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## **Oral versus axilla temperature measurement: a review of the evidence**

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### **Abstract**

The contribution of research to improved deliverance of quality health care is emerging as a widely recognized area known as evidence-based practice. The benefits of this approach to health care can be seen in a variety of fields within the discipline of nursing. In recent years, research regarding the reliability of different temperature measurements on different sites of the body has concentrated upon comparing new techniques and devices with established methods. Oral and axillary temperature-taking are both accepted methods of measuring temperature. Currently these established techniques are being compared to new techniques such as tympanic membrane temperature measurements to ascertain the reliability of both the new and accepted methods. In this process, comparisons and contrasts of axillary and oral findings often emerge. The results amongst several studies present both similar and different findings and the variability of research results is noted by many researchers. Factors such as clinical setting, age group and cost-effectiveness emerge as relevant considerations for practice.

Davis (1993, p.267) identifies the debate over the best method for assessing temperatures as being a long and continuous one. Recent research such as a study conducted by Irvin (1999, p.85) confirms the complexity of comparing different methods of temperature-taking. Irvin's study is a comparison of the oral thermometer versus the tympanic thermometer, a relatively new instrument developed over a decade ago (1999, p.85). Irvin (1999, p.85) highlights the problems of oral measurement which are eliminated with the infrared tympanic thermometers such as a patient's hot or cold oral consumption, smoking and mouth breathing. O'Toole (1998, p.780) also identifies external influences on oral findings including factors such as teeth brushing and tachypnoea. Despite the identified possibilities of inaccuracies in oral measurements Irvin (1999, p.89) concludes in her study that it may be premature to label the oral thermometer as less accurate than the tympanic thermometer. The benefits of the established oral thermometer are addressed in other research studies.

Benefits of oral thermometers include easy access to the sublingual pockets in the oral cavity, patient comfort and quick response time to changes in core body temperature (O'Toole, 1998, p.780). Similarly, axilla measurements have positive aspects such as patient comfort and safety and convenience in young children and unconscious patients (O'Toole, 1998, p.780-781). Relatively new research has concentrated upon the effectiveness of axilla measurements of febrile states in infants and young children as opposed to its convenience. In their study comparing axilla and oral temperatures, Haddock et al (1996, p.124) conclude that axillary temperatures should not be relied upon to detect fever in infants and young children. This conclusion follows the results of their study which showed that axillary temperatures indicated febrile states in only 27.8% of the children who

were febrile by oral and tympanic measurements (1996, p.124). The implications of studies such as these, whilst warranting further investigation force the nursing profession to look beyond ritualistic practice toward evidence-based practice (O'Toole, 1998, p.p.781)

Buswell (1997, p.359) states that nursing research has always differed on the topic of insertion periods for mercury filled thermometers. A study conducted by Cutter (1994, p.610) indicates the implications this has on nurses' knowledge on how long to leave thermometers in both oral and axilla sites. Cutter (1994, p.608) highlights the inconsistencies in different studies' suggestions of how long to leave thermometers in situ in different sites of the body. The confusion surrounding this area is reflected in the results of this study which showed that the majority of nurses were not leaving thermometers in situ in accordance with the recommended time periods (1994, p.616). The implication of this study as discussed by Cutter (1994, p.616) is the highlighted need for staff education. The inconvenience of leaving an oral thermometer in for ten minutes which is one recommended time period is however noted by Cutter (1994, p.616). This leads to a discussion on alternative devices such as tympanic membrane thermometers (1994, p.616)

O'Toole (1998, p.784) highlights studies which compare tympanic membrane temperature-taking favourably to oral measurements with a mercury thermometer. In the detection of fever however, O'Toole (1998, p.784) suggests that according to other studies the reliability of tympanic as opposed to oral measurements is questionable. In a study by Lanham et al (1999, p.42) published in *Pediatric Nursing*, results indicated that infrared tympanic thermometers (ITT) may not be accurate in determining the presence of fever in children under the age of six. Being a relatively new temperature-monitoring product, studies such as these add to the knowledge base about the use of ITT. The availability of research such as this is identified by Thompson (1998, p.58) as essential in delivering evidence-based care.

