



# Peripheral IV Infiltrations and Extravasations (PIVIE) Prevention Bundle 1.0

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## I. Background & Team

Intravenous catheter placement and management is commonly regarded as a routine clinical practice. Approximately 74% of hospitalized pediatric patients have vascular access catheters inserted either peripherally or centrally. However, potential complications from a peripheral IV infiltrate range from trivial irritation and discomfort to serious harm, such as permanent skin and soft tissue loss, impaired limb function, compartment syndrome, distal vascular compromise, and even loss of fingers or other parts of a limb.

In 2015, a cohort of 27 hospitals came together to test various factors thought likely to reduce incidents of peripheral IV infiltrations and extravasations. The original cohort hospitals each chose 1-2 factors out of a list of 19 to test. In early 2017, a statistical analysis was conducted to determine which factors were correlated to improved outcomes, but it was determined that the factors were too loosely defined which made the analysis inconclusive. In late 2017, after identifying and interviewing eight hospitals achieving good results, the factors were consolidated from 19 to 5 and very clearly defined for consistency in implementation across the cohort hospitals. After re-establishing baselines beginning in 2018, the cohort, then consisting of 33 hospitals, began testing the five new factors.

In early 2019, the cohort had a 17.5% reduction in the centerline of serious PIVIE rate. A second analysis was conducted to identify the combination of interventions statistically correlated with the reduction of PIVIEs. Multiple analytical methods were utilized, including ANCOVA, response plots, LS Means, and Tukey-Kramer. For analysis purposes, hospitals were divided into three groups based on level of reliability to factor adherence, and each factor along with combinations of factors were compared based on PIVIE rates for hospitals in each group.

As a result of this evidence, three out of five factors were originally adopted as standard bundle elements that were highly likely to result in decreased harm to hospitalized children when reliably implemented:

- Assess PIV every 60 minutes using Touch/Look/Compare (TLC) or Assess/Compare/Touch (ACT)
- Notify hospital-acquired condition (HAC) champion / Unit leader / Vascular Access Team (VAT) member and provider for ongoing injury assessment and adequate treatment
- Use standardized percentage measurement-based assessment tool

Of the above factors, assessing the PIV every 60 minutes was linked to statistically significant rate reduction. The other two had statistical support when used in combination with the practice of assessing the PIV. A fourth factor, “Educating patients/families on Touch/Look/Compare or Assess/Compare/Touch,” was not statistically significant and was thus not included as a *standard* element. However, this factor has strong support from clinical experts and is therefore included as a *recommended* bundle element. The fifth factor did not show statistical significance or have strong enough support to include in this bundle.

After launching the original bundle and having the network apply the standard bundle elements, SPS identified that the latter two elements, “Notify HAC champion/unit leader/VAT member and provider for ongoing injury assessment & adequate treatment” and “Use standardized percentage measurement-based assessment tool,” were mitigation-based interventions that could only be applied if a PIVIE injury occurred. To address this issue, SPS moved these two elements from standard to recommended, resulting in 1 standard element, “Assess PIV every 60 minutes using TLC or ACT.”

Section IV of this document lists the standard and recommended bundle elements along with descriptions of each.

SPS’s approach to harm classification of PIVIE injuries has evolved over time as the network has continued to learn how to most effectively measure, track and improve PIVIEs. As harm categories have changed, SPS Clinical Leadership and HAC Subject Matter Experts have considered implications of the PIVIE measurement updates and taken steps to mitigate risks to network- and hospital-level data quality.

### **PIVIE Leadership Team**

Jillian Rojas, Ann & Robert H. Lurie Children's Hospital of Chicago (Co-leader)  
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### **Participating Cohort Hospitals**

Alberta Health Services, Alberta Children's Hospital	Hasbro Children's Hospital at Rhode Island
Ann & Robert H. Lurie Children's Hospital of Chicago	Intermountain Primary Children's Hospital
Arkansas Children's Hospital	Le Bonheur Children's Hospital
Baystate Children's Hospital	Lehigh Valley Children's Hospital
Boston Children's Hospital	Miller Children's & Women's Hospital Long Beach
Children's Health Children's Medical Center Dallas	Monroe Carell Jr. Children's Hospital at Vanderbilt
Children's Healthcare of Atlanta	MUSC Children's Hospital
Children's Hospital Colorado	Prisma Health Children's Hospital
Children's Hospital of Philadelphia	Penn State Hershey Children's Hospital
Children's Hospital of Wisconsin	Phoenix Children's Hospital
Children's National Medical Center	ProMedica Toledo Children's Hospital
Cincinnati Children's	Riley Hospital for Children at Indiana University Health
Cohen Children's Medical Center of New York	Seattle Children's
Cook Children's Medical Center	Texas Children's Hospital
Dayton Children's	Valley Children's Hospital
Dell Children's Medical Center of Central Texas	Wolfson Children's Hospital
Gillette Children's Specialty Healthcare	

