**WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care**

**Worksheet author(s)**

<table>
<thead>
<tr>
<th>Michael Watkinson MA MB BChir FRCPCH</th>
<th>Marilyn Escobedo MD</th>
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**Date Submitted for review:** October 2009

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**Clinical question.**

In newborn preterm infants in the delivery room under radiant heaters (P), what are the preferred methods of decreasing heat loss (room temperature, wrapping, warming mattresses, etc.) (I) compared to infants receiving standard traditional management (C) to achieve optimal temperatures (O) and does a combination of treatments cause hyperthermia (O)?

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Is this question addressing an intervention/therapy, prognosis or diagnosis? **Intervention**

State if this is a proposed new topic or revision of existing worksheet: **Update**

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**Conflict of interest specific to this question**

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? **NO**

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**Search strategy (including electronic databases searched).**

Pubmed, Cochrane, Medline, Embase, Google Scholar, Database of Abstracts of Reviews of Effects (DARE), hand searches of paediatric and perinatal journals

"[MeshBody Temperature Regulation/physiology"[Mesh] AND "Infant, Premature"
"Infant, Premature"[Mesh]) AND "Polyethylene"[Mesh]
"Delivery Rooms"[Mesh] AND "Body Temperature"[Mesh]
“Infant, Newborn [Mesh] and “Delivery Rooms” [Mesh]
"Infant, Newborn"[Mesh] AND "Hypothermia"[Majr]
"Infant, Newborn"[Mesh] AND "Hyperthermia, Induced"[Mesh]
"Infant, Newborn"[Mesh] AND "Resuscitation"[Majr]) AND "Body Temperature"[Mesh]

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Heat Loss,
Wrapping,
Swaddling
Mattress
Exothermic
Sodium acetate mattress
Transwarmer
Hats
Skin to skin
Kangaroo

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• State inclusion and exclusion criteria

**Included:** Preterm babies in the delivery room.
Interventions to improve thermal care including hats, exothermic mattresses, wrapping and increasing delivery room temperature.

**Excluded:** Thermal interventions in the neonatal unit post admission,
term babies,
babies > 1500g
animal studies
Abstract only studies

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• Number of articles/sources meeting criteria for further review:

14 articles were reviewed in detail:

2 meta-analyses
5 RCTs, one of which was of poor quality and considered only briefly
6 Historical control series
1 single case series
## Summary of evidence

### Evidence Supporting Clinical Question

<table>
<thead>
<tr>
<th>Good</th>
<th>Cramer 2005 A 28-29</th>
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<tbody>
<tr>
<td>Fair</td>
<td>Besch 1971 A &gt;2000</td>
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<tr>
<td>Brennan 1996 A 1500</td>
<td>Almeida 2009 A &lt;1500</td>
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<tr>
<td>Knobel 2005 A 29</td>
<td>Knobel 2005 A 29 (for bags)</td>
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<td>Vohra 2004 A 28</td>
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<td>Vohra 1999 AB 28</td>
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<tr>
<td>Poor</td>
<td>Bergman 2004 A &gt;1200</td>
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<td></td>
<td>Bjorklund 2000 A 28</td>
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<td>Ibrahim 2009 A 28-30</td>
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<td></td>
<td>Lee 2008 A 1500</td>
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<table>
<thead>
<tr>
<th>Level of evidence</th>
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<tbody>
<tr>
<td>A = Improvement in NICU admission temperature/reduction in incidence of hypothermia</td>
</tr>
<tr>
<td>B = Reduction in mortality</td>
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<tr>
<td>C = reduced morbidity (variously includes low Apgar, first pH, first glucose, duration of O2 therapy, duration of stay)</td>
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<tr>
<td>D Hyperthermia (taken here as a evidence opposing the question)</td>
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</table>

- **28** At < 28 completed weeks gestation only
- **28-30** At 28 –30 weeks only
- **28-29** At < 28-29 weeks
- **29** At < 29 weeks expected gestational age
- **30** At < 30 weeks
- **31** At < 31 weeks

- **<1000** <1000g
- **< 1500** < 1500g
- **>1200** > 1200g
- **>2000** > 2000g

Brennan 1996 — references in blue italics are also in a previous worksheet review and are included again as they are part of more recent meta-analyses reviewed here.
### Evidence Neutral to Clinical question

<table>
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<tr>
<th>Level of evidence</th>
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<tbody>
<tr>
<td>Good</td>
<td>Cramer 2005 A 28-29</td>
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<tr>
<td>Poor</td>
<td>Ibrahim 2009 BC 28-30</td>
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</tbody>
</table>

