Young Infant Hypothermia Clinical Pathway

June 2025

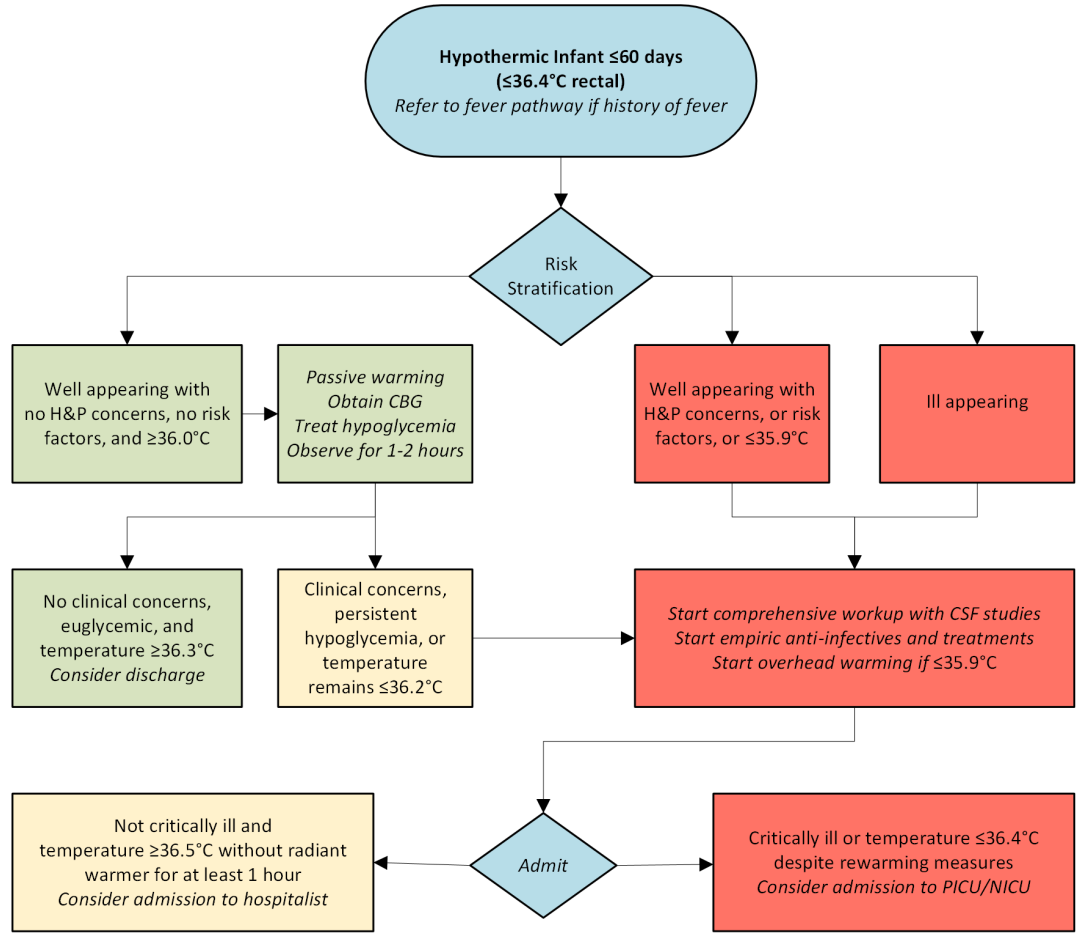
Outcomes/Goals	1. Identification, management, and disposition of infants ≤60 days with temperatures ≤36.4°C 2. Infants ≤35.9°C will be placed on a radiant warmer within 15 minutes of temperature acquisition 3. Antibiotics will be administered within 60 minutes for acutely ill or toxic-appearing infants
Inclusion Criteria	Infants aged 0–60 days with rectal temps ≤36.4°C measured at home, another healthcare facility, or in ED
Exclusion Criteria	History of fever (≥38.0°C)
NURSE Documentation	❑ Chief complaint; Pre-arrival temperature(s) and route of measurement; associated symptoms, birth and medical history; wet diapers; medications and allergies; vital signs including naked weight
INTERVENTIONS Initiate on arrival	❑ ESI Triage level II ❑ Full set of vitals including rectal temperature and naked weight ❑ If temperature ≥36.0°C, passively warm with hat and single/double swaddle or skin-to-skin with blanket ❑ If temperature ≤35.9°C, place on radiant warmer within 15 minutes ❑ Capillary blood glucose (CBG) ❑ Initiate PIV, prepare LP setup at bedside with topical anesthetic if ill-appearing or temperature ≤35.9°C ❑ Continuous pulse oximetry; provide oxygen to maintain SpO2 > 93%
DIAGNOSTICS	❑ CMP, CBG; point-of-care electrolytes if ill appearing or T < 36.0 ❑ CBC with differential, procalcitonin, coagulopathy panel, POC lactate w/VBG ❑ Blood culture ❑ CSF: Gram stain, cell count, protein, glucose, culture, HSV panel, enterovirus PCR ❑ Urine: Catheter specimen—Pedi UTI Panel (urinalysis, microscopy, and mandatory culture) ❑ Other diagnostics to consider: TSH, free T4, ammonia, RPP ❑ Chest X-ray and EKG if indicated (tachypnea, hypoxia, cough, cyanosis) ❑ Neuroimaging for suspected trauma, vitamin K deficiency, or other intracranial abnormality ❑ If suspected HSV infection, obtain surface swabs for HSV culture, blood for HSV PCR, CSF for HSV PCR
PHYSICIAN/LIP	