In addition to infrared tympanic thermometers, the axillary infrared device is a relatively new product designed for use in neonates with a specially designed probe that slides into the axilla (O'Toole, 1998, p.784). As O'Toole (1998, p.784) notes however, studies on the accuracy and reliability of this device can not be found and Thompson (1998, p.58-59) states that this unavailability of new product research is a barrier for nurses in the development of an evaluative culture. Whilst it has been highlighted that the accuracy of axilla thermometers in detecting fever in children under the age of six is not reliable, axillary temperature-taking does achieve more reliable results in neonatal settings according to a study conducted by Cusson et al (1997, p.206).

Cusson et al (1997, p.202) studied the effect of environment on body site temperatures in full-term neonates. The conclusions reached in this study suggest that for neonates in superheated environments, axillary temperatures are a more reliable method of ascertaining a correct temperature, thus reducing unnecessary medical intervention, in contrast to ITT (Cusson, 1997, p.206). This highlights the importance of age and clinical settings in deciding which site and device is most appropriate (O'Toole, 1998, p.786). Furthermore, O'Toole (1998, p.786) highlights the inappropriateness of using ITTs which have been calibrated using average adult temperatures on children and neonates.

In a study conducted by Davis, similar findings to Cusson's research were noted regarding the use of ITT in the neonatal setting (1993, p.270). Whilst Davis recommends that tympanic measurement should not be used for infants under the age of three, the study showed that in older children

tympanic measurement identified temperature elevations that oral measurement did not and therefore should be considered for regular use in children older than three years (1993, p.270).

Thompson, in his article on evidence-based nursing, discusses the importance of developing the knowledge, skills and values of health professionals (1998, p.59). Studies such as Cutter's survey of current practices in temperature-taking highlight the need for uniform methods and therefore knowledge of studies which suggest recommended methods and times (1994, p.608). However, in this overview of new research on oral, axilla and other temperature-taking methods it has been demonstrated that this is not a 'black and white' issue. Different authors recommend different 'optimum' times that a thermometer be left in situ and Cutter's study reflects the implications such varied recommendations has on clinical practice (1994, p.608).

The minimum time period suggested for oral thermometers to be left in place, as stated by Cutter (1994, p.610) is three minutes. 37.3% of her respondents left oral thermometers in for one minute; 34% left them in for two minutes; 18.7% left them in for three minutes and 4% left them in for over three minutes (1994, p.610). Studies such as these are important as they highlight the need for nurse education whilst they also reflect the impact that varying recommendations by authors have on clinical practice. Results such as these may also indicate that the reason for temperature research being a 'long and continuous' process could be due to inaccuracies and discrepancies in methods (Davis, 1993, p.267).

Irvin (1999, p.88) identifies the emphasis presently placed on cost efficiency in the health care setting and how this influences choices regarding temperature-taking methods. Whilst mercury-in-glass thermometers appear to be relatively inexpensive, Buswell (1997, p.360) identifies 'hidden' costs associated with their use such as cleaning solutions, breakage and nursing time cleaning the thermometers. O'Toole (1998, p.786) discusses the ongoing cost associated with infrared thermometers, both axilla and tympanic, which have disposable covers in addition to the initial cost of instrumentation. Single-use thermometers such as the TempaDot are identified by Buswell (1997, p.362) as the most cost efficient in addition to concluding that they may be the most beneficial for patients.

Buswell (1997, p.362) states that: "Nursing must become more research-based for the benefit of patients and the future of the profession." Following this Buswell (1997, p.362) recommends that single-use thermometers, in addition to being cost-effective, should be advocated by nurses for use when appropriate due to its success in research projects. However, in O'Toole's 1998 report on temperature measurement devices the single-use thermometers' limitations are highlighted (1998, p.782-783). O'Toole (1998, p.782) notes that in two studies, axillary temperatures obtained with a TempaDot thermometer were on average 0.25-0.29 C higher than those obtained with a mercury thermometer. This difference was attributed to the flatter shape of the TempaDot thus allowing it to achieve closer contact with the patient's skin than the mercury thermometer's rounded bulb (O'Toole, 1998, p.783-784). Another limitation of the disposable or single-use thermometer is its inability to record temperatures below 35.5 C (O'Toole, 1998, p.784).