- **A** = Improvement in NICU admission temperature/reduction in incidence of hypothermia
- **B** = Reduction in mortality
- **C** = Reduced morbidity (variously includes low Apgar, first pH, first glucose, duration of O₂ therapy, duration of stay)
- **D** = Hyperthermia (taken here as evidence opposing the question)

- **28** At < 28 completed weeks gestation only
- **28-30** At 28 – 30 weeks only
- **28-29** At < 28-29 weeks
- **29** At < 29 weeks expected gestational age
- **31** At < 31 weeks
- **1500** < 1500g (gestations ranged from 24 to 32 weeks)
## Evidence Opposing Clinical Question

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<tr>
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<td>Bredemeyer 2005 D(^{29})</td>
<td>Smith 2005 D(^{29})</td>
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A = Improvement in NICU admission temperature/reduction in incidence of hypothermia
B = Reduction in mortality (variously includes low Apgar, first pH, first glucose, duration of O\(_2\) therapy, duration of stay)
C = reduced morbidity
D = Hyperthermia (taken here as evidence opposing the question)

<table>
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<tr>
<th>Age Group</th>
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<td>At &lt; 31 weeks</td>
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<td>&lt; 1500g</td>
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CURRENT ISSUES/PROBLEMS

Occlusive wrapping

The meta-analyses of the RCT occlusive wrapping trials show a definite improvement in NICU admission temperature with a weighted mean difference (WMD) of 0.76°C (McCall 2008) and 0.63°C (Cramer 2005) (LOE1).

Individual small trials have looked at effects on stabilization after birth, short term changes in acid-base balance, respiratory distress, IVH, NEC O2 need and length of hospitalization. Numbers remain small, studies have been underpowered. No clear and repeated evidence has been found for effects on these short term morbidities. This is a field where it is impossible to blind observers to the treatment allocation – both wrappings and mattresses are readily apparent. There is therefore always the possibility of bias.

An increased incidence of hyperthermia is reported in a number of studies and to date is the only repeated finding - though not in all studies - that might result in adverse effects from wrapping (LOE3). There is some data to suggest that many hot babies were born to febrile mothers and the babies were ‘congenitally’ hot (Smith 2005). Most studies have used the radiant heaters at full manual power and servo-temperature control during stabilization may reduce the incidence of hypothermia in some centres.

Vohra’s original study (1999) was underpowered to assess the effect of wrapping on mortality, but depending on the statistics used, the 5 deaths in the un-wrapped group were significantly greater than the zero deaths in the wrapped babies. They also had a significantly lower admission temperature. No other studies were powered to assess the effect upon mortality, though a large RCT on wrapping is underway, and it is hoped that this will resolve these questions on morbidity and mortality.

One meta-analysis (Cramer 2005) states “future editions of the neonatal resuscitation program need to include recommendations about the use of wrap to prevent heat loss in vulnerable populations.” The other (McCall 2008) states “...the small numbers of infants and studies and the absence of long term follow up means that firm recommendations for clinical practice cannot be given.” Both meta-analyses agree that no significant effect on mortality has been shown. In reality, many NICUs now use wraps and/or mattresses to reduce hypothermia on admission. Not only that but there may have been a knock on effect to improve delivery room thermal care in general (e.g. Kent 2008, Lee 2008). It will be interesting to see how this affects the results of the on-going HeLP trial.

At present no wrapping studies have long term follow up. This is a major reason for the McCall 2008 meta-analysis not supporting wrapping.

Hats

McCall 2008 refers to study by Roberts {Roberts JR. Use of a stockinette cap on premature infants after delivery {(dissertation), Denton (TX): Texas Women’s University, 1981} to which this reviewer does not have access. The youngest babies in the study were 32 weeks gestation. The Cochrane review concludes that there is a non-significant benefit on temperature in favour of those infants wearing the cap vs. non-capped controls. However Coles (1979) had previously reported that stockinette hats had no benefit for term infants, and therefore Roberts’ data is not surprising. Stothers (1981) and Chaput de Saintonge (1979) showed that gamgee lined woolen hats improved thermal balance in term babies. The thermal benefit of woolen hats in term babies was confirmed by Lang (2003) when compared to cotton diapers loosely applied to infants’ heads.

There are no randomized trials of woolen hats in preterm babies.

