Purpose: To explain the importance of the principles of thermography in the NICU.

Target Client Population: Any neonate in the NICU; however, these guidelines are applicable to those neonates who require assistance in maintaining their neutral thermal environment.

| Background | Control of thermoregulation is one of the critically important factors in physiological maintenance of the neonate in the NICU. Heat loss in the neonate, especially the very small premature neonate, is due to the properties of the skin, low insulation (i.e., fat), high evaporation and limited ability to vasoconstrict. Importantly, the body surface area is high in relation to weight in the neonate; a factor that significantly facilitates heat loss in this group. Maintenance of thermoregulation in the neonate involves reducing one or more of the four mechanisms of heat loss; convection, conduction, evaporation and radiation. The use of an incubator/radiant warmer to facilitate maintenance of a thermoneutral environment is routine practice in the NICU until the neonate is able to maintain his/her own thermoregulatory control. |
| Treatment Criteria | Clinical evidence supports the use of thermoregulation in the following situations: The neonate should be weaned from the incubator or radiant warmer when the following parameters have been met:

  - When the incubator temperature is less or equal to 28 degrees C.
  - When the neonate’s physiological status (ability to self-regulate temperature) is demonstrated and not based on the neonate’s actual weight, corrected gestational age or attainment of full oral feedings.
  - When the neonate has a consistent weight gain of 15-20 g/kg/d in the incubator.
  - When the neonate shows evidence of cardiovascular stability, i.e., stable vital signs.

The use of servo temperature control™ during weaning would be considered the preferred method. Servo temperature control is an electronic feedback system which functions as a thermostat to maintain a constant temperature at the site of the probe, usually on the skin over the abdomen, to maintain a constant abdominal skin temperature at 36C - 36.5C, thereby reducing the risks of cold stress or overheating. There is insufficient clinical evidence to support weaning the infant from the incubator or radiant warmer for any other indication. |
### Clinical Evidence

- A meta-analysis by the Cochrane Neonatal Collaborative Review Group (1998, 2002 and 2008), included data from two randomized/quasi randomized clinical trials in which servo-control of the abdominal skin temperature at 36°C was measured against incubator air temperature at 31.1-32.2°C. The findings showed that by keeping the baby's temperature at 36°C by servo-control reduced the newborn death rate in low birth weight babies rather than setting a constant incubator temperature of 31.8°C.

- A retrospective nonrandomized study by Schneiderman, et al (2009), found that on average for every additional 100 g an infant weighed at an open crib was associated with an increase in time to achieve full PO feeding by 0.8 days, a decrease in weight gained per day by 1 g and an increased LOS by 0.9 days.

- A prospective randomized clinical trial by Zecca, et al (2010) studied infants who transferred from an incubator to an open crib at 1600 g versus 1800 g. The authors concluded that weaning moderately premature infants at a body weight of 1600 g versus 1800 g was safe and reduced the average length of stay (LOS) by 9.5 days. The trial noted that the time spent in the open crib was the same for both groups. The infants in the early transfer group did not require more time to achieve full feeding competency, and the breast feeding amount was similar to that in the standard transition group. The authors did note that future trials should replicated the findings with more preterm infants.

- A multicenter randomized controlled trial reviewed by New, et al (2012), reached a similar conclusion. The authors concluded that medically stable infants can be transferred to open cots at a birth weight of 1600 g without any significant adverse effects on temperature stability or weight gain. However, this study noted that an earlier transfer to an open cot did not necessarily result in a shortened LOS. A possible explanation as to why the LOS was not impacted was that achieving full oral feeds had more influence on the timing of discharge. It was noted that the feeding milestone is one of the last milestones to be achieved by preterm infants born less than 32 weeks.

- Another randomized clinical trial regarding weight at weaning preterm infants from the incubator conducted by Berger, et al (2013), came to the same conclusions that weaning very low birth weight infants from an incubator to a warming bassinet at a body weight of 1500 g is feasible with no significant deleterious effects on weight gain or resting energy expenditure.

- Infants < 32 weeks should be placed on a chemical heating mattress and or in a polyethylene wrap in the delivery room for transfer to the NICU to prevent hypothermia and improve admission temperature.

- Weaning should occur prior to achieving full enteral feeds. This proactive approach has been shown to reduce LOS.

### Bibliography


Cochrane Review entitled Transfer of preterm infants from incubator to open cot at lower verses higher body weight. The reviewers are K. New, V Flenady and MW Davies. It was first published in 2004 and revised in 2007 and revised in 2011
Cochrane Review entitled Servo-control for maintaining abdominal skin temperature at 36°C in low birth weight infants. The reviewer is J. Sinclair. It was first published in 1998 and revised in 2002 and revised in 2004 and revised in 2008


Flenady VJ, Woodgate PG. Radiant warmer vs. incubators in newborn infants. Cochrane Systematic Reviews. 2003; Issue 4


Revision History
The following are approved changes incorporated into the revision numbers indicated below.

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Description of Change</th>
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<tbody>
<tr>
<td>1.0 05/16/2013</td>
<td>New guideline (MB)</td>
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<tr>
<td>2.0 01/15/2014</td>
<td>Job aid revised into medical necessity clinical guideline (LK)</td>
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