## **II. Prevention Bundle Elements - Overview**

### **SPS Standard Element**

- Assess PIV every 60 minutes using Touch/Look/Compare (TLC) or Assess/Compare/Touch (ACT)

### **SPS Recommended Elements**

- Educate patient and families on Touch / Look / Compare or Assess / Compare / Touch once per day
- Notify HAC champion / Unit leader / Vascular Access Team (VAT) member and provider for ongoing injury assessment and adequate treatment
- Use standardized percentage measurement-based assessment tool

## **III. Prevention Bundle Elements – Evidence Reviewed**

SPS stratified bundle elements based on their level of evidence to assist hospitals in prioritizing their efforts at designing and implementing evidence-based bundles for PIVIEs and the other aviator HACs:

- *Standard Element:* Strong evidence suggests that implementation of this element is associated with significant decrease in serious patient harm; **all SPS hospitals should implement and measure reliability of this element.**
- *Recommended Element:* Preliminary data and clinical expert opinion support the implementation of this element; **SPS hospitals should strongly consider implementing this element.**

Standard Bundle Element	Level of Evidence SPS Pioneer Analysis
Assess PIV every 60 minutes using Touch/Look/Compare (TLC) or Assess/Compare/Touch (ACT)	Scenario 1
Recommended Bundle Element	Level of Evidence SPS Pioneer Analysis
Educate patient and families on Touch / Look / Compare or Assess / Compare / Touch once per day	Scenario 5
Notify HAC champion / Unit leader / Vascular Access Team (VAT) member and provider for ongoing injury assessment and adequate treatment	Scenario 5 When combined with assessing PIV element, this recommended element bundle evidence demonstrated statistically significant improvement
Use standardized percentage measurement-based assessment tool	Scenario 5 When combined with assessing PIV element, this recommended element bundle evidence demonstrated statistically significant improvement

**Level of SPS Evidence Scenario Key:**

- **Scenario 1:** Hospitals that reliably implement an element show improvement
- **Scenario 2:** Hospitals that do not implement an element fail to improve when the system improves
- **Scenario 3:** When all hospitals implement an element, hospitals that implement an element without measuring reliability fail to improve when the system improves
- **Scenario 4:** Hospitals that reliably implement an element do not show improvement; however, relevant research literature supports adoption
- **Scenario 5:** Implementing an element is not statistically associated with improvement; however, preliminary data and clinical expert opinion support the implementation of this element

## IV. Prevention Bundle Elements Descriptions

Prevention Bundle Element	Care Descriptions
<b>Standard Elements</b>	
Assess PIV every 60 minutes using Touch/Look/Compare (TLC) or Assess/Compare/Touch (ACT)	<ul style="list-style-type: none"> <li>PIV site must be touched and validated as soft, warm, and dry.</li> <li>PIV site must be seen as uncovered, dry, and visible.</li> <li>PIV site must be the same size as the other extremity.</li> </ul>
<b>Recommended Element</b>	
Educate patients/families on Touch/Look/Compare (TLC) or Assess/Compare/Touch (ACT)	<ul style="list-style-type: none"> <li>Patients / families are educated on the importance of TLC or ACT and taught symptoms to watch for</li> <li>Education completed every day the PIV is present</li> </ul>
Notify HAC champion / Unit leader / Vascular Access Team (VAT) member and provider for ongoing injury assessment and adequate treatment	<ul style="list-style-type: none"> <li>Designated person notified within the institution</li> <li>Notified party comes to bedside real time for bedside assessment</li> <li>Appropriate treatment started</li> </ul>
Use Standardized Measurement Based Assessment Tool	<ul style="list-style-type: none"> <li>Percentage based assessment tool used on every PIVIE</li> </ul>

## V. Measurement – Outcome Data

Outcome measures are the number of events as defined in the PIVIE Operational Definition. Outcomes are submitted monthly. The definition of All PIVIEs and PIVIEs with Serious Harm is included in the PIVIE Operational Definition.

