

## Office of Evidence Based Practice – Specific Care Question: In the pediatric patient receiving intravenous (IV) therapy which IV infiltrate scoring instrument has been validated to identify IV infiltrates?

**Specific Care Question :**

In the pediatric patient receiving intravenous (IV) therapy which IV infiltrate scoring instrument has been validated to identify IV infiltrates?

**Question Originator:**

Lacey Bergerhofer, RN, BSN, Clinical Informatics & Practice Manager, Nursing Practice Council Co-chair

**Plain Language Summary from The Office of Evidence Based Practice: Summary:**

Of the two studies included in this review the Simona (2012) measured reliability and validity of the *Pediatric Peripheral Intravenous Infiltration Scale*. Groll, Davies, Mac Donald, Nelson, and Virani (2010) measured the reliability and validity of the *Phlebitis and Infiltrations Scales*. There is a paucity in validation literature related to identifying peripheral intravenous infiltrates. Based on moderate quality evidence neither scale has a satisfactory Cohen  $\kappa$  (statistical test that measures interrater reliability) and should not be used to determine PIV infiltrates. Further research is likely to have an important influence on the confidence of these scales.

**EBP Scholar’s responsible for analyzing the literature:**

Jacqueline A. Bartlett, PhD, RN, Evidence Based Practice Director  
 Jamie Menown, RN, CPN

**EBP team member responsible for reviewing, synthesizing, and developing this literature:**

Jacqueline A. Bartlett, PhD, RN, Evidence Based Practice Director

**Search Strategy and Results:**

The search strategy was not retained by the Health Sciences Librarian staff. Seven articles from the search were retained for review. An ancestry search was then performed. In total 34 articles were reviewed with two of these references (Groll et al., 2010; Simona, 2012) providing pertinent information for this review.

**Studies included in this review:**

Groll et al. (2010) and Simona (2012)

**Studies not included in this review with rationale for exclusion:**

Author	Rationale for exclusion
Amjad, Murphy, Nylander-Housholder, and Ranft (2011)	Narrative review: Revised IV infiltration grading scale without inter-rater reliability
Beaulieu (2012)	Narrative review: Extravasation management
Bellin et al. (2002)	Narrative review: IV contrast
Chanes, da Luz Goncalves Pedreira, and de Gutierrez (2012)	Descriptive study: Validity of two algorithms (vesicant drugs administration and extravasation)
Clifton-Koeppel (2006)	Descriptive study: Wound care for intravenous extravasation
Clark et al. (2013)	Review: Risk stratification of potential extravasation medications
de Lima Jacinto, Avelar, and Pedreira (2011)	Descriptive study: Identified variables for IV infiltrates in children
de Wit et al. (2013)	Narrative review: Managing intravenous extravasation
Flemmer and Chan (1993)	Narrative review: Managing intravenous extravasation
Gopalakrishnan, Goel, and Banerjee (2012)	Systematic review: Managing skin extravasation injuries in neonates
Hooke (2005)	Narrative review: Assessment of anthracycline extravasation

**Office of Evidence Based Practice – Specific Care Question: In the pediatric patient receiving intravenous (IV) therapy which IV infiltrate scoring instrument has been validated to identify IV infiltrates?**