Evaluation	**History and physical findings of concern (REAL BIGS):** **R**espiratory distress: Grunting, flaring nostrils, retractions, tachypnea, cyanosis **E**nergy deficiency: Excessive sleepiness or persistent irritability **A**bnormal tone: Hypotonia, hypertonia, jitteriness, abnormal movements, deficits **L**iver issues: Jaundice within the first 24 hours or persistent beyond two weeks **B**ad feeding: Difficulty feeding, weak sucking, reduced intake **I**rregular vitals: Tachypnea, hypotension, tachycardia, bradycardia, temperature **G**astrointestinal problems: Swollen or tender abdomen, vomiting, bloody stool **S**kin changes: Slow cap refill, abnormal mottling, pallor, cold extremities, petechiae, purpura **Selected risk factors:** Prematurity, maternal infections (<28 days GA), repeated temperature instability, comorbidities, WBC abnormalities, thrombocytopenia
Management	❑ Fluids: Normal saline bolus 10-20 mL/kg PRN ❑ Hypoglycemia: D10W bolus of 5 mL/kg for CBG < 50 ❑ Analgesia: Acetaminophen 12.5 mg/kg PO or 15 mg/kg PR ❑ Anti-infectives **0–21 days**: o If no concern for meningitis or HSV: IV ampicillin (50 mg/kg) plus IV gentamicin (5 mg/kg) o If concern for meningitis or HSV: IV acyclovir (20 mg/kg) and IV ampicillin (75 mg/kg), plus either IV ceftazidime (50 mg/kg) for infants 0–14 days old or with hyperbilirubinemia, or IV ceftriaxone (50 mg/kg) for infants older than 14 days without hyperbilirubinemia ❑ Anti-infectives **22–60 days**: o If concern for meningitis or HSV: IV ceftriaxone (50 mg/kg) o If concern for HSV or meningitis: IV acyclovir (20 mg/kg) and IV ampicillin (75 mg/kg), plus either IV ceftriaxone (50 mg/kg) for infants without hyperbilirubinemia, or IV ceftazidime (50 mg/kg) for infants with hyperbilirubinemia ❑ Other considerations: Hydrocortisone (CAH: 10–20d, hyperkalemia, hypoglycemia, ambiguous genitalia), prostaglandin E1 (ductal-dependent cardiac lesion)
ADMISSION	❑ Admit to PICU/NICU: Critically ill infants, infants actively requiring a radiant warmer, and infants who are unable to maintain a temperature ≥36.5°C for at least one hour ❑ Admit to pediatric hospitalist: Stable infants with findings of concern or risk factors who maintain a temperature ≥36.5°C for at least one hour ❑ Consider discharge: Asymptomatic, low-risk infants who can maintain or achieve a temperature of ≥36.3°C after 1-2 hours of passive warming. Call primary care physician.

