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OPEN PEER REVIEW

Comparison of Infrared Smart Mobile Phone Thermometer to Non-contact Forehead Infrared Thermometer in Pediatric Emergency Room Patients

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About this report

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1 Original submission

1 comment · 30 May 2024

Referee 1 Reviewer

MAJOR REVISION 30 May 2024

This article is well-structured, presenting a novel comparison between infrared smart mobile phone thermometers (SMT) and non-contact forehead infrared thermometers (NCFIT).
These questions can help stimulate further discussion, provide insight into the study's methodology, and identify potential areas for improvement or future research directions. Please check these questions and adjust the answers in the text of the article to provide clarity for readers:

1. What is the stated temperature accuracy of the devices used in the article? What might be the possible reason for the large difference between devices? Please explain it in the discussion.
2. As the measurement distance increases, the SMT reading decreases and the variance increases. What is the reason for this result?
3. The results indicate a weak correlation between the NCFIT and SMT readings. How do you interpret this weak correlation, and what implications does it have for the potential clinical usability?
4. The cutoff value for SMT was set at 36.15°C. Given this finding, please provide further discussion on the use of SMT for fever screening in pediatric patients and how this might impact clinical decision-making.
5. Do different measurement positions impact the measurement results? Please discuss this further with reference to recent research literature.