Irving (2001)	Narrative review: Managing intravenous extravasation
McCullen and Pieper (2006)	Descriptive study: Identified variables associated with extravasations in neonates
Millam (1988)	Narrative review: Intravenous extravasation and management
Montgomery and Budreau (1996)	Narrative review: Developing a CPG
Montgomery et al. (1999)	Guideline implementation: Did not measure inter-rater reliability
Perez Fidalgo et al. (2012)	Narrative review: Intravenous extravasation
Pettit and Hughes (1993)	Narrative review: Intravenous extravasation
Phelps, Tolley, and Bobo (1993)	Cohort study: Analyzed differences in positive rate pulse and patients with/without clinical infiltration
Phillips (2011)	Narrative review: Wound care for intravenous extravasation
Ramasetu (2004)	Narrative review: Used Montgomery et al. (1999) scale
Sawatzky-Dickson and Bodnaryk (2006)	Extravasation protocol
Sauerland, Engelking, Wickham, and Corbi (2006)	Narrative review: Vesicant extravasation
Schie and Goodman (2013)	Narrative review: Managing skin extravasation injuries in neonates
Thigpen (2007)	Narrative review: Intravenous extravasation
Timmons (2011)	Narrative review: Wound care for intravenous extravasation
Tofani et al. (2012)	Quality study: Used modified intravenous assessment, did not report testing the tool
Tong (2007)	Narrative review: Themes identified to prevent extravasation injury in neonates
Warren (2011)	Pre- / Post- cohort study: Used Montgomery et al. (1999) scale
Wickham, Engelking, Sauerland, and Corbi (2006)	Narrative review: Antineoplastic and nonantineoplastic vesicant agent management
Wynsma (1998)	Narrative review: Negative intravascular therapy in infants
Yucha, Russ, and Baker (1997)	Diagnostic study: Sensitivity/Specificity of a medical device (Venoscope <sup>®</sup> )

**Method Used for Appraisal and Synthesis:**

Psychometrics literature

**Updated 12/30/13**

## **Office of Evidence Based Practice – Specific Care Question: In the pediatric patient receiving intravenous (IV) therapy which IV infiltrate scoring instrument has been validated to identify IV infiltrates?**

### **Characteristics of included study :**

**Simona (2012):** This study modified the Infusion Nurses Society Phlebitis and Infiltration scale to develop a pediatric tool.

#### **Strengths:**

- Modified an existing scale
- Content validity occurred using a group of IV experts and staff nurses
- Literature review guided the modification
- Three nurses (infusion specialist, charge nurse and staff) blindly assessed the infiltration area

#### **Weaknesses:**

- Only one of the measuring groups (infusion specialists) measured the edematous area

#### **Results:**

- Cohen  $\kappa^*$  (the statistic noting intrarater reliability) was reported:
  - for staff nurses was 0.58 ( $P < .001$ )
  - for charge nurses, 0.49 ( $P < .001$ )
  - for the infusion specialist nurses, 0.80
- Cohen  $\kappa$  between IV team nurses and staff nurses and between IV team nurses and charge nurses were 0.62 ( $P < .001$ ) and 0.60 ( $P < .001$ ), respectively.
- Cohen  $\kappa$  between staff and charge nurses, was 0.78 ( $P < .001$ ).

\* Cohen  $\kappa$  has a range from 0.1.00, with larger values indicating better reliability. Generally, a Cohen  $\kappa > .70$  is considered satisfactory.

**Groll et al. (2010):** This study established the psychometric properties of Infusion Nurses Society Phlebitis and Infiltration scale.

#### **Strengths:**

- Concurrent validity occurred between the scale and the patient chart

#### **Weaknesses:**

- Research nurses scored the scales

#### **Results:**

- Cohen  $\kappa^*$ 
  - For Phlebitis scale was 0.45,  $P < .001$
  - For Infiltration scale was .39,  $P < .001$

## Office of Evidence Based Practice – Specific Care Question: In the pediatric patient receiving intravenous (IV) therapy which IV infiltrate scoring instrument has been validated to identify IV infiltrates?