It is common clinical practice to apply a hat to preterm babies who are occlusively wrapped. In the three RCTs on occlusive wrapping (Vohra 1999, Vohra 2004, Knobel 2005), once the infants were either wrapped in polythene or dried
and placed in warm towels, standard NRP procedures were followed. The guidelines from 2000 and earlier (International Consensus on Science Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency International Guidelines for Neonatal Resuscitation and the 4th edition of the Neonatal Resuscitation Textbook) did not advocate the use of hats. However, in Knobel’s 2005 study newborns wore “thin cotton knit hats on all babies (study and control) since that was the pre-existing policy at the time” (Knobel R, Wimmer J, personal communication). The babies in Vohra’s ongoing HeLP RCT wear / do not wear hats according to the practice of the local unit. (Vohra S, personal communication).

**On the basis of evidence from term babies it seems appropriate to put a woolen hat on those preterm babies at risk of hypothermia.**

**Skin to skin contact**

Bergmann 2004 undertook a non-blinded RCT of skin to skin contact in babies > 1200g, starting after a satisfactory 5 minute Apgar score. It is of poor quality and limited relevance to the care of more preterm babies and is not considered further. There are no other randomized trials of skin to skin care in preterm babies immediately after birth, indeed it is inapplicable in those who need stabilization.

**Warming mattresses**

There is only one LOE1 RCT on 24 babies < 1500g nursed on exothermic mattresses. This showed the mean admission temperature of the intervention group was 1.6°C higher than the controls. However it is more than 10 years old and although the smallest baby weighed < 600g, the mean birthweight was > 1000g. Therefore many of the babies in that trial would not present a major clinical challenge in 2008. The value of using such mattresses in babies <750 g needs further trials. Almeida et al (2009) reported on the use of an exothermic mattress in neonates <1500g in the delivery room, comparing 40 babies placed on the mattress with 74 babies who were not. Unfortunately the controls were only wrapped in warm blankets after drying. A more valuable comparison would have occurred if all newborns had been placed in plastic bags as advocated by Vohra and others. Singh et al (2009) reported 3 historical cohorts, one where babies were managed by drying and wrapping in a towel, one by wrapping in polythene bags only, and one by wrapping in bags and placing on an exothermic mattress. Temperatures incrementally improved but there was no blinding of observers and other improvements in care may have occurred. More RCTs are needed.

There is no long term follow up data on infants nursed on warming mattresses.

**Delivery Room temperature**

There is no RCT data on the effects of delivery room temperature on NICU admission temperatures.

Kent 2008 reports a case series with historical controls of traditional care against first increasing operating theatre temperature alone, and then combining increased ambient temperatures with occlusive wrapping. The effects of these changes were confounded by also running educational programmes on thermal care. The initial theatre temperature was 20°C, then it was increased to 25°C for infants at ≥ 28 weeks and 26-28°C for infants below that gestation. Statistically significant improvement in admission temperatures were achieved only for babies < 28 weeks with a rise in mean admission temperature from 35.3°C to 35.9°C – i.e. many babies were still hypothermic. The paper does not differentiate between the effects of the warmer operating theatre and the effect of the educational programme.

Knobel 2005 undertook a post hoc analysis on the effects of delivery room temperatures as part of his RCT on polyurethane bags. The authors divided the temperatures dichotomously into warm (> 26.0°C) and cool (≤ 26.0°C). Intervention and (separately) control infants born in warm rooms had higher mean admission temperatures than their counterparts in cool rooms. However the mean admission temperatures were all hypothermic except for those infants born in warm rooms and then wrapped. Wrapped infants in warm rooms had a significantly higher temperature than the unwrapped infants in warm rooms (37.1°C vs. 36.3°C, p<0.01) (LOE 3).
Cramer 2005 used data from 126 infants in two RCTs of wrapping and calculated that there was a positive relationship between delivery room temperature and NICU admission temperature. It is unclear what the range of delivery room temperatures was.

In general the science on the effects of delivery room temperature and NICU admission temperature is poor. One might expect extreme temperatures to have an effect, but in the absence of raw data it is impossible to know if extremes contribute to any relationship. Issues such as cooling drafts, different power output of radiant heaters and length of time in the delivery room need to be known before a true effect can be calculated.


The work of Knobel 2005 and Kent 2008 suggests but does not prove that delivery room temperature should be at least 26°C for infants < 28 weeks.

**Combinations of heat loss prevention techniques.**

The table below shows papers that have reported on combinations of heat loss prevention techniques. Both Knobel 2005 and Kent 2008 report some data showing that a higher delivery room temperature can further raise the NICU admission temperature of wrapped babies, but the quality of the data is limited.

