop their own plans and procedures for the prevention and management of hypothermia in the newborn.



**DIVISION OF FAMILY HEALTH**

**Meeting of Technical Working Group on  
Thermal Control of the Newborn**

Geneva, 8-10 April 1992

Room X 10

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\*00043827\*

The World Health Organization is a specialized agency of the United Nations with primary responsibility for international health matters and public health. Through this organization, which was created in 1948, the health professions of some 165 countries exchange their knowledge and experience with the aim of making possible the attainment by all citizens of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life.

By means of direct technical cooperation with its Member States, and by stimulating such cooperation among them, WHO promotes the development of comprehensive health services, the prevention and control of diseases, the improvement of environmental conditions, the development of health manpower, the coordination and development of biomedical and health services research, and the planning and implementation of health programmes.

These broad fields of endeavour encompass a wide variety of activities, such as developing systems of primary health care that reach the whole population of Member countries; promoting the health of mothers and children; combating malnutrition; controlling malaria and other communicable diseases including tuberculosis and leprosy; having achieved the eradication of smallpox, promoting mass immunization against a number of other preventable diseases; improving mental health; providing safe water supplies; and training health personnel of all categories.

Progress towards better health throughout the world also demands international cooperation in such matters as establishing international standards for biological substances, pesticides and pharmaceuticals; formulating environmental health criteria; recommending international non-proprietary names for drugs; administering the International Health Regulations; revising the International Classification of Diseases, Injuries, and Causes of Death; and collecting and disseminating health statistical information.

Further information on many aspects of WHO's work is presented in the Organization's publications.

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Complications arising during pregnancy and childbirth cause the deaths of half a million women every year, the vast majority in the developing world. Over 4 million newborn babies die each year, most of them as a result of poorly managed pregnancies and deliveries. Millions more women and babies suffer debilitating and life-long consequences of ill-health.

The World Health Organization seeks to alleviate the burden of suffering borne by women, children and families, through its Maternal Health and Safe Motherhood Programme which seeks to reduce levels of maternal and neonatal mortality and ill-health significantly by the year 2000.

The Organization's activities fall into four main areas:

- technical cooperation with countries in planning, implementing, managing and evaluating national safe motherhood and newborn care programmes;
- epidemiological research into levels and causes of maternal and neonatal mortality and operational research on cost-effective ways of reducing deaths and disabilities;
- strengthening human resources for the provision of essential obstetric care, including development of standard treatment and management protocols, programme planning guidelines and training materials;
- production of advocacy materials and collection, analysis and dissemination of information to provide scientifically sound data on the nature and dimensions of maternal and newborn mortality and morbidity and how change can be brought about.

If you would like to know more about the WHO Maternal Health and Safe Motherhood Programme, write to:

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