

# Reduction of Head Computed Tomography Scan Usage in Children with Head Trauma

Sara Rosenzweig, MD, Jessica Miller-Mantell, DO, Carl Kaplan, MD, Patricia Brill, NP

## Background

- Head trauma in children is a common reason for presentation to the pediatric emergency department (PED). Clinically important traumatic brain injury (ctTBI) is rare.
- A study in 2009 by Pediatric Emergency Care Applied Research Network (PECARN) evaluated the risk for ctTBI in children less than 18 years old and with a GCS of 14 or greater who had head trauma. This study created a highly sensitive clinical decision rule that stratifies patients with non-trivial head injury into low, intermediate, and high-risk groups for ctTBI, to help determine their need for computed tomography (CT) or observation.
- CT utilization rates remain low at institutions that follow the PECARN rule closely, without missing many ctTBI.
- CT increases risk of lifetime malignancy in children.
- Other quality improvement (QI) studies have shown that specific interventions can help decrease head CT utilization in head trauma, both overall and in the intermediate risk groups.
- We aim to reduce the rate of CT utilization in pediatric patients presenting to the Stony Brook Children's Hospital PED with head trauma, with a specific focus on those who are stratified as intermediate risk for ctTBI using PECARN guidelines, through a multifaceted quality improvement initiative.

## Objectives

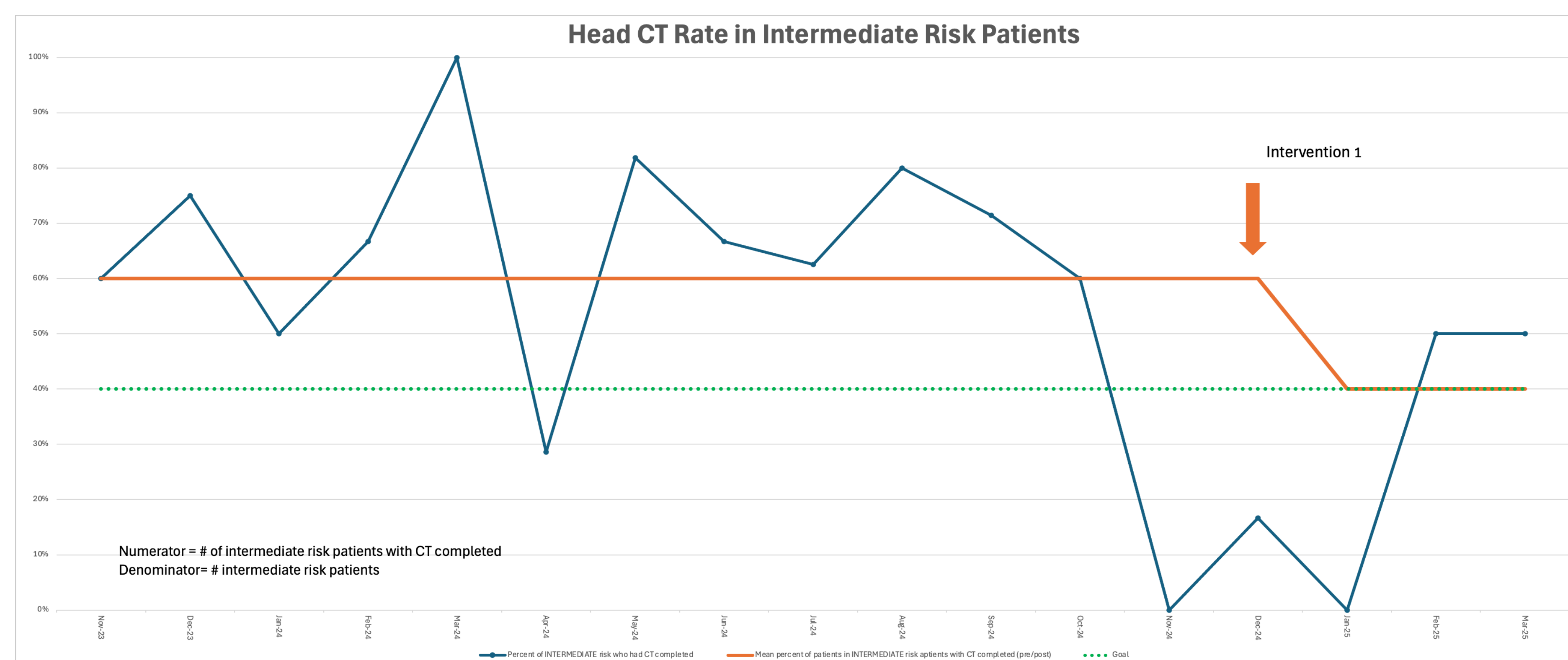
- Evaluate the rate of head CT utilization in patients presenting to the PED with head trauma
- Investigate factors that contribute to ordering head CT
- Reduce head CT rates for children younger than 18 years of age who present to the PED with blunt head trauma and are stratified as intermediate risk for ctTBI using PECARN guidelines by 20% in 12 months**