<table>
<thead>
<tr>
<th>Occlusive wrapping</th>
<th>Delivery room temperature</th>
<th>Hats</th>
<th>Warming mattresses</th>
<th>Skin to skin</th>
</tr>
</thead>
</table>

**General comments**

The gestational age below which wrapping or mattresses should be used has still not been clearly established. There is LOE1 for < 28 weeks (see tables), but slightly higher gestation babies may also benefit. In individual institutions this probably depends on delivery room temperatures and the facilities for and timing of transfer to NICU.

There is a need to define and agree the optimal range for admission temperature. This may differ from temperature at birth, especially if the mother is febrile. Ranges between 36.5°C and 38°C have been suggested but there is little scientific evidence behind these precise figures. (Laptook A, Watkinson M. 2008) nevertheless, an agreed range would enable better comparison between studies and facilitate the meta-analyses.

**Future studies need to explain clearly**

1. If the head was dried and a hat put on, and the type of hat – i.e. Woolen or not.
2. The use of radiant heaters and or table heaters in resuscitaires, including the maximum power and distance from the baby, and whether the heater was in servo mode set to “X°C”, or manual output at “X%” power.
3. The temperature settings of the of the incubator/resuscitaires used to transport the baby to NICU should be stated
4. The origins of hyperthermia – is maternal fever the main cause, would use of servo-control on radiant heaters reduce the incidence of hyperthermia on admission to NICU?

**Acknowledgements:**

**Citation List**
Almeida 2009

LOE2 with fair to poor quality. A non-randomised ‘convenience sample’ in which the control group was poorly matched to the study group nursed on Transwarmer mattresses. Data may have been collected retrospectively. Unfortunately the controls were only wrapped in warm blankets after drying, and there were no newborns wrapped in polythene bags.


Bergman 2004


LOE1 but poor quality and of limited relevance. Randomisation in the study was after the 5 minute Apgar score was > 7, site of the temperature measurement not specified, control group 0.6°C cooler at ten minutes of age and details of incubator care limited. This study has little to offer in terms of caring for babies < 28 weeks, though it may encourage some to offer skin to skin care for well stable babies weighing > 1200g.

Besch 1971

Besch NJ, Perlstein PH, Edwards NK et al. The transparent baby bag. NEJM 1971; 284: 121-4

LOE1 with fair quality. It was a RCT on preterm neonates, but infants weighed over 2000g, and therefore debatably of minimal relevance to VLBW newborns in 2009. Limited demographic details hence rated as fair.

Bjorklund 2000


LOE3 and poor quality as authors seem uncertain as to the cause of the improvement in admission temperatures. Letter only in response to Vohra 1999. Historical controls.
Abstract: none

Bredemeyer 2005.


LOE 3 with fair quality. Essentially a retrospective audit and declared as such, so treatment allocation apparent. Head wrapped in padding. Transferred to NICU on resuscitaire wrapped in polythene and nested in warm towels. Data included on status at 6 hours but not reviewed here. Significant differences in admission temperature, time to stabilisation (not defined) but the intervention group also had higher humidity. Hyperthermia defined as axillary temperature > 37.2°C, and rose from 32% to 74% (p<0.01). No difference in incidence of maternal fever or chorioamnionitis. Other morbidities not reported.
Brennan 1996


LOE 1 and fair quality as not blinded. A small randomized trial on the use of Transwarmer® mattresses during the transfer of preterm babies between the delivery room and the NICU. No original abstract available. Allocation to mattresses apparent. Unwrapped babies (?). Small numbers. Other aspects of thermal care unclear except for infants being under a radiant heater and not wrapped in bags/polythene. No hyperthermic (>37.5°C) babies.

(Review author’s abstract). Hypothesis tested was that babies <1500g under a radiant heater and placed on a sodium acetate exothermic mattress immediately after birth (experimental group) would have a higher NICU admission temperature than those placed under a radiant heater. Gestational age ranged from 24 to 32 weeks: mean GA of control group was 27.3 weeks, and of the experimental group 27.8 weeks (p=0.6). Birth weights ranged from 531 to 1498g: mean BW of the control group was 1027g, and of the experimental group 1033g (p=0.96). There was no statistically significant difference in the mean time of temperature measurement (19 v 18 minutes). The mean admission temperature of the control group was 35.0°C and of the experimental group 36.6°C (p=0.0009).