Measurement	Formula	Reporting Period
All PIVIE	$(\text{Number of All PIVIE injuries}) / \text{Total number patient days} \times 1000$	Monthly
PIVIEs with Serious Harm	$(\text{Number of PIVIEs with Serious Harm}) / \text{Total number of patient days} \times 1000$	Monthly

### Example Outcomes Webform for PIVIE:

**Outcomes Data**

ATTENTION: There is an updated 2023 PIVIE Operational Definition that contains new PIVIE measures: All PIVIEs and PIVIEs with Serious Harm. Please submit data on this webform only if your hospital's detection methods are confidently capturing All PIVIEs and PIVIEs with Serious Harm.

Reporting outcomes data? [Reset](#)

Yes  
 No

Number of All PIVIEs !

Number of PIVIEs with Serious Harm !

## VI. Measurement – Prevention Bundle Reliability

Process reliability is measured by looking at 20 monthly house-wide observations of patients with PIV to see if the factors were implemented reliably to the observed patient.

Measurement	Formula	Number of Observations	Reporting Period
% reliability to the standard PIVIE Standard Bundle element*	Number of audits totally compliant with SPS Standard Bundle Element / Number of audits completed x 100	<ul style="list-style-type: none"> <li>Minimum of 20 house-wide audits per month for assessment of PIV every 60 minutes</li> </ul>	Monthly

### Example Process Reliability Webform for PIVIE:

Bundle Reliability

Reporting bundle reliability data? [Reset](#)

Yes  
 No

Number of bundles observed that were successfully completed

Number of bundles observed

### How to Complete Monthly Audits for Bundle Process Reliability:

- Audits should occur in units house-wide (i.e., all inpatient areas where patients have peripheral IVs). See inclusion and exclusion criteria in PIVIE operational definition for further details.
- Success or failure for each bundle audit is determined by evaluating one (single) hourly assessment. The bundle standard is that every PIV be assessed every 60 minutes, with a 15 minute grace period; if >75 minutes have passed since the last assessment, the audit would not pass.
- Audits should follow random sampling practices; should staff identify a PIVIE during assessment, they are encouraged to complete an apparent cause analysis.
- Audits can be completed via direct observation OR chart review, following the recommendations below:

If Auditing by Observation	If Auditing by Chart Review
<ul style="list-style-type: none"> <li>• Identify a patient, date and time to observe</li> <li>• Ensure the patient has at least one IV fluid running during the sample time</li> <li>• Identify when last hourly assessment was completed</li> <li>• Evaluate whether staff's assessment using TLC or ACT meets bundle criteria</li> <li>• If the assessment meets bundle criteria, the audit is compliant</li> <li>• If the assessment does NOT meet bundle criteria, the audit is non-compliant</li> <li>• If necessary, prompt staff to enter assessment documentation into the patient's chart</li> </ul>	<ul style="list-style-type: none"> <li>• Identify a patient, date and time to sample; recommendation is to pick a sample time from the previous day or shift</li> <li>• Ensure the patient has at least one IV fluid running during the sample time</li> <li>• Review the chart and look at the previous hour's documentation <b>from the sample date and time</b></li> <li>• Documentation should be 60-75 minutes from the previous assessment</li> <li>• If the documentation is in the chart for PIVIE prevention (TLC or ACT), this audit is compliant</li> <li>• If the documentation is missing from the chart, this audit is non-compliant</li> </ul>

## VII. References

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- NDNQI Staff, "Guidelines for Data Collection And Submission on Peripheral Intravenous (PIV) Infiltration Indicator," NDNQI, p. 2, June 2014.
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- Wound Care Centers, "www.woundcarecenters.org," Home | Articles | Wound Types | Partial Thickness Burns, [Online]. Available: <http://www.woundcarecenters.org/article/wound-types/partial-thickness-burns>. [Accessed 15 October 2014].

## VIII. Revision History

Version	Primary Author(s)	Description of Version	Date Completed
Version 1	Mike Adamson, Melissa Chambers, Debbie Haddon, Vicki Jones, Sylvia Rineair	Initial version	9/10/2019
Version 2	Melissa Chambers, Debbie Haddon, Vicki Jones, Aaron Dawson	Added clarification to the measurement of reliability	2/11/2020
Version 3	Aaron Dawson; Co-Leaders	Moving two standard elements to recommended	2/26/2021
Version 4	Katie Staubach; Sarah Gomez; Patsy Sisson, Emily Gehring, PIVIE Co-Leaders & SMEs	Added clarification to the measurement of reliability	4/29/2021
Version 5	Sarah Gomez; PIVIE Co-leaders & SMEs	Updated I. Background & Team, V. Measurement – Outcome Data & VII. References to reflect revised 12/19/22 Operational Definition	1/17/2023

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