### References:

- Amjad, I., Murphy, T., Nylander-Housholder, L., & Ranft, A. (2011). A new approach to management of intravenous infiltration in pediatric patients: pathophysiology, classification, and treatment. *J Infus Nurs*, 34(4), 242-249. doi: 10.1097/NAN.0b013e31821da1b3
- Beaulieu, M. J. (2012). Hyaluronidase for extravasation management. *Neonatal Netw*, 31(6), 413-418. doi: 10.1891/0730-0832.31.6.413
- Bellin, M. F., Jakobsen, J. A., Tomassin, I., Thomsen, H. S., Morcos, S. K., Thomsen, H. S., . . . Webb, J. A. (2002). Contrast medium extravasation injury: guidelines for prevention and management. *Eur Radiol*, 12(11), 2807-2812. doi: 10.1007/s00330-002-1630-9
- Chanes, D. C., da Luz Goncalves Pedreira, M., & de Gutierrez, M. G. (2012). Antineoplastic agents extravasation from peripheral intravenous line in children: a simple strategy for a safer nursing care. *Eur J Oncol Nurs*, 16(1), 17-25. doi: 10.1016/j.ejon.2011.01.005
- Clark, Eloise, Giambra, Barbara K., Hingl, John, Doellman, Darcy, Tofani, Barbara, & Johnson, Neil. (2013). Reducing Risk of Harm From Extravasation: A 3-Tiered Evidence-Based List of Pediatric Peripheral Intravenous Infusates. *Journal of Infusion Nursing*, 36(1), 37-45. doi: 10.1097/NAN.1090b1013e3182798844.
- Clifton-Koeppel, Robin. (2006). Wound Care After Peripheral Intravenous Extravasation: What Is the Evidence? *Newborn and Infant Nursing Reviews*, 6(4), 202-211. doi: <http://dx.doi.org/10.1053/j.nainr.2006.10.001>
- de Lima Jacinto, A. K., Avelar, A. F., & Pedreira, M. L. (2011). Predisposing factors for infiltration in children submitted to peripheral venous catheterization. *J Infus Nurs*, 34(6), 391-398. doi: 10.1097/NAN.0b013e3182306491
- de Wit, M., Ortner, P., Lipp, H. P., Sehouli, J., Untch, M., Ruhnke, M., . . . Jordan, K. (2013). Management of cytotoxic extravasation - ASORS expert opinion for diagnosis, prevention and treatment. *Onkologie*, 36(3), 127-135. doi: 10.1159/000348524
- Flemmer, L., & Chan, J. S. (1993). A pediatric protocol for management of extravasation injuries. *Pediatr Nurs*, 19(4), 355-358, 424.
- Gopalakrishnan, P. N., Goel, N., & Banerjee, S. (2012). Saline irrigation for the management of skin extravasation injury in neonates. *Cochrane Database Syst Rev*, 2, CD008404. doi: 10.1002/14651858.CD008404.pub2
- Groll, D., Davies, B., Mac Donald, J., Nelson, S., & Virani, T. (2010). Evaluation of the psychometric properties of the phlebitis and infiltration scales for the assessment of complications of peripheral vascular access devices. *J Infus Nurs*, 33(6), 385-390. doi: 10.1097/NAN.0b013e3181f85a73
- Hooke, M. C. (2005). Clinical nurse specialist and evidence-based practice: managing anthracycline extravasation. *J Pediatr Oncol Nurs*, 22(5), 261-264. doi: 10.1177/1043454205279289
- Irving, V. (2001). Managing extravasation injuries in preterm neonates. *Nurs Times*, 97(35), 40, 43-46.
- McCullen, K. L., & Pieper, B. (2006). A retrospective chart review of risk factors for extravasation among neonates receiving peripheral intravascular fluids. *J Wound Ostomy Continence Nurs*, 33(2), 133-139.
- Millam, D. A. (1988). Managing complications of i.v. therapy (continuing education credit). *Nursing*, 18(3), 34-43.
- Montgomery, L. A., & Budreau, G. K. (1996). Implementing a clinical practice guideline to improve pediatric intravenous infiltration outcomes. *AACN Clin Issues*, 7(3), 411-424.
- Montgomery, L. A., Hanrahan, K., Kottman, K., Otto, A., Barrett, T., & Hermiston, B. (1999). Guideline for i.v. infiltrations in pediatric patients. *Pediatr Nurs*, 25(2), 167-169, 173-180.
- Perez Fidalgo, J. A., Garcia Fabregat, L., Cervantes, A., Margulies, A., Vidall, C., & Roila, F. (2012). Management of chemotherapy extravasation: ESMO--EONS clinical practice guidelines. *Eur J Oncol Nurs*, 16(5), 528-534.
- Pettit, J., & Hughes, K. (1993). Intravenous extravasation: mechanisms, management, and prevention. *Journal of Perinatal & Neonatal Nursing*, 6(4), 69-79.
- Pheips, S. J., Tolley, E. A., & Bobo, D., Jr. (1993). Infusion technology for predicting and detecting infiltration of peripheral intravenous catheter sites in infants. *Clin Pharm*, 12(3), 216-221.
- Phillips, Amy. (2011). Peripheral Intravenous (PIV) Catheter Extravasation Wound Care Guidelines. *Journal of Pediatric Nursing*, 26(4), e21-e21. doi: 10.1016/j.pedn.2011.01.264
- Ramasetu, Jayashree. (2004). Pharmacology Review: Prevention and Management of Extravasation Injuries in Neonates. *NeoReviews*, 5(11), e491-e497. doi: 10.1542/neo.5-11-e491