Young Infant Hypothermia Clinical Pathway

May 2025

Exclusions
Fever or history or fever
Primary Risk Factors
Prematurity
Maternal infections (<28 days GA)
Repeated temperature instability
Comorbidities
Secondary Risk Factors
WBC abnormalities
Thrombocytopenia

Hypothermia Differential
Sepsis
Meningitis
UTI
Pneumonia
HSV
Congenital TORCH Infection
Exposure
Erroneous temperature
Toxin exposure
Inborn errors of metabolism
Hypoglycemia
Endocrine dysfunction
Intracranial pathology
Non-accidental trauma
Congenital heart disease
Prematurity
Malnutrition
Acute intra-abdominal pathology
BRUE
Hyperbilirubinemia



Workup Options
Fluid resuscitation: 10 mL/kg PRN
Labs: CBC, CMP, coags, VBG/lactate, blood culture, HSV PCR/swabs, RPP, UA, urine micro/culture, ammonia, CSF (incl. HSV PCR), TSH and/or free T4
Imaging: Neuroimaging for NAT or intracranial pathology
Empirics: IV acyclovir, ampicillin, ceftazidime (0-14d, hyperbilirubinemia) OR ceftriaxone (>14d, no hyperbilirubinemia)
Consider: Hydrocortisone (CAH: 10-20d, hyperkalemia, hypoglycemia, ambiguous genitalia), Prostaglandin E1 (ductal-dependent cardiac lesion)

Infant H&P Findings of Concern
"REAL BIGS"
Respiratory distress: Grunting, flaring nostrils, retractions, tachypnea, cyanosis
Energy deficiency: Excessive sleepiness or persistent irritability
Abnormal tone: Hypotonia, hypertonia, jitteriness, abnormal movements, deficits
Liver issues: Jaundice within the first 24 hours or persistent beyond two weeks
Bad feeding: Difficulty feeding, weak sucking, reduced intake
Irregular vitals: Tachypnea, hypotension, tachycardia, bradycardia, temperature
Gastrointestinal problems: Swollen or tender abdomen, vomiting, bloody stool
Skin changes: Slow cap refill, mottling, pallor, cold extremities, petechiae, purpura

Note: These guidelines are based on a DCH ED review of internal and external data. The pathway provides a reasonable approach to the management of hypothermic infants but is not intended to replace clinical judgement.

Disease Process Rationale and Data

Goals of Clinical Pathway

1. Identification, management, and disposition of infants ≤60 days with temperatures ≤36.4°C
2. Infants with temperatures ≤35.9°C will be placed on a radiant warmer within 15 minutes of temperature acquisition
3. Antibiotics will be administered within 60 minutes for acutely ill or toxic-appearing infants

Definition of Disease Process

Hypothermia in young infants (0–60 days old) is a potentially serious condition in which a core body temperature below 36.5°C can reflect an underlying infectious, metabolic, neurologic, gastrointestinal, or environmental problem. Newborns and young neonates (0-7 days) are especially prone to environmental hypothermia because of their relatively large surface area-to-body mass ratio, lower subcutaneous fat, and immature thermoregulatory mechanisms. However, hypothermia may be the only or earliest sign of severe infection, because young infants may not mount a typical febrile response. Environmental exposures can contribute, but clinicians must strongly consider pathologic causes in infants with risk factors or those who are even minimally symptomatic. Prompt warming measures and a thorough workup that includes CSF studies is indicated for all young infants with a temperature below 36.0°C, as mortality and risk of serious bacterial infections (meningitis, bacteremia, urinary tract infection, pneumonia) begin to increase significantly below this temperature threshold.