Cramer 2005


LOE1 as a meta-analysis of the effects of wrapping. It fulfils the 6 criteria need to be graded as of good quality, though the log of excluded trials is not complete, I think. Only 3 RCTs included (Vohra 1999, Vohra 2004 and Knobel 2004) with 5 historical control studies (Bjorkland 2000, Lenclen 2002, Lyon 2003, Meyer 2003, Newton 2003 – see previous worksheet for 2005). Types of study are well separated in the analyses. Some statistical manipulation of published data to enable comparison and then aggregation. Full data on 126 babies in the RCTs enabled linear regression analyses between admission temperature and treatment status (wrap v no wrap), gestational age, delivery room temperature, maternal temperature and admission age as independent variables. Significant relationships were found for being wrapped, gestation, maternal temperature and delivery room temperature. The details are not very complete but this paper’s data may be the best evidence currently available for the effect of delivery room temperature. In the discussion they suggest hyperthermia was likely to be associated with maternal fever and infection – rather than with being wrapped - but do not reference that statement. (However see Smith 2005. The RCTs in this study are also in the meta-analyses of McCall 2008, so there is no a true doubling of the data for meta-analyses supporting wrapping of babies.

Ibrahim 2009

Ibrahim CPH, Yoxall CW. Use of plastic bags to prevent hypothermia at birth in preterm infants- do they work at lower gestations? Acta Paediatrica 2009;98:256-60

Level 3 or less, quality poor as abstract seems self contradictory, allocation to wrapping apparent and incomplete data collection. Unconvincing results. 24.2% of all babies had no admission temperature recorded. Error in the results section of the abstract. Introduction of wrapping was also accompanied by “concerted effort to educate the staff on thermal control ....” Incidence of hyperthermia rose from 12.5% to 39.8% (p<0.001). No servo control of temperature from radiant heater (personal communication).

Kent 2008

LOE 3 and fair quality as not blinded. Rise in theatre temperatures from initial epoch of 20°C to 25°C for deliveries at 28 to 35 weeks and 26-28°C at ≤ 27 weeks. Educational programme run on thermal care. Axillary temperatures. Mean admission temperature for vaginal deliveries at all ages did not rise significantly (35.6, 35.8, 35.9°C) but only 4 babies < 28 weeks in last epoch. See abstract for rise in temperatures of babies delivered by caesarian section, and by inference this rise was attributed to environmental temperature change and introduction of wrapping. No comments on radiant heater settings, use of hats, transfer to NICU etc. From figures hyperthermia (>37.5°C) occurred in 1/73 (1.3%), 1/35 (2.9%) and 4/48 (8.3%) infants in the 3 successive epochs.

Knobel 2005


LOE 1 RCT and fair quality for wrapping in polyurethane bags. Allocation to wrapping apparent. Post hoc analysis of delivery room temperature of > 26°C v cooler rooms showed control infants born in warm rooms had higher temperatures than those in cool rooms and separately so did the intervention group (LOE2). Unclear why 26°C chosen. Infants < 29 weeks. Picture shows hat, no mention in text. Hyperthermia rate 2.5%. No statement over thermo-control mode of radiant heaters. Transported to NICU covered with warm blankets.

Lee 2008.

Lee HC, Ho QT, Rhine WD. A quality improvement project to improve admission temperatures in very low birth weight infants. J Perinatol 2008;28;754-8.

LOE3 and quality ?fair/poor. I have included this because it represents the real life strategy adopted by many units recently of having a drive on education about thermal care and introducing plastic bags to wrap babies of less than a specific gestation. Here however it was for babies <1500g, which implies either that they were weighed at birth, or they were 'recruited' after admission to NICU and weighing there. The areas targeted were 1) Early power up of radiant warmers, 2) Polyethylene wraps, 3) Chemical warming mattresses prior to delivery 4) Appropriate caps available 5) Warm blankets accessible. No changes in mortality/grade 3&4 IVH rates. In the text they claim not to have an increase in hyperthermia (undefined) but the histograms suggest some increase in numbers above both 37 and 37.5°C.


LOE3 of fair quality with retrospective controls. Only paper to show benefit upto < 30 weeks

Lyon 2004

LOE3 and fair quality in a letter. A report on improved temperature control when babies < 29 weeks are placed undried in plastic bags after birth compared to historical controls. Mean temperature on admission in bags was 37°C, and from the graph shown it appears that at least 5 of the 45 bagged neonates had admission temperatures ≥38°C.

