

Thermoregulation Devices

Guide to Selection

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THERMOREGULATION DEVICES

Neonatal hypothermia occurs when a newborn's body temperature drops below 36.5°C (97.7°F).ⁱ A significant increase in neonatal mortality is associated with each 1°C reduction in body temperature.ⁱ Loss of body heat can occur due to cold environments or failure to immediately dry and wrap the infant after birth. Because pre-term and low-birth-weight babies have smaller amounts of the fat that helps to generate heat, they are at greater risk for hypothermia.ⁱⁱ

The World Health Organization states that, "Every year, more than 20 million infants are born weighing less than 2500g—over 96% of them are in developing countries. These low-birth-weight infants are at increased risk of neonatal morbidity and mortality."ⁱⁱⁱ While kangaroo mother care (prolonged skin-to-skin contact between mother and newborn), is the preferred method of preventing and addressing newborn hypothermia, it is not always possible.

Thermoregulation technologies are an important complement to kangaroo mother care by improving the health outcomes of preterm and sick neonates. While incubators provide the most advanced warming technology, they are often prohibitively expensive and do not allow easy access to the infant. Further, there can be a risk of infection when using an incubator. Not only must the unit be thoroughly cleaned and disinfected at regular intervals, but also the water in the reservoir must be changed frequently to prevent the growth of microorganisms.^{iv} Recent research also shows that the warm, humidified air inside the incubator encourages microbial growth inside the incubator under certain environmental conditions.^v Therefore, other technologies may be better options for low-resource settings. Warming beds provide easy access to the infant both for feeding and changing, and also for performing medical examinations and procedures without decreasing the amount of heat being provided to the infant. More expensive warmers may also include x-ray capabilities within the bed, thereby preventing the infant from needing to be moved for such tests. However, warming beds can increase dehydration, so the infant must be closely monitored at all times and daily fluid requirements must be calculated accordingly.^{vi} Other types of warming and heat stabilization through heated mattresses and wraps can also be effective methods of thermoregulation depending on the age, weight, and health of the infant.

Several thermoregulation devices have recently been developed in Southeast Asia which are specifically marketed and priced for low-resource settings and include training for end-users on the repair and maintenance of the device.

In 2009, PATH convened a panel of neonatologist to review the most important characteristics for warming devices in low-resource settings. These experts outlined 19 factors important to warming devices for transport and 18 factors important to warming devices for facility-based care. These factors are outlined in the following summary of neonatal warming technologies.^{vii}

This guide contains commercialized devices that are available on the market today. The guide is organized by device type—1) infant radiant warmer beds, 2) exothermic mattresses, and 3) occlusive wraps—and then by price within each category. Some devices are appropriate for facility use only, some for transportation only, and some for both. Criteria for transportation or facility-specific criteria are excluded if there were none.

ⁱ Belches TC, Tilly AE, Miller TR, et al. Randomized Trial of Plastic Bags to Prevent Term Neonatal Hypothermia in a Resource-Poor Setting. *Pediatrics*. 2013; 132(3):e656-e661.

ⁱⁱ PATH. Intrapartum-related events rapid landscape analysis - Thermoregulation. February 2012. Available at: <http://sites.path.org/technologysolutions/healthtechprogram/documents/>. Accessed October 7, 2013.

ⁱⁱⁱ World Health Organization (WHO). Kangaroo mother care to reduce morbidity and mortality and improve growth in low-birth-weight infants. Available at: http://www.who.int/elena/titles/kangaroo_care_infants/en/. Accessed October 7, 2013.

^{iv} World Health Organization (WHO). Thermal Protection of the Newborn: a practical guide. 1997. http://www.who.int/maternal_child_adolescent/documents/ws42097th/en/. Accessed April 9, 2014.

^v de Goffau M, Bergman KA, de Vries HJ, et al. Cold Spots in Neonatal Incubators Are Hot Spots for Microbial Contamination- *Appl. Environ. Microbiol.* 2011; 77(24): 8568-8572.

^{vi} Flenday V, Woodgate PG. Radiant warmers versus incubators for regulating body temperature in newborn infants. *Cochrane Database of Systematic Reviews*. 2003;4:CD000435.