Associated Complications

Complication	Discussion
Hypoglycemia	Lower core temperatures exacerbate the neonate's already limited glycogen stores, leading to hypoglycemia, which can precipitate seizures and permanent neurologic injury if unaddressed
Metabolic acidosis	Excessive energy expenditure to produce heat can cause lactic acid buildup, resulting in an anion-gap metabolic acidosis that complicates overall clinical stability
Coagulopathy	Core temperature changes can impair clotting factor function, resulting in bleeding or worsening of underlying coagulopathy
Respiratory effects	Hypothermic infants will generate heat through increased metabolic activity, which in turn leads to a higher demand for oxygen. If this increased demand isn't met by adequate ventilation and oxygen delivery, hypoxemia can result. Efforts to compensate for hypoxemia and metabolic acidosis can lead to increased respiratory effort. Hypothermia can also depress the central nervous system, leading to hypoventilation, irregular breathing patterns, and periodic apnea
Cardiovascular effects	Early in cold stress, tachycardia may appear as a compensatory mechanism, but prolonged or worsening hypothermia often leads to bradycardia, reduced cardiac output, and hypotension. Peripheral vasoconstriction, while aimed at conserving heat, further impairs circulation and tissue oxygenation

Selected Etiologies of Young Infant Hypothermia

Diagnosis	Features	Work-up/Management
Immature thermoregulation	History of prematurity or low birth weight increases risk, often occurs in 0–7 day age group. Should be able to warm and maintain temperature with passive measures	Check CBG, take thorough history and physical exam, warm the infant using appropriate methods (skin-to-skin, radiant warmer), and monitor temperature closely for at least 1 hour. Consider underlying causes if hypothermia persists
Meningitis	Irritability or lethargy, poor feeding, vomiting, altered mental status, seizures, bulging fontanelle (not always present). Nuchal rigidity not common. CSF pleocytosis	Lumbar puncture for CSF analysis (cell count, protein, glucose, Gram stain, culture). Blood culture. Start broad-spectrum antibiotics immediately after lumbar puncture. Supportive care including seizure control if needed
HSV	Maternal or familial exposure, vesicles or lesions, lethargy, poor feeding, jaundice, seizures, thrombocytopenia	Viral cultures of skin, eyes, mouth, and rectum. CSF PCR for HSV. Blood PCR for HSV. Liver function tests. Start intravenous acyclovir immediately. Supportive care
UTI	Poor feeding, fussiness, low energy, vomiting. History of UTI or renal or urologic abnormalities may increase risk. Urinary changes are difficult to assess at this age	Urinalysis and culture obtained via catheterization or suprapubic aspiration. If UTI present, obtain labs and blood culture. Consider CSF studies.
Cardiac lesion	Poor feeding, lethargy, cyanosis, tachypnea, abnormal heart tones, diaphoresis, edema	Perform cardiac exam. Check pre- and post-ductal oxygen saturation, EKG, chest X-ray, four-point blood pressures. Consult with pediatric cardiology for echocardiogram
Neuropathology	Lethargy, poor feeding, vomiting, macrocephaly, bulging fontanelle, seizures, hypotonia or hypertonia. May be associated with congenital anomalies, birth trauma, accidental or non-accidental trauma	Detailed neurological exam. Head circumference measurement. Neuroimaging (e.g., ultrasound, CT, MRI). Consult with pediatric neurology or neurosurgery as indicated
Inborn error of metabolism	Poor feeding, vomiting, lethargy, seizures, hypotonia, jaundice, unusual odors, respiratory distress. Onset may vary from the first few days to a few weeks of life. May have a family history of metabolic disorders	Newborn screening results. Specific metabolic labs (e.g., ammonia, lactate, electrolytes, blood gases, urine organic acids). Consult with a metabolic specialist. Management depends on the specific disorder. Monitor glucose, electrolytes, blood gases
Endocrine disorder	Poor feeding, lethargy, jaundice, vomiting, poor weight gain, hypotension, hypoglycemia, hyperkalemia, hyponatremia, ambiguous genitalia in females, virilization	Point-of-care electrolytes, thyroid function tests. Give hydrocortisone immediately if there is concern for CAH or adrenal crisis and consult with pediatric endocrinology. Monitor glucose, electrolytes, and fluid status

References:

Delaney, K. M., Bober, J. G., Koos, J. A., & Hom, J. (2023). The prevalence for the risk of serious infection in hypothermic infants≤ 60 days: a systematic review. *Academic Emergency Medicine*, *30*(1), 40-44.

Drewry, A. M., Fuller, B. M., Skrupky, L. P., & Hotchkiss, R. S. (2015). The presence of hypothermia within 24 hours of sepsis diagnosis predicts persistent lymphopenia. *Critical care medicine*, *43*(6), 1165-1169.