## Methods

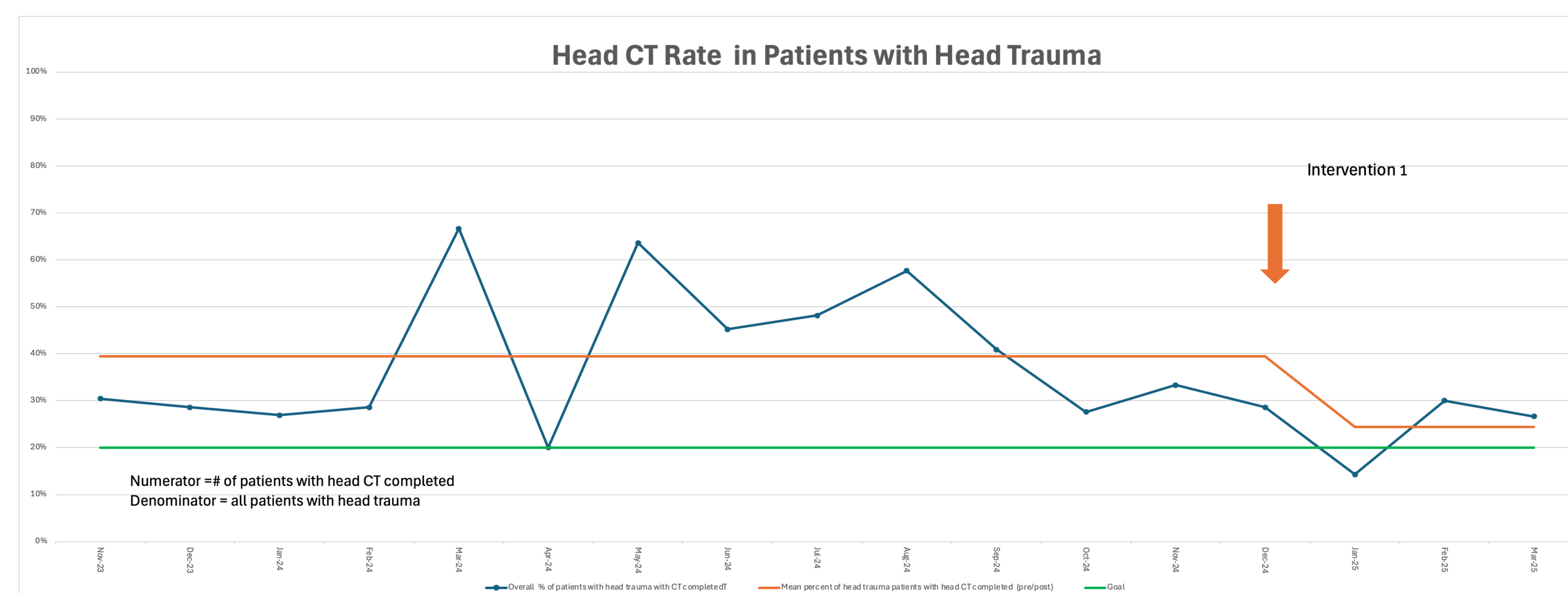
- Multi-faceted quality improvement initiative to decrease the number of head CTs on patients in the PED with head trauma.
- Inclusion criteria: <18 years of age who presented to the PED who meet PECARN head injury criteria from November 2023-December 2024 for pre-intervention, January 2025-March 2025 post first intervention.
- Medical records were reviewed. Data points including initial patient GCS (if recorded), if head CT was performed, if CT was indicated per PECARN rule, disposition, and length of stay were recorded. Patients were stratified into high, low and intermediate risk groups using PECARN guidelines through chart review
- A multidisciplinary team was created. We delineated two potential PDSA Cycles, where the information gathered based on the above data, would be implemented into actionable changes to overall reduce the number of CTs ordered on patients presenting to the PED with head trauma with a specific focus on those who are stratified as intermediate risk (using PECARN guideline).
- Statistical process control methodology was used to assess CT rates over time.

