

CADTH RAPID RESPONSE REPORT: SUMMARY OF ABSTRACTS

Infrared Tympanic Thermometers for Measurement of Temperature in Adults and Children: Clinical Effectiveness, Diagnostic Accuracy, and Guidelines

Service Line: Rapid Response Service
Version: 1.0
Publication Date: April 10, 2019
Report Length: 7 Pages

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Cite As: Infrared tympanic thermometers for measurement of temperature in adults and children: clinical effectiveness, diagnostic accuracy, and guidelines. Ottawa: CADTH; 2019 Apr. (CADTH rapid response report: summary of abstracts).

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Funding: CADTH receives funding from Canada's federal, provincial, and territorial governments, with the exception of Quebec.

Research Questions

1. What is the comparative clinical effectiveness of infrared tympanic thermometers compared with electronic oral or temporal thermometers?
2. What is the diagnostic accuracy of infrared tympanic thermometers compared with electronic oral or temporal thermometers?
3. What are the evidence-based guidelines regarding thermometry using infrared tympanic thermometers, electronic oral thermometers, or temporal thermometers?

Key Findings

Two non-randomized studies were identified regarding the clinical effectiveness and diagnostic accuracy of infrared tympanic thermometers for the measurement of temperature in adults and children. In addition, one evidence-based guideline was identified regarding infrared tympanic thermometers for the measurement of temperature in adults and children.

Methods

A limited literature search was conducted on key resources including PubMed, the Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to guidelines for Q3 only. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2009 and March 25, 2019. Internet links were provided, where available.

Selection Criteria-

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

Population	Adults or children requiring thermometry in a hospital setting
Intervention	Q1-2: Infrared tympanic thermometers Q3: Infrared tympanic thermometers, electronic oral thermometers, temporal thermometers
Comparators	Q1-2: Electronic oral or temporal thermometers Q3: No comparator
Outcomes	Q1: Clinical effectiveness (e.g., detection of hypo or hyperthermia, accuracy of measurement) Q2: Diagnostic accuracy (e.g., sensitivity, specificity) Q3: Guidelines
Study Designs	Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, evidence-based guidelines

Results

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, and evidence-based guidelines.

Two non-randomized studies were identified regarding the use of infrared tympanic thermometers for the measurement of temperature in adults and children. In addition, one evidence-based guideline was identified regarding infrared tympanic thermometers for the measurement of temperature in adults and children. No relevant health technology assessments, systematic reviews, meta-analyses, or randomized controlled trials were identified.

Additional references of potential interest are provided in the appendix.

Overall Summary of Findings

Two non-randomized studies^{1,2} were identified regarding the clinical effectiveness and diagnostic accuracy of infrared tympanic thermometers for the measurement of temperature in adults and children. The authors of the first study aimed to compare the performance of infrared tympanic thermometers with non-contact infrared thermometers and digital axillary thermometers in healthy newborns in a neonatal intensive care unit. The authors observed that all three types of thermometers had a similar temperature measurement among term and pre-term newborns. The authors of the second study² aimed to examine the differences in tympanic and temporal temperatures among patients with fever within the emergency department. They observed that the temporal thermometer is more reliable than tympanic thermometers in measuring the temperature in children under one year and adults aged 18 to 65 years.²

The evidence-based guideline from the Emergency Nurses Association does not recommend the use of infrared tympanic thermometers in patients that are febrile (regardless of age), or in patients aged zero to three months and three years to 18 years.³ The guidelines states there is insufficient or no evidence to support the use of infrared tympanic thermometers in populations that are hypothermic, critically ill/intubated, or aged three months to three years and over 18 years.³ The guidelines do recommend the use of oral thermometers in patients who are febrile, hypothermic, critically ill/ intubated adults, and those aged three years and over; however, they do not recommend oral thermometers in pediatric patients who are critically ill/intubated or those under three years of age.³ Lastly, the guidelines do recommend the use of temporal thermometers in pediatric patients who are febrile and patients three years and older. They do not recommend the use of temporal thermometers in patients less than three months old or in febrile adult patients.³ There is insufficient or no evidence to provide recommendations on temporal thermometer use in patients, regardless of age, who are hypothermic, critically ill/intubated or aged three months to three years.³

References Summarized

Health Technology Assessments

No literature identified.

Systematic Reviews and Meta-analyses

No literature identified.

Randomized Controlled Trials

No literature identified.