Emergency Nurses Association. (2015). *Clinical practice guideline: Non-invasive temperature measurement.* Emergency Nurses Association. Retrieved from http://www.ena.org

Kasmire, K. E., Vega, C., Bennett, N. J., & Laurich, V. M. (2021). Hypothermia: a sign of sepsis in young infants in the emergency department?. *Pediatric Emergency Care*, *37*(3), e124-e128.

Lo, Y. H. J., Graves, C., Holland, J. L., Rogers, A. J., Money, N., Hashikawa, A. N., & Ramgopal, S. (2023). Temperature threshold in the screening of bacterial infections in young infants with hypothermia. *Emergency Medicine Journal*, *40*(3), 189-194.

Lo, Y. H. J., Ramgopal, S., Hashikawa, A. N., Cranford, J. A., & Rogers, A. J. (2022). Variability in emergency department management of hypothermic infants≤ 90 days of age. *The American Journal of Emergency Medicine*, *60*, 121-127.

Money, N. M., Lo, Y. H. J., King, H., Graves, C., Holland, J. L., Rogers, A., ... & Ramgopal, S. (2024). Predicting serious bacterial infections among hypothermic infants in the emergency department. *Hospital Pediatrics*, *14*(3), 153-162.

Mullany, L. C., Katz, J., Khatry, S. K., LeClerq, S. C., Darmstadt, G. L., & Tielsch, J. M. (2010). Risk of mortality associated with neonatal hypothermia in southern Nepal. *Archives of pediatrics & adolescent medicine*, *164*(7), 650-656.

Mullany, L. C., Katz, J., Khatry, S. K., LeClerq, S. C., Darmstadt, G. L., & Tielsch, J. M. (2010). Neonatal hypothermia and associated risk factors among newborns of southern Nepal. *BMC medicine*, *8*, 1-13.

Perry, M. C., Yaeger, S. K., Noorbakhsh, K., Cruz, A. T., & Hickey, R. W. (2021). Hypothermia in young infants: frequency and yield of sepsis workup. *Pediatric emergency care*, *37*(8), e449-e455.

Raffaele, J. L., Sharma, M., Berger, S., Mitchell, M., Lee, C., Morrison, J., ... & Williams, S. (2023). Prevalence of invasive bacterial infection in hypothermic young infants: a multisite study. *The Journal of Pediatrics*, *258*, 113407.

Ramgopal, S., Graves, C., Aronson, P. L., Cruz, A. T., Rogers, A., & RIsk Stratification for Hypothermic Infants (RISHI) study group. (2023). Clinician management practices for infants with hypothermia in the emergency department. *Pediatrics*, *152*(6), e2023063000.

Ramgopal, S., Noorbakhsh, K. A., Pruitt, C. M., Aronson, P. L., Alpern, E. R., & Hickey, R. W. (2020). Outcomes of young infants with hypothermia evaluated in the emergency department. *The Journal of Pediatrics*, *221*, 132-137.

Ramgopal, S., Walker, L. W., Vitale, M. A., & Nowalk, A. J. (2019). Factors associated with serious bacterial infections in infants≤ 60 days with hypothermia in the emergency department. *The American Journal of Emergency Medicine*, *37*(6), 1139-1143.

Romanovsky, A. A., & Székely, M. (1998). Fever and hypothermia: two adaptive thermoregulatory responses to systemic inflammation. *Medical hypotheses*, *50*(3), 219-226.

Wood, J. K., Halvorson, E. E., Auriemma, J. R., Ervin, S. E., Thurtle, D. P., Keskinyan, V. S., ... & Haberman, C. (2018). Clinical characteristics and health outcomes of neonates reporting to the emergency department with hypothermia. *Hospital Pediatrics*, *8*(8), 458-464.

World Health Organization. (1997). *Thermal protection of the newborn: a practical guide* (No. WHO/RHT/MSM/97.2). World Health Organization.

Yankova, L. C., & Aronson, P. L. (2024). Infants With Hypothermia: Are They Just Like Febrile Infants?. *Hospital Pediatrics*, *14*(3), e161-e163.

Revision History Table

Document Number Rev. mmddyy	Final Approval by	Brief description of change/revision