^{vii} PATH. Internal Research. Newborn Thermal Care Devices for Low-Resource Settings. December 2009.

Permission granted from the manufacturers for all included photographs.

SECTION I:

INFANT RADIANT WARMER BEDS

INDIAN-MADE RADIANT HEAT WARMERS

Basic information	Manufacturer	Multiple manufacturers
	Link	Multiple manufacturers. Examples include: Shreeyash Electro Medical (Pune), http://www.shreeyashindia.com/ Zeal Medical (Mumbai), http://www.zealmedical.com/ Meditrin Instruments (Mumbai), http://www.meditrin.co.in/ Phoenix Medical Systems (Chennai), http://www.phoenixmedicalsystems.com/ Bird Meditech (Mumbai), http://birdmeditech.com/ Medicaid (Delhi), http://www.indiamart.com/medicaid-delhi/ Mediserve (Delhi), http://www.indiamart.com/mediserve/ Mech Tech Lab (Pune) Lectromedik Pvt. Ltd. (Bangalore)
	Manufacturer description	Not available
	Characteristics applicable to low-resource settings	Made in India, requires power supply, wide availability in Indian market, but may not be affordable for lower-level or remote facilities.
	Use type	Facility
	Features	There are numerous higher-quality, relatively low cost models made in India, ranging from a basic model to designs with features such as: LED screen, bed tilt, skin temperature probe, procedure lighting, alarms, and automatic and manual control modes.
	Pre/post-sales support	Unknown
	Approximate price	US\$300—\$1,400

Purpose of device	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	✓

Characteristics for facility use	
Generates and maintains heat	✓
Real-time temperature indicator for infant	Varies by device
Limited temperature control by user, or high/low temperature signal for device	✓
Minimal maintenance/consumables	✓
Ease of use by trained health workers in urgent care settings	✓
Easy access to baby (to change diaper, etc.)	✓
Baby visible for monitoring	✓
Low-literate and written instructions imprinted on device	unknown
Compatible with alternate power source, if uses electricity	NO
Durable for routine daily use	✓
Able to be reused	✓
Easy to clean	✓
Appearance of high-tech design to appeal to health professionals	✓
Safety: able to hold infant securely with no risk of dropping/falling	✓
Safety: manufactured of nontoxic materials	✓
Safety: no chance of suffocation or strangulation	✓
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	✓

MTTS INFANT WARMER



Basic information	Manufacturer	MTTS
	Link	http://www.mtts-asia.com/
	Manufacturer description	MTTS Warmer is designed to keep infants warm in first aid emergencies or medical environments that require an appropriate temperature.
	Characteristics applicable to low-resource settings	Designed and manufactured in Vietnam. Requires power supply. Can cause dehydration. Must be switched on 30 minutes before use.
	Use type	Facility
	Features	Temperature display screen, skin sensor, alarm when temp is higher than 38.7°C/101.6°F, 500W overhead heating element, 220V power supply required, indoor temp must be at least 20°C/ 68°F, halogen lamp next to warming unit provides lighting for health care workers. East Meets West's Breath of Life program provides partner hospitals with training for MTTs equipment.
	Pre/post-sales support	Yes
	Approximate price	US\$1,630
Purpose of device	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	NO

Characteristics for facility use

Generates and maintains heat	✓
Real-time temperature indicator for infant	✓
Limited temperature control by user, or high/low temperature signal for device	✓
Minimal maintenance/consumables	✓
Ease of use by trained health workers in urgent care settings	✓
Easy access to baby (to change diaper, etc.)	✓
Baby visible for monitoring	✓
Low-literate and written instructions imprinted on device	NO
Compatible with alternate power source, if uses electricity	NO
Durable for routine daily use	✓
Able to be reused	✓
Easy to clean	✓
Appearance of high-tech design to appeal to health professionals	✓
Safety: able to hold infant securely with no risk of dropping/falling	✓
Safety: manufactured of nontoxic materials	✓
Safety: no chance of suffocation or strangulation	✓
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	✓