Electronic thermometers and their efficiency are evaluated in recent studies concentrating on new temperature measurement devices. It is suggested by Pontious et al that the ideal position to use such thermometers is in the sublingual pocket as electronic thermometers used in the axilla produce lower measurements than the mercury thermometer (1994, p.121). Similarly, Loveys (1998, p.920) comments on the electronic thermometers insensitivity for detecting fever, achieving 50-70%

accuracy. According to O'Toole (1997, p.784), electronic thermometers can measure temperatures from 26.7 C - 42.2 C which is a greater range than the TempaDot is capable of. This type of thermometer is expensive to buy and can be difficult to place orally due to the weight of the probe, which is attached to a flex (O'Toole, 1997, p.784).

In O'Toole's 1998 publication of temperature measurement devices she states that: "...it is apparent that some devices have been widely researched and others have had little or nothing at all published except for the manufacturer's data sheets (1998, p.786). As previously mentioned, the accuracy of the axillary infrared device cannot be commented on due to lack of research (O'Toole, 1998, p.784). This situation is supported by Loveys (1998, p.920) who also comments on the lack of data analyzing the devices' sensitivity and specificity. Cutter (1994, p.616) comments that consideration should be given to replacing thermometers with the appropriate device in association with extensive education to minimize risks.

The perceived lack of new product information is not conducive to establishing an evaluative culture in the health care setting (Thompson, 1998, p.59). It does appear however, that comparing and contrasting new and established temperature measurement devices is a complicated process with many variables, as Lanham et al comment in their own study: "Variability in research design and inconsistent/mixed findings limit the comparability of this and previous research (1999, p.42)."

Lanham et al, for example describe axillary and oral readings as a reflection of the shell temperature of the body as opposed to measurements of core temperatures which are reflected in rectal and tympanic measurements (1999, p.39). In contrast, Irvin (1999, p.85) states that core temperatures can best be measured in the mouth, rectum and the axilla. Both research articles are 1999 publications and whilst they may have been conducted at differing intervals before publication, such a large discrepancy in definitions reflect the variability associated with measuring temperature.

Despite new developments in temperature taking devices and sites, the oral and axilla temperature-taking methods continue to be comparable to contemporary products such as the infrared tympanic thermometer. It has been demonstrated that axilla and oral measurement devices also continue to evolve with the introduction of the infrared axilla device and single-use and electronic thermometers. Comparing and contrasting new products with established items and each other is problematic due to inconsistencies in both research methods and clinical practice. Continued studies analyzing the accuracy and reliability of different devices in different sites is important however for the encouragement of evidence based practice. Factors such as clinical setting and age group have also been identified as areas that require further investigation to clarify recommendations and to ultimately enhance the deliverance of evidence-based quality care.

## **References**

- Buswell, C., 1997, 'Comparing mercury and disposable thermometers' *Professional Nurse*, vol.12, no.5, pp.359-362.
- Cusson, R., Madonia, J. & Taekman, J., 1997, 'The Effect of Environment on Body Site Temperatures in Full-Term Neonates' *Nursing Research*, vol.46, no.4, pp.202-206.
- Cutter, J., 1994, 'Recording patient temperature - are we getting it right?' *Professional Nurse*, vol.9, no.9, pp.608-616.
- Davis, K., 1993, 'The Accuracy of Tympanic Temperature Measurement in Children' *Pediatric Nursing*, vol.19, no.3, pp.267-271
- Haddock, B., Merrow, D. & Swanson, M., 1996, 'The Falling Grace of Axillary Temperatures' *Pediatric Nursing*, vol.22, no.2, pp.121-124.
- Irvin, S., 1999, 'Comparison of the Oral Thermometer Versus the Tympanic Thermometer' in *Clinical Nurse Specialist*, vol.13, no.2, pp.85-89.
- Lanham, D. & Walker, B., 1999, 'Accuracy of Tympanic Temperature Readings in Children Under 6 Years of Age' *Pediatric Nursing*, vol.25, no.1, pp.39-42.
- Loveys, A., 1998, 'Measuring Temperatures' *Pediatric Infectious Disease Journal*, vol.17, no.10, pp.920-921.
- O'Toole, S., 1998, 'Temperature measurement devices' *Professional Nurse*, vol.13, no.11, pp.779-786.
- O'Toole, S., 1997, 'Alternatives to mercury thermometers' *Professional Nurse*, vol.12, no.11, pp.783-786.
- Thompson, D., 1998, 'Why evidence-based nursing' *Nursing Standard*, vol.13, no.9., pp.58-59.