Non-Randomized Studies

1. Sollai S, Dani C, Berti E, et al. Performance of a non-contact infrared thermometer in healthy newborns. *BMJ open*. 2016 Mar 16;6(3):e008695.
[PubMed: PM26983944](#)
2. Yang WC, Kuo HT, Lin CH, et al. Tympanic temperature versus temporal temperature in patients with pyrexia and chills. *Medicine (Baltimore)*. 2016 Nov;95(44):e5267.
[PubMed: PM27858893](#)

Guidelines and Recommendations

3. Clinical practice guideline: Non-invasive temperature measurement. Des Plaines (IL): Emergency Nurses Association. [2016].
https://www.ena.org/docs/default-source/resource-library/practice-resources/cpg/temperaturemeasurementcpg.pdf?sfvrsn=8853209f_14
See: Tympanic Temperature Measurement, pages 6-7

Appendix — Further Information

Previous CADTH Reports

4. Thermometer use for febrile pediatric patients: clinical effectiveness, accuracy, and guidelines. (CADTH Rapid response report : summary of abstracts). Ottawa: CADTH. 2018.
<https://www.cadth.ca/thermometer-use-febrile-pediatric-patients-clinical-effectiveness-accuracy-and-guidelines>
5. Tympanic thermometer use in adults in a hospital setting: accuracy, clinical effectiveness, and guidelines. (CADTH Rapid response report : summary of abstracts). Ottawa: CADTH. 2018.
<https://www.cadth.ca/tympanic-thermometer-use-adults-hospital-setting-accuracy-clinical-effectiveness-and-guidelines-0>
6. Thermometer use for febrile pediatric patients: a review of clinical effectiveness, accuracy, and guidelines. (CADTH Rapid response report : summary with critical appraisal). Ottawa: CADTH. 2016.
<https://www.cadth.ca/thermometer-use-febrile-pediatric-patients-review-clinical-effectiveness-accuracy-and-guidelines>
7. Non-contact thermometers for detecting fever: a review of clinical effectiveness (CADTH Rapid response report : summary with critical appraisal). Ottawa: CADTH. 2014.
<https://www.cadth.ca/non-contact-thermometers-detecting-fever-review-clinical-effectiveness>
8. Infrared thermometers for detecting fever: clinical effectiveness. (CADTH Rapid response report : reference list). Ottawa: CADTH. 2014.
<https://www.cadth.ca/infrared-thermometers-detecting-fever-clinical-effectiveness>

Systematic Reviews and Meta-Analyses – Comparator or Setting Unspecified

9. Geijer H, Udumyan R, Lohse G, Nilsagard Y. Temperature measurements with a temporal scanner: systematic review and meta-analysis. *BMJ Open*. 2016 Mar 31;6(3):e009509.
[PubMed: PM27033957](https://pubmed.ncbi.nlm.nih.gov/27033957/)
10. Zhen C, Xia Z, Ya Jun Z, Long L, Jian S, Gui Ju C, Long L. Accuracy of infrared tympanic thermometry used in the diagnosis of Fever in children: a systematic review and meta-analysis. *Clin Pediatr (Phila)*. 2015 Feb;54(2):114-26.
<https://www.ncbi.nlm.nih.gov/pubmed/?term=zhen+2015+accuracy+of+infrared>
11. Systematic review and meta-analysis of the diagnostic accuracy of an infrared tympanic thermometer for use with adults. *Int J Nurs*. 2014;1(2):115-134.
http://ijnnet.com/journals/ijn/Vol_1_No_2_December_2014/9.pdf
12. Zhen C, Xia Z, Long L, Pu Y. Accuracy of infrared ear thermometry in children: a meta-analysis and systematic review. *Clin Pediatr (Phila)*. 2014 Oct;53(12):1158-1165.
[PubMed: PM24879119](https://pubmed.ncbi.nlm.nih.gov/24879119/)

Non-Randomized Studies

Alternative Comparators

13. Bijur PE, Shah PD, Esses D. Temperature measurement in the adult emergency department: oral, tympanic membrane and temporal artery temperatures versus rectal temperature. *Emerg Med J*. 2016 Dec;33(12):843-847.

[PubMed: PM27334759](#)

Unspecified Setting

14. Mogensen CB, Wittenhoff L, Fruerhoj G, Hansen S. Forehead or ear temperature measurement cannot replace rectal measurements, except for screening purposes. *BMC Pediatr*. 2018 Jan 26;18(1):15.

[PubMed: PM29373961](#)

15. Allegaert K, Casteels K, van Gorp I, Bogaert G. Tympanic, infrared skin, and temporal artery scan thermometers compared with rectal measurement in children: a real-life assessment. *Curr Ther Res Clin Exp*. 2014 Dec;76:34-38.

[PubMed: PM25067984](#)

Alternative Setting

16. Fogt DL, Henning AL, Venable AS, McFarlin BK. Non-invasive Measures of Core Temperature versus Ingestible Thermistor during Exercise in the Heat. *Int J Exerc Sci*. 2017;10(2):225-233.

[PubMed: PM28344737](#)

17. Teller J, Ragazzi M, Simonetti GD, Lava SA. Accuracy of tympanic and forehead thermometers in private paediatric practice. *Acta Paediatr*. 2014 Feb;103(2):e80-83.

[PubMed: PM24127699](#)