KSE WARMER WITH PHOTOTHERAPY



Basic information	Manufacturer	KSE Medical
	Link	http://www.ksemedical.com/
	Manufacturer description	Designed to keep infants warm in first aid emergencies or medical environments that require an appropriate temperature.
	Characteristics applicable to low-resource settings	Designed and manufactured in Vietnam. Requires power supply. Can cause dehydration. Must be switched on 30 minutes before use.
	Use type	Facility
	Features	Temperature display screen, skin sensor, alarm when temp is higher than 38.7°C/101.6°F, 500W overhead heating element, 220V power supply required, indoor temperature must be at least 20°C/68°F, halogen lamp next to warming unit provides lighting for health care workers. Unit is warmer+phototherapy. While KSE has moved away from making warmer only, they will make one if requested (about \$1,500 less than warmer+phototherapy device).
	Pre/post-sales support	Warranty for 1 year from date of shipment.
	Approximate price	US\$3,850
Purpose of device	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	NO

Characteristics for facility use	
Generates and maintains heat	✓
Real-time temperature indicator for infant	✓
Limited temperature control by user, or high/low temperature signal for device	✓
Minimal maintenance/consumables	✓
Ease of use by trained health workers in urgent care settings	✓
Easy access to baby (to change diaper, etc.)	✓
Baby visible for monitoring	✓
Low-literate and written instructions imprinted on device	NO
Compatible with alternate power source, if uses electricity	✓
Durable for routine daily use	✓
Able to be reused	✓
Easy to clean	✓
Appearance of high-tech design to appeal to health professionals	✓
Safety: able to hold infant securely with no risk of dropping/falling	✓
Safety: manufactured of nontoxic materials	✓
Safety: no chance of suffocation or strangulation	✓
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	✓

LULLABY BABY WARMER



Basic information

Manufacturer	GE Healthcare India
Link	http://www3.gehealthcare.in/en/
Manufacturer description	System operation is intuitive, even for first-time users, and requires minimal training..The micro-processor technology and intelligent engineering behind the Lullaby Warmer create a consistently warm bed for baby with built-in monitors that notify caregivers of critical temperature events.
Characteristics applicable to low-resource settings	Requires power supply. Intended for urban and semi-urban settings in developing countries. Designed and manufactured in India for use in developing countries (initial market in India with plans to expand).
Use type	Facility
Features	Not available in the U.S. Visually-coded control panel and color-coded safety alarms, large LED screen, lighting for illumination of infant, APGAR timer, warmer heats to 100% for 12 minutes, and then reduces to a steady 24% to maintain ready status. Calrod® heater matching bed size for even distribution of heat, probe guard helps prevent the skin probe from becoming detached from the baby, a “check baby” alarm if skin temperature deviates by $\pm 1^{\circ}$ C from the set point, integrated x-ray tray below mattress, bed tilt of $\pm 15^{\circ}$ continuous positions.
Pre/post-sales support	Yes
Approximate price	US\$3,000

Purpose of device	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	✓

Characteristics for facility use	
Generates and maintains heat	✓
Real-time temperature indicator for infant	✓
Limited temperature control by user, or high/low temperature signal for device	✓
Minimal maintenance/consumables	NO
Ease of use by trained health workers in urgent care settings	✓
Easy access to baby (to change diaper, etc.)	✓
Baby visible for monitoring	✓
Low-literate and written instructions imprinted on device	NO
Compatible with alternate power source, if uses electricity	NO
Durable for routine daily use	✓
Able to be reused	✓
Easy to clean	✓
Appearance of high-tech design to appeal to health professionals	✓
Safety: able to hold infant securely with no risk of dropping/falling	✓
Safety: manufactured of nontoxic materials	✓
Safety: no chance of suffocation or strangulation	✓
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	✓

EFFICIA INFANT WARMER



Basic information	Manufacturer	Philips Healthcare India
	Link	http://www.healthcare.philips.com/in_en/
	Manufacturer description	An affordable, feature-rich microenvironment that provides dependable infant thermoregulation support. As such, they allow caregivers to offer a high level of care with a low cost of ownership.
	Characteristics applicable to low-resource settings	Requires power supply. Designed and manufactured in India specifically for developing countries. Being marketed in India and Africa as a low-cost option. New as of summer 2013. Intended to directly compete with GE Lullaby Warmer.
	Use type	Facility
	Features	Not available in the U.S. Three warmers in this range and are offered at various price points intended for premium urban hospitals, tier II facilities, and primary care settings. Features include (may depend on model): low power consumption, foam mattress, dual-mode temperature control, self-locking tilt mechanism, APGAR timer.
	Pre/post-sales support	Yes
	Approximate price	Philips states that product is priced to be competitive with GE Lullaby Warmer
Purpose of device	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	✓

