**TITLE:** Type of Thermometer for Inpatients: Clinical-Effectiveness and Guidelines

**DATE:** 28 May 2009

**RESEARCH QUESTIONS:**

1. What is the clinical-effectiveness of tympanic, temporal, oral, and rectal thermometers for inpatients?
2. What is the accuracy of tympanic, temporal, oral, and rectal thermometers for inpatients?
3. What are the guidelines for use of tympanic, temporal, oral, and rectal thermometers for inpatients?

**METHODS:**

A limited literature search was conducted on key health technology assessment resources, including PubMed, the Cochrane Library (Issue 2, 2009), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, EuroScan, international health technology agencies, and a focused Internet search. The search was limited to English language articles published between 2004 and May 2009. No filters were applied to limit the retrieval by study type. Internet links were provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

**RESULTS:**

HTIS 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, controlled clinical trials, observational studies, and evidence-based guidelines.
One systematic review, one randomized controlled trial, ten observational studies, and one evidence-based guideline were identified regarding tympanic, temporal, oral, and rectal thermometers for inpatients. No relevant health technology assessments, systematic reviews, or controlled clinical trials were identified. Additional articles of interest may be found in the appendix.

OVERALL SUMMARY OF FINDINGS:

Seven articles discussed the use of thermometers in adult inpatient populations.\textsuperscript{1,3-5,8,11,12} The conclusions reported among the studies were not consistent. In one study,\textsuperscript{4} temperatures measured with temporal thermometers were found to be comparable with axillary temperature measurement. The systematic review on temporal thermometers was unable to recommend the use of temporal artery thermometers over existing methods due to conflicting and incomplete evidence identified.\textsuperscript{1} Myny et al.\textsuperscript{12} reported good reliability and accuracy of the temporal thermometer but concluded that it showed no substantial benefit over standard rectal, oral, or bladder measurement methods.

Study conclusions regarding the use of tympanic thermometers for inpatients were also inconsistent. Moran et al.\textsuperscript{8} found there was poor agreement between tympanic temperature measurement and core body temperature, as measured by pulmonary artery catheter. Dzarr et al.\textsuperscript{3} concluded that tympanic measurement was more sensitive than either oral or axillary temperature measurement. Smitz et al.\textsuperscript{5} found that tympanic measurements were as accurate as rectal temperature, when rectal temperature measurements were used as baseline in a geriatric population. Leon et al.\textsuperscript{11} found tympanic measurements to be highly reliable when compared with axillary temperatures measured with a mercury-in-glass thermometer.

Six articles discussed the use of thermometers in pediatric inpatient populations.\textsuperscript{2,6,7,9,10,13} Two infant studies showed a significant difference in temperature based on location of measurement.\textsuperscript{2,6} Axillary temperatures were much lower than rectal temperatures when measured with the same thermometer.\textsuperscript{6}

Devrim at al.\textsuperscript{7} compared at-home tympanic, clinical tympanic, and standard mercury-in-glass thermometers. They observed that, when comparing the clinical tympanic thermometer to the standard mercury-in-glass, 4% of afebrile patients were misdiagnosed as febrile and 5% of febrile patients were misdiagnosed as afebrile when using the clinical tympanic thermometer. Nimah et al.\textsuperscript{9} concluded that infrared tympanic thermometers are more accurate and showed better agreement with core temperature during fever cycles, as compared to temporal, axillary, and rectal temperature measurements.

Hebbar et al.\textsuperscript{10} measured temporal, rectal, axillary, and pulmonary artery core temperatures, in pediatric ICU patients. The sensitivity and specificity of temporal measurements for diagnosis were similar to axillary measurement. However, no measurement method was found to be sufficiently better to be recommended over rectal, or the other invasive measurements, for determining fever.

One guideline\textsuperscript{13} recommends axillary temperature measurement for infants up to four weeks of age, and either electronic axillary, tympanic, or chemical dot axillary measurement for children four weeks to five years of age.

Overall, the studies showed that in adults, there was no significant benefit reported for the use of temporal thermometers over temperature measurement with oral, axillary, rectal, or bladder
temperature measurement. Three studies determined tympanic temperature measurement was sensitive, accurate, and reliable in adults. However, an additional study reported poor agreement with core temperature measurements. In infants, rectal temperature measurement was found to be more accurate than axillary, however, there are conflicting recommendations from the guidelines that suggest oral and rectal measurements not be used in children five years of age and younger. No studies concluded that tympanic or temporal measurement was better than other temperature measurement methods in children.
REFERENCES SUMMARIZED:

Health technology assessments
No literature identified

Systematic reviews and meta-analyses


Randomized controlled trials


Observational studies


Guidelines and recommendations


Note: see 1.1 Thermometers and detection of fever, page 9

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APPENDIX – FURTHER INFORMATION:

Position statements


Review articles


   CRD abstract: http://www.crd.york.ac.uk/CRDWeb/ShowRecord.asp?ID=12006003727

Additional references