

# Comparison of Temporal Artery and Rectal Thermometry Measurements in Pediatric Emergency Department Patients

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## INTRODUCTION

Febrile patients account for 20% of pediatric emergency department (ED) visits<sup>5</sup>. Accurate temperature measurement is essential in assessing the pediatric patient. Yet, the best method for obtaining pediatric temperatures is not without controversy<sup>6</sup>. Available methods in the ED setting include rectal, axillary, tympanic and temporal artery thermometry.

Despite that there are many methods for obtaining a temperature in the pediatric patient, the rectal route has long been accepted as the "gold standard" for temperature measurement in children 3 months of age and younger. Nonetheless, obtaining a rectal temperature has several disadvantages for the patient, family, and nurse<sup>1,3</sup>.

Studies addressing pediatric temperature assessment in the emergent setting are limited, and the results are not conclusive. Research has been conducted supporting the accuracy of temporal artery (TA) temperature measurement<sup>2,3</sup>, while other studies have found it to be sufficiently different from rectal measurements precluding recommendation of its use<sup>5,7</sup>. However, TA thermometry is better tolerated by patients than rectal.

The Society of Pediatric Nurses (SPN) released this position statement in June 2008: "Temporal artery thermometry is accurate with infants older than 90 days without fever as well as for all patients greater than three months of age with or without fever, ill or well"<sup>1</sup>. The society continues to recommend the rectal method for infants 90 days or younger who are ill, have a fever, or have an ill diagnosis. Due to SPN's position statement and the inconclusiveness of published data, further study of rectal and TA thermometry is warranted.

## PURPOSE

The study was designed to determine if temporal artery temperatures approximated rectal temperature values within +/- 0.5°F by:

- Assessment of rectal temperature initially
- Assessment of temporal artery temperature immediately thereafter
- Statistical analysis of the two digital measurements for agreement

## METHODOLOGY

**STUDY DESIGN:** The quantitative research protocol was prospective and comparative. For each subject, rectal and TA temperatures were measured by the same data collector. The study was IRB approved, and written informed consent was obtained from the subject's parent/guardian.

**INCLUSION CRITERIA:** male or female children over 90 days and <5 years old of any ethnic background with parents who understood English

**EXCLUSION CRITERIA:** children arriving by EMS, presenting with life threatening conditions such as compromise in airway, breathing or circulation, presenting with rectal anomalies, presenting with malformation to the temporal area or facial trauma, or mentally challenged

**STUDY SETTING:** a Magnet community hospital in the Southeastern US with 52,868 ED visits in 2009 and a census of 3131 pediatric visits during the study period (December 2008 through April 2010)

**STATISTICS:** mean, standard deviation, Chi Squared Goodness-of-Fit Test, Matched Pair Two-Tailed t Test, stepwise regression, linear regression, power analysis (sample size determination)

## DEMOGRAPHICS

Demographic	Age Group				Total n (%)
	91 Days – ≤1 Yr n (%)	1 Yr – ≤2 Yrs n (%)	2 Yrs – ≤3 Yrs n (%)	3 Yrs – ≤4 Yrs n (%)	
All Subjects	65 (27)	110 (46)	53 (22)	11 (5)	239 (100)
Males	38 (16)	61 (26)	34 (14)	6 (3)	139 (58)
Females	27 (11)	49 (21)	19 (8)	5 (2)	100 (42)
Asian	2 (1)	0	0	0	2 (1)
African Amer.	40 (17)	0	0	0	40 (17)
Hispanic	17 (7)	5 (2)	0	0	22 (9)
Caucasian	6 (3)	93 (39)	53 (22)	11 (5)	163 (68)
Other	0	12 (5)	0	0	12 (5)

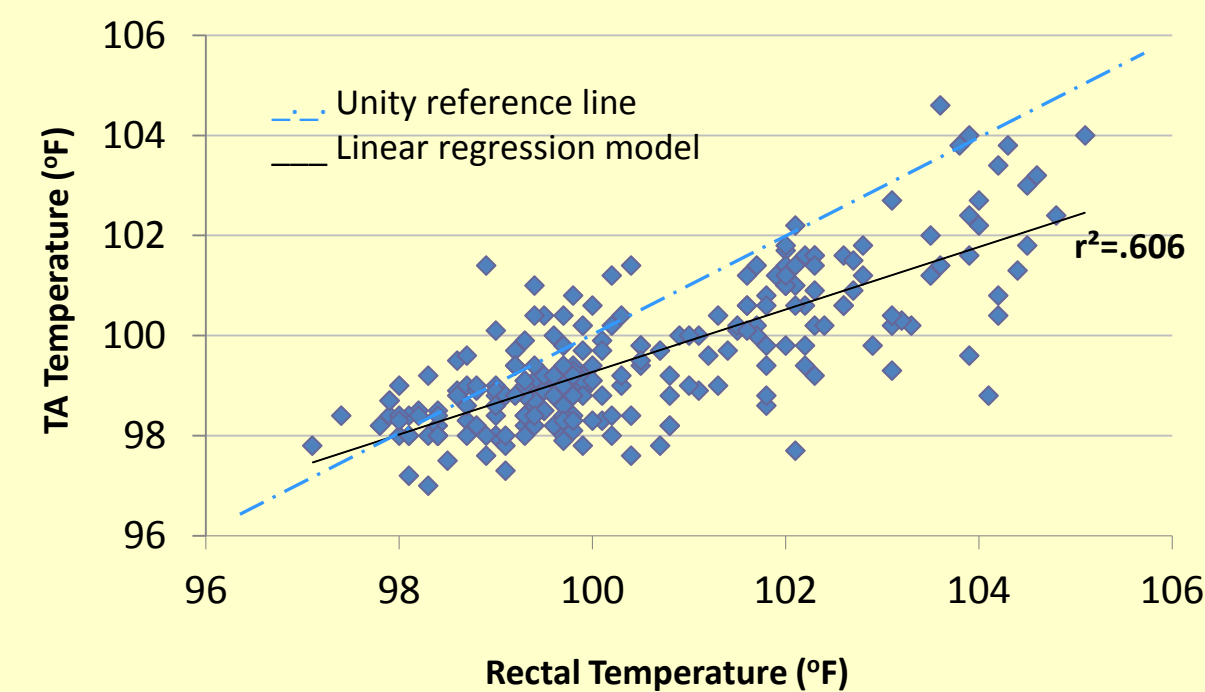
- More male (58.16%) than female (41.84%) children were consented by their parents to participate in the study
- Gender distribution of the subjects was not significantly different from the gender distribution of the pediatric census during the study period ( $\chi^2=.021$ ,  $p=.886$ )
- 94% of the sample population was comprised of African American, Hispanic and Caucasian children with the majority of subjects being Caucasian
- Based on facility census, fewer Hispanic than African American subjects were enrolled in the study compared to the percentages of the two ethnicities seen in this ED (data not shown)

