Infrared Tympanic Thermometers for Measurement of Temperature in Adults and Children: Clinical Effectiveness, Diagnostic Accuracy, and Guidelines
Authors: Deba Hafizi, Suzanne McCormack


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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

<table>
<thead>
<tr>
<th>Population</th>
<th>Adults or children requiring thermometry in a hospital setting</th>
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<tbody>
<tr>
<td>Intervention</td>
<td>Q1-2: Infrared tympanic thermometers</td>
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<td></td>
<td>Q3: Infrared tympanic thermometers, electronic oral thermometers, temporal thermometers</td>
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<tr>
<td>Comparators</td>
<td>Q1-2: Electronic oral or temporal thermometers</td>
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<td></td>
<td>Q3: No comparator</td>
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<tr>
<td>Outcomes</td>
<td>Q1: Clinical effectiveness (e.g., detection of hypo or hyperthermia, accuracy of measurement)</td>
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<tr>
<td></td>
<td>Q2: Diagnostic accuracy (e.g., sensitivity, specificity)</td>
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<td></td>
<td>Q3: Guidelines</td>
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<tr>
<td>Study Designs</td>
<td>Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, evidence-based guidelines</td>
</tr>
</tbody>
</table>
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 study\(^2\) 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
PubMed: PM26983944

PubMed: PM27858893

Guidelines and Recommendations
See: Tympanic Temperature Measurement, pages 6-7
Appendix — Further Information

Previous CADTH Reports

   https://www.cadth.ca/thermometer-use-febrile-pediatric-patients-clinical-effectiveness-accuracy-and-guidelines


   https://www.cadth.ca/thermometer-use-febrile-pediatric-patients-review-clinical-effectiveness-accuracy-and-guidelines

   https://www.cadth.ca/non-contact-thermometers-detecting-fever-review-clinical-effectiveness

   https://www.cadth.ca/infrared-thermometers-detecting-fever-clinical-effectiveness

Systematic Reviews and Meta-Analyses — Comparator or Setting Unspecified

   PubMed: PM27033957


    PubMed: PM24879119
Non-Randomized Studies

Alternative Comparators

PubMed: PM27334759

Unspecified Setting

PubMed: PM29373961

PubMed: PM25067984

Alternative Setting

PubMed: PM28344737

PubMed: PM24127699