## Methods

- Primary outcome: Head CT rate in intermediate risk head trauma patients using PECARN guidelines**
- Balancing measures: Length of stay (LOS) and return visits
- 1<sup>st</sup> PDSA cycle: physician education and incorporation of a template or "dot phrase" for ease of documentation in our electronic medical records. This phrase is easy to use and includes part of the decision tool, patients risk stratification, and why scan was done
- We will report the preliminary findings of our quality improvement project including the pre-intervention data and results of the initial intervention.



	Pre-Intervention (11/23-12/24)	Post First Intervention (01/25-03/25)
Head CT Rate	39.3% (121/307)	24.5% (12/49)
Head CT Rate in Intermediate Risk Patients	63.3% (57/90)	40.0% (6/15)
LOS	161 min	137 min



## Results

- Following PDSA 1, both overall CT utilization rate for patients with head trauma and CT utilization rate in intermediate risk patients decreased. Length of stay also decreased after PDSA 1 (See table 1)
- For low and intermediate risk patients for which CT was not recommended, but obtained, reasons were characterized into four groups: parental request, PED physician preference, consultative service request, or unclear. Baseline data showed only 18% of children in this category had a clear reason for scanning. Post intervention, 70% of patients had a clear reason documented.
- Baseline data showed most children (72%) who were in the intermediate category and who received a CT scan had only one isolated factor that triggered the CT scan
- No patient who had a return visit during the study period had significant finding on CT or intervention.

## Conclusion

- CT utilization rate in our PED was higher than reported by other children's hospitals. Many of these could have been avoided, including 18% who received a CT scan despite being low risk for ctTBI with no CT recommended per PECARN.
- Many children considered intermediate risk (those for which observation vs. CT head is recommended) received a CT scan, representing ~50% of the total head CT utilization in our PED.
- After our 1<sup>st</sup> intervention, which included physician education and a template for the EMR, both overall head CT utilization rate and head CT utilization rate in those stratified as intermediate risk decreased with no increase in LOS or return visits
- We plan to do more PDSA cycles in the future to further decrease our CT rate. This includes creation of a parental PECARN education document and individual provider feedback
- By decreasing the overall head CT rate, we aim to reduce risk of lifetime malignancy, reduce ED visit cost, reduce resource utilization, and time spent waiting for radiology reports.

## References

- Bressan S, Romanato S, Mion T, Zanconato S, Da Dalt L. Implementation of adapted Pecarn Decision rule for children with minor head injury in the Pediatric Emergency Department. *Academic Emergency Medicine*. 2012;19(7):801-807. doi:10.1111/j.1553-2712.2012.01384.x
- Kuppermann N, Holmes JF, Dayan PS, et al. Identification of children at very low risk of clinically-important brain injuries after head trauma: A prospective cohort study. *The Lancet*. 2009;374(9696):1160-1170. doi:10.1016/s0140-6736(09)61558-0
- Nigrovic LE, Stack AM, Mannix RC, et al. Quality improvement effort to reduce cranial CTS for children with minor blunt head trauma. *Pediatrics*. 2015;136(1). doi:10.1542/peds.2014-3588
- Nigrovic LE, Kuppermann N. Children with minor blunt head trauma presenting to the Emergency Department. *Pediatrics*. 2019;144(6). doi:10.1542/peds.2019-1495 (only have access to the abstract)
- Jennings RM, Burtner JJ, Pellicer JF, et al. Reducing head CT use for children with head injuries in a Community Emergency Department. *Pediatrics*. 2017;139(4). doi:10.1542/peds.2016-1349
- Holmes JF, Yen K, Ugalde IT, et al. Pecarn prediction rules for CT imaging of children presenting to the emergency department with blunt abdominal or minor head trauma: A multicentre prospective validation study. *The Lancet Child & Adolescent Health*. 2024;8(5):339-347. doi:10.1016/s2352-4642(24)00029-4
- Lesyk N, Kirkland SW, Villa-Roel C, et al. Interventions to reduce imaging in children with minor traumatic head injury: A systematic review. *Pediatrics*. 2024;154(6). doi:10.1542/peds.2024-066955
- Babi FE, Borland ML, Phillips N, et al. Accuracy of PECARN, CATCH, and CHALICE head injury decision rules in children: a prospective cohort study. *The Lancet*. 2017;389(10087):2393-2402. doi:https://doi.org/10.1016/s0140-6736(17)30555-x
- MDcalc.com. Published 2023. <https://www.mdcalc.com/calc/589/pecarn-pediatric-head-injury-trauma-algorithm>
- Radiation Risks and Pediatric Computed Tomography. National Cancer Institute. Published September 4, 2018. <https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/pediatric-ct-scans>