## TEMPERATURE COMPARISON by AGE GROUP

Rectal and Temporal Artery (TA) Temperature Measurements				
Age Category	n	Mean Rectal Temperature (+/-SD)	Mean TA Temperature (+/-SD)	p value
91 Days – ≤1 Yr	65	100.59 (1.70)	99.58 (1.38)	<.0001
1 Yr – ≤2 Yrs	110	100.54 (1.83)	99.61 (1.51)	<.0001
2 Yrs – ≤3 Yrs	53	100.21 (1.84)	99.45 (1.41)	<.0001
3 Yrs – ≤4 Yrs	11	100.90 (1.71)	100.04 (1.16)	.0551
Total	239	100.50 (1.79)	99.58 (1.43)	<.0001

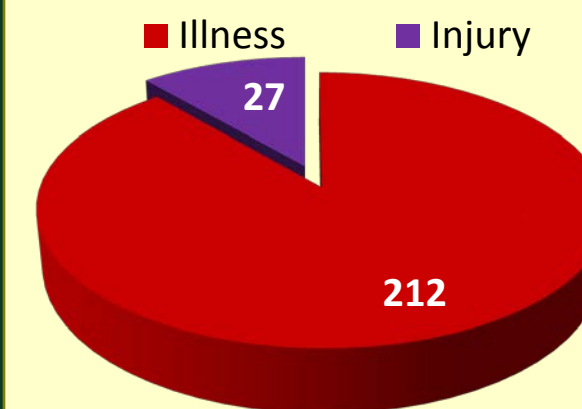
- Two-tailed t Test analyses showed a significant difference, with 95% confidence, between rectal and TA measurements for all age categories except the limited sample of the oldest subjects (n=11)

## COMPARISON of TEMPORAL ARTERY and RECTAL TEMPERATURES for AGREEMENT



- As expected, TA and rectal temperatures were not equivalent
- Agreement between the two temperature measurements was unsatisfactory ( $r^2=.606$ )
- TA thermometry commonly underestimated higher rectal temperatures

## REASON for ED VISIT



- Temperatures of injury subjects were lower than those of illness subjects
  - Mean rectal measurement:
    - 99.3°F - injury
    - 100.6°F - illness
  - Mean temporal measurement:
    - 98.6°F - injury
    - 99.7°F - illness

## Influence of Confounding Variables on Temperature

Variable	Rectal Temp p value	TA Temp p value
Age	.9127	.3099
Gender	.9999	.9999
Presenting Condition	.0003	.0001

- Stepwise regression analysis revealed presenting condition of illness or injury did impact temperature measurements significantly for both rectal and TA thermometry (at a 95% confidence level), but neither age nor gender played a role

## SUMMARY

### CONCLUSIONS

- TA and rectal temperatures varied by a mean difference of 0.913°F, which did not support the hypothesis of +/- 0.5°F agreement
- This study demonstrated less agreement between TA and rectal thermometry than previous research reports, yet the insufficient agreement supports data published by others
- Influence of presenting condition (injury vs. illness) on temperature measurement was found to be significant

### STUDY LIMITATIONS

- Limited recruitment of 3 to <4 yr olds
- Distribution of ethnicities among subjects
- Lack of data regarding whether or not subjects received antipyretics within 4 hrs of triage

### IMPLICATIONS

- Prevailing opinion: >0.5°C (>0.9°F) difference between temperature measures is considered to be clinically significant
- Potential practice change: obtain temperatures for injured pediatric patients presenting in the ED setting by TA thermometry
- Additional studies: warranted to determine best practice

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- ED Research Team
- Data Collectors

Pictured seated (l to r): Sue Patton RN, Susan Hesterberg RN, former team leader; standing (l to r) Karen Drum BSN, RN, CEN, Ann Moore MSN, RN-BC, CEN, Mike Helton BSN, RN, David Solomon BSN, RN, CEN, EMT-P, Anita Herman BSN, RN, CEN, and Sam Shoun, NA

Not pictured: Julie Carrigan BSN, RN, CEN, Nancy Lawrence RN, Cherie Turney BSN, RN, CEN, Amanda Lyster BSN, RN, and Danielle Thurman BSN, RN.

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