**Office of Evidence Based Practice – Specific Care Question: In the pediatric patient receiving intravenous (IV) therapy which IV infiltrate scoring instrument has been validated to identify IV infiltrates?**

- Sauerland, C., Engelking, C., Wickham, R., & Corbi, D. (2006). Vesicant extravasation part I: Mechanisms, pathogenesis, and nursing care to reduce risk. *Oncol Nurs Forum*, 33(6), 1134-1141. doi: 10.1188/06.onf.1134-1141
- Sawatzky-Dickson, D., & Bodnaryk, K. (2006). Neonatal intravenous extravasation injuries: evaluation of a wound care protocol. *Neonatal Netw*, 25(1), 13-19. doi: 10.1891/0730-0832.25.1.13
- Schie, Jill C., & Goodman, Karen L. (2013). Treatment of Neonatal Extravasation Injuries Using Non-Contact, Low-Frequency Ultrasound: Development of a New Treatment Protocol. *Newborn and Infant Nursing Reviews*, 13(1), 42-47. doi: <http://dx.doi.org/10.1053/j.nainr.2012.12.007>
- Simona, R. (2012). A pediatric peripheral intravenous infiltration assessment tool. *J Infus Nurs*, 35(4), 243-248. doi: 10.1097/NAN.0b013e31825af323
- Thigpen, J. L. (2007). Peripheral intravenous extravasation: nursing procedure for initial treatment. *Neonatal Netw*, 26(6), 379-384. doi: 10.1891/0730-0832.26.6.379
- Timmons, Judy. (2011). Peripheral Intravenous Catheter Extravasation Wound Care Guidelines. *Journal of Pediatric Nursing*, 26(2), e7-e7. doi: 10.1016/j.pedn.2010.12.033
- Tofani, B. F., Rineair, S. A., Gosdin, C. H., Pilcher, P. M., McGee, S., Varadarajan, K. R., & Schoettker, P. J. (2012). Quality improvement project to reduce infiltration and extravasation events in a pediatric hospital. *J Pediatr Nurs*, 27(6), 682-689. doi: 10.1016/j.pedn.2012.01.005
- Tong, R. (2007). Preventing extravasation injuries in neonates. *Paediatr Nurs*, 19(8), 22-25. doi: 10.7748/paed2007.10.19.8.22.c4462
- Warren, D. (2011). Implementation of a protocol for the prevention and management of extravasation injuries in the neonatal intensive care patient. *Int J Evid Based Healthc*, 9(2), 165-171. doi: 10.1111/j.1744-1609.2011.00213.x
- Wickham, R., Engelking, C., Sauerland, C., & Corbi, D. (2006). Vesicant extravasation part II: Evidence-based management and continuing controversies. *Oncol Nurs Forum*, 33(6), 1143-1150. doi: 10.1188/06/onf.1143-1150
- Wynsma, L. A. (1998). Negative outcomes of intravascular therapy in infants and children. *AACN Clin Issues*, 9(1), 49-63.