Characteristics for facility use	
Generates and maintains heat	✓
Real-time temperature indicator for infant	✓
Limited temperature control by user, or high/low temperature signal for device	✓
Minimal maintenance/consumables	NO
Ease of use by trained health workers in urgent care settings	✓
Easy access to baby (to change diaper, etc.)	✓
Baby visible for monitoring	✓
Low-literate and written instructions imprinted on device	NO
Compatible with alternate power source, if uses electricity	✓
Durable for routine daily use	✓
Able to be reused	✓
Easy to clean	✓
Appearance of high-tech design to appeal to health professionals	✓
Safety: able to hold infant securely with no risk of dropping/falling	✓
Safety: manufactured of nontoxic materials	✓
Safety: no chance of suffocation or strangulation	✓
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	✓

BABYTHERM

Basic information	Manufacturer	Dräger (Germany) / Draeger (USA)
	Link	http://www.draeger.com
	Manufacturer description	Supporting premature and full-term neonates with a unique thermal environment, while giving you ease of access so you can provide the best possible care.
	Characteristics applicable to low-resource settings	Requires power source. Design not focused on developing countries.
	Use type	Facility
	Features	Newest models offer: Heated gel mattress which reduces heat output of overhead radiant heater which in turn reduces insensible water loss, sensor for measuring skin temperature, SmartSWIVEL technology focuses radiant heat on infant even if radiant heater is moved to one side during procedures, x-ray tray, even heat distribution via ceramic heater and golden reflectors, easily visible warning light plus alarms are emailed away from bed, bed tilt, integrated phototherapy and examination lamps. Device can also be used to cool infants by setting gel mattress temperature to a value lower than current core temperature.
	Pre/post-sales support	Yes
	Approximate price	Information unavailable. Likely US\$10,000—US\$20,000
Purpose of device	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	✓

Characteristics for facility use

Generates and maintains heat	✓
Real-time temperature indicator for infant	✓
Limited temperature control by user, or high/low temperature signal for device	✓
Minimal maintenance/consumables	NO
Ease of use by trained health workers in urgent care settings	NO
Easy access to baby (to change diaper, etc.)	✓
Baby visible for monitoring	✓
Low-literate and written instructions imprinted on device	NO
Compatible with alternate power source, if uses electricity	NO
Durable for routine daily use	✓
Able to be reused	✓
Easy to clean	✓
Appearance of high-tech design to appeal to health professionals	✓
Safety: able to hold infant securely with no risk of dropping/falling	✓
Safety: manufactured of nontoxic materials	✓
Safety: no chance of suffocation or strangulation	✓
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	✓

SECTION II:

EXOTHERMIC MATTRESSES

TRANSWARMER

MATTRESS

Basic information	Manufacturer	Cooper Surgical
	Link	http://www.coopersurgical.com
	Manufacturer description	A gel-filled, thermostable, disposable mattress that provides up to 2 hours of warming when cold stress is a concern...Based on a 24°C/75°F start temperature, the mattress reaches a peak temperature of 40°C/104°F in less than 60 seconds.
	Characteristics applicable to low-resource settings	Does not require power supply. Heats for 2 hours. Single-use only.
	Use type	Transport
	Features	Gel filled pad. Heats in 60 seconds, no power supply required. Check with physician before use with premature infants.
	Pre/post-sales support	No
	Approximate price	US\$35.00
Purpose of device	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	NO