Abstract
Letter only. No abstract

Mathew 2007

LOE3 and fair quality as allocation to treatment (wrapping) apparent using historical controls. Showed 1°C increase in temperature on admission and improved pH in first 6 hours, but blood gas sampling site(s) not recorded. No significant effect on mortality but only 27 babies in whole study, so underpowered. Head dried and hat put on. Radiant heaters set manually to maximum. Transferred to NICU in incubator at 35°C.

McCall 2008

LOE 1. Meta-analysis. All studies included in this review are listed separately in this citation list. (Brennan 1996, Knobel 2005, Vohra 1999, Vohra 2004) All trials have the difficulty of being unable to conceal the allocation of infants to treatment/control groups. This paper has the first analysis of numbers needed to treat (2 to 4) so this is a very economic treatment and appears safe, especially if hyperthermia can be avoided.

The RCTs in this study are also in the meta-analyses of Cramer 2005, so there is no a true doubling of the data for meta-analyses supporting wrapping of babies.

Authors’ conclusions
Plastic wraps or bags, skin-to-skin care and Transwarmer mattresses all keep preterm infants warmer, leading to higher temperatures on admission to neonatal units and less hypothermia. Given the low NNT, consideration should be given to using these interventions in the delivery suite. However, the small numbers of infants and studies and the absence of long-term follow-up mean that firm recommendations for clinical practice cannot be given. There is a need to conduct large, high quality randomised controlled trials looking at long-term outcomes.

Meyer 2003

LOE3 and fair quality as numbers low. A study comparing NNU admission temperatures before and after starting to place neonates < 1000g undried in plastic wraps in the delivery room The median temperature of 19 infants admitted since wrapping was commenced was 36.7°C on arrival to the nursery compared with 35.5°C for the previous 86 unwrapped infants.
Meyer 2007


LOE1 but fair quality as allocation to treatment apparent. Stratified RCT. Powered to detect 35% difference in undesirable temperatures (<36.5°C, >37.5°C) which was probably over-optimistic, and then calculated that over 200 infants needed in such a study to detect a 15% difference- i.e. the difference between the 75% and 60% of their results. Clear statements over environmental temperature, use of hats and incubator/radiant heater settings. Incubator portholes open for CPAP. 5-7 minute transfer to NICU (long time). Head not covered (?) Because CPAP used??)

Newton 2003


LOE3 and fair quality. A study comparing NNU admission temperatures before and after starting to place neonates <30 weeks undried in plastic bags in the delivery room and analyzing the outcome by multiple regression. Hyperthermia unsatisfactorily defined as >37.0°C.

No abstract. Letter only

Singh 2009


LOE3 with fair quality, but no blinding and historical controls limit value of study. This group reports more hyperthermia than others. Nevertheless data suggest that exothermic mattresses can have an additive effect even when polythene wrapping is already used. RCTs are needed to decide this.

Smith 2005


LOE4 for this case series with fair quality as follow up only to 15 minutes. Included because it demonstrates that 8 of the 11 hyperthermic babies - of a series of 27 infants < 29 weeks wrapped in polythene bags - were born hot. However, 3 of the 27(11%) were iatrogenically heated above 37.5°C. Placed in ‘neutral’ category but could be placed as supporting wraps (no hypothermia) or opposing them -11% induced hyperthermia rate.
**Vohra 1999**


*LOE 1 but fair quality as small numbers and allocation to wrapping apparent. Adjustments made to trial size by changing temperature difference threshold. Unclear if significant difference in babies < 28 weeks was a post hoc analysis (?). Incidence of hyperthermia not commented on. Excess of deaths in unwrapped babies (p=0.04) led to speculation that prevention of hypothermia might reduce mortality hence leading on to further trials. Radiant heaters on manual control, maximum output. Head dried, - no hats used? From figure 8/27 (30%) wrapped babies were hyperthermic (rectal temp ≥ 37.0°C) and 2 (7%) were ≥37.5°C. Mode of transfer to NICU unclear.*

**Vohra 2004**


*LOE 1 but quality fair as allocation to wrapping apparent and a again a modest sized RCT building on previous study but now looking only at babies < 28 weeks. Includes morbidity & mortality data but underpowered to pick up significant differences in these parameters. No significant difference in mortality rates. Radiant heaters on manual control, maximum output. Again 2/27 (7%) wrapped infants had rectal temperatures ≥37.5°C. Head dried, - no hats used? Infants carried to NICU.*

**Additional references in comments:**