Characteristics for facility use		Characteristics for transport use	
Generates and maintains heat	✓ (heat lasts 2 hrs)	Instant heat generation	✓
Real-time temperature indicator for infant	NO	High/low indicator for device temperature (threshold/range)	NO
Limited temperature control by user, or high/low temperature signal for device	NO	Maintains warmth for time that it takes to travel maximum possible distance to health facility	✓ (heat lasts 2 hrs)
Minimal maintenance/consumables	✓	Minimal or no maintenance	✓
Ease of use by trained health workers in urgent care settings	✓	Ease of use for unskilled or minimally skilled health workers and/or family members/caregivers	✓
Easy access to baby (to change diaper, etc.)	✓	Easy access to baby (to change diaper, feed, etc.)	✓
Baby visible for monitoring	✓	Keeps moisture away from baby's body	NO
Low-literate and written instructions imprinted on device	NO	Baby visible for monitoring	✓
Compatible with alternate power source, if uses electricity	Not applicable	Low-literate instructions imprinted on device	NO
Durable for routine daily use	✓	Not dependent on electricity; minimal energy requirements	✓
Able to be reused	NO	Durability in varying conditions (e.g., shock, temperature, humidity, elevation)	✓
Easy to clean	NO	Able to be reused	NO
Appearance of high-tech design to appeal to health professionals	NO	Easy to clean	NO
Safety: able to hold infant securely with no risk of dropping/falling	NO	Looks finished, well made	✓
Safety: manufactured of nontoxic materials	✓	Safety: able to hold infant securely with no risk of dropping/falling	NO
Safety: no chance of suffocation or strangulation	✓	Safety: manufactured of nontoxic materials	✓
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	Requires bed or other stable platform.	Safety: no chance of suffocation or strangulation	✓
		Portability: device can be carried by health worker/caregiver	Requires bed or other stable platform.

EMBRACE



Basic information	Manufacturer	Embrace Global
	Link	https://embraceglobal.org/
	Manufacturer description	The design looks like a miniature sleeping bag that incorporates a phase change material, which stays at a constant temperature for up to 6 hours. This low-cost solution maintains premature and low birth weight babies' body temperature to help them survive and thrive.
	Characteristics applicable to low-resource settings	Heating of pad requires AC power, generator or alternate AC power source. Once pad is heated it does not require power for a period of 4-6 hours.
	Use type	Facility, Transport
	Features	Low cost. Consists of AccuTemp heater (requires power supply), WarmPak, and BabyWrap. WarmPak is heated in AccuTemp Heater and the pak is then inserted into BabyWrap. The combination of the pak and the wrap keep infant at constant temperature for up to 6 hours. Long-term (6-months) training programs available.
	Pre/post-sales support	Yes
Approximate price	US\$200 <small>(not available for purchase. Embrace donates the device only to partner NGOs working directly with health facilities in low resource settings)</small>	
Purpose of device	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	NO

Characteristics for facility use		Characteristics for transport use	
Generates and maintains heat	✓	Instant heat generation	NO
Real-time temperature indicator for infant	✓	High/low indicator for device temperature (threshold/range)	✓
Limited temperature control by user, or high/low temperature signal for device	NO	Maintains warmth for time that it takes to travel maximum possible distance to health facility	✓ (4-6hrs)
Minimal maintenance/consumables	✓	Minimal or no maintenance	✓
Ease of use by trained health workers in urgent care settings	✓	Ease of use for unskilled or minimally skilled health workers and/or family members/caregivers	✓
Easy access to baby (to change diaper, etc.)	NO	Easy access to baby (to change diaper, feed, etc.)	NO
Baby visible for monitoring	NO	Keeps moisture away from baby's body	✓
Low-literate and written instructions imprinted on device	NO	Baby visible for monitoring	NO
Compatible with alternate power source, if uses electricity	✓	Low-literate instructions imprinted on device	NO
Durable for routine daily use	✓	Not dependent on electricity; minimal energy requirements	✓
Able to be reused	✓	Durability in varying conditions (e.g., shock, temperature, humidity, elevation)	✓
Easy to clean	✓	Able to be reused	✓
Appearance of high-tech design to appeal to health professionals	NO	Easy to clean	✓
Safety: able to hold infant securely with no risk of dropping/falling	✓	Looks finished, well made	✓
Safety: manufactured of nontoxic materials	✓	Safety: able to hold infant securely with no risk of dropping/falling	✓
Safety: no chance of suffocation or strangulation	✓	Safety: manufactured of nontoxic materials	✓
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	✓	Safety: no chance of suffocation or strangulation	✓
		Portability: device can be carried by health worker/caregiver	✓

BABYWARMER



Basic information	Manufacturer	Kanmed
	Link	http://www.kanmed.se
	Manufacturer description	A warm water mattress that warms newborn or premature babies. It is based on the philosophy of Kangaroo Mother Care. A very soft designed Water Mattress that is 37°C/98.6°F substitutes the mother's skin.
	Characteristics applicable to low-resource settings	Requires power supply. Water mattress can provide warmth for 2 hours in case of power interruption.
	Use type	Facility, Transport
	Features	Consists of control unit, low voltage heating pad, baby nest, a water mattress, and anti-algae additive. Optional gel or foam mattresses for larger infants (water mattress for babies as small as 800g, gel mattress for babies 1500g or more, and foam mattress for term babies that just need comfort heating). Maintains constant temp of 37°C/98.6°F, can keep baby warm for 2 hours in case of power interruption and can also be connected to battery for transport. Manual states that Babywarmer can be used in place of an incubator when baby is mainly in need of warming.
	Pre/post-sales support	Yes
Purpose of device	Approximate price	US\$3,000
	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	✓

Characteristics for facility use		Characteristics for transport use	
Generates and maintains heat	✓	Instant heat generation	✓
Real-time temperature indicator for infant	✓	High/low indicator for device temperature (threshold/range)	✓
Limited temperature control by user, or high/low temperature signal for device	✓	Maintains warmth for time that it takes to travel maximum possible distance to health facility	✓ (2hrs)
Minimal maintenance/consumables	✓	Minimal or no maintenance	✓
Ease of use by trained health workers in urgent care settings	✓	Ease of use for unskilled or minimally skilled health workers and/or family members/caregivers	✓
Easy access to baby (to change diaper, etc.)	✓	Easy access to baby (to change diaper, feed, etc.)	✓
Baby visible for monitoring	NO	Keeps moisture away from baby's body	✓
Low-literate and written instructions imprinted on device	NO	Baby visible for monitoring	NO
Compatible with alternate power source, if uses electricity	✓	Low-literate instructions imprinted on device	NO
Durable for routine daily use	✓	Not dependent on electricity; minimal energy requirements	✓
Able to be reused	✓	Durability in varying conditions (e.g., shock, temperature, humidity, elevation)	✓
Easy to clean	✓	Able to be reused	✓
Appearance of high-tech design to appeal to health professionals	✓	Easy to clean	✓
Safety: able to hold infant securely with no risk of dropping/falling	✓	Looks finished, well made	✓
Safety: manufactured of nontoxic materials	✓	Safety: able to hold infant securely with no risk of dropping/falling	✓
Safety: no chance of suffocation or strangulation	✓	Safety: manufactured of nontoxic materials	✓
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	✓	Safety: no chance of suffocation or strangulation	✓
		Portability: device can be carried by health worker/caregiver	✓

SECTION III:

OCCLUSIVE WRAPS

POLYETHYLENE BAGS AND WRAP

Basic information	Manufacturer	Multiple manufacturers
	Link	Multiple manufacturers. Examples include: Fisher & Paykel Healthcare, https://www.fphcare.com/ ; NeoMed, http://www.neomedinc.com/ .
	Manufacturer description	Not available
	Characteristics applicable to low-resource settings	Low cost, waterproof. Does not generate heat. Short-term solution. May not be re-useable and may require more than one bag/wrap per infant due to soiling. Extra care must be taken to ensure safety of infant.
	Use type	Facility, Transport, Community
	Features	Protects infant from radiant, evaporative, and convective heat loss. Evidence shows that polyethylene bags/wraps decrease hypothermia better in pre-term infants than in term infants.
	Pre/post-sales support	None
	Approximate price	US \$0.03 and up
Purpose of device	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	NO

Characteristics for facility use		Characteristics for transport use	
Generates and maintains heat	NO	Instant heat generation	NO
Real-time temperature indicator for infant	NO	High/low indicator for device temperature (threshold/range)	NO
Limited temperature control by user, or high/low temperature signal for device	NO	Maintains warmth for time that it takes to travel maximum possible distance to health facility	NO
Minimal maintenance/consumables	✓	Minimal or no maintenance	✓
Ease of use by trained health workers in urgent care settings	✓	Ease of use for unskilled or minimally skilled health workers and/or family members/caregivers	✓
Easy access to baby (to change diaper, etc.)	NO	Easy access to baby (to change diaper, feed, etc.)	NO
Baby visible for monitoring	NO	Keeps moisture away from baby's body	NO
Low-literate and written instructions imprinted on device	NO	Baby visible for monitoring	NO
Compatible with alternate power source, if uses electricity	Not applicable	Low-literate instructions imprinted on device	NO
Durable for routine daily use	NO	Not dependent on electricity; minimal energy requirements	✓
Able to be reused	NO	Durability in varying conditions (e.g., shock, temperature, humidity, elevation)	✓
Easy to clean	NO	Able to be reused	NO
Appearance of high-tech design to appeal to health professionals	NO	Easy to clean	NO
Safety: able to hold infant securely with no risk of dropping/falling	NO	Looks finished, well made	NO
Safety: manufactured of nontoxic materials	✓	Safety: able to hold infant securely with no risk of dropping/falling	NO
Safety: no chance of suffocation or strangulation	NO	Safety: manufactured of nontoxic materials	✓
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	✓	Safety: no chance of suffocation or strangulation	NO
		Portability: device can be carried by health worker/caregiver	✓

MYLAR BLANKETS AND WRAPS



Basic information	Manufacturer	Multiple manufacturers
	Link	Examples include: Maternova, http://maternova.net/ ; Primacare, http://primacaremedical.com/ .
	Manufacturer description	Not available
	Characteristics applicable to low-resource settings	Low cost, waterproof, windproof, lightweight. Does not generate heat. Short-term solution. May not be re-useable and may require more than one wrap per infant due to soiling.
	Use type	Facility, Transport, Community
	Features	Airtight foil reduces convection, heat loss due to evaporation of perspiration/ moisture/ blood loss is minimized, limited extent of reflective surface inhibits losses due to thermal radiation.
	Pre/post-sales support	None
	Approximate price	US\$0.75 and up
Purpose of device	Insulation (prevention of hypothermia)	✓
	Warming (mild hypothermia)	✓
	Thermoregulation (for sick infants that need to be treated for hypothermia)	NO

Characteristics for facility use		Characteristics for transport use	
Generates and maintains heat	NO	Instant heat generation	NO
Real-time temperature indicator for infant	NO	High/low indicator for device temperature (threshold/range)	NO
Limited temperature control by user, or high/low temperature signal for device	NO	Maintains warmth for time that it takes to travel maximum possible distance to health facility	NO
Minimal maintenance/consumables	✓	Minimal or no maintenance	✓
Ease of use by trained health workers in urgent care settings	✓	Ease of use for unskilled or minimally skilled health workers and/or family members/caregivers	✓
Easy access to baby (to change diaper, etc.)	NO	Easy access to baby (to change diaper, feed, etc.)	NO
Baby visible for monitoring	NO	Keeps moisture away from baby's body	✓
Low-literate and written instructions imprinted on device	NO	Baby visible for monitoring	NO
Compatible with alternate power source, if uses electricity	NO	Low-literate instructions imprinted on device	NO
Durable for routine daily use	NO	Not dependent on electricity; minimal energy requirements	✓
Able to be reused	✓	Durability in varying conditions (e.g., shock, temperature, humidity, elevation)	✓
Easy to clean	NO	Able to be reused	✓
Appearance of high-tech design to appeal to health professionals	NO	Easy to clean	NO
Safety: able to hold infant securely with no risk of dropping/falling	✓	Looks finished, well made	NO
Safety: manufactured of nontoxic materials	✓	Safety: able to hold infant securely with no risk of dropping/falling	✓
Safety: no chance of suffocation or strangulation	NO	Safety: manufactured of nontoxic materials	NO
Able to transport infant in case of surgery or when infant needs to be moved to another location or within the facility	✓	Safety: no chance of suffocation or strangulation	NO
		Portability: device can be carried by health worker/caregiver	✓

This guide to selection is part of a six-piece series of Survive and Thrive guides, including birthing and cesarean section simulators, continuous positive airway pressure (CPAP), fetal monitors, portable ultrasound, rechargeable lighting, and thermoregulation devices. You can search for any of these guides in the PATH Publications Catalogue at <http://www.path.org/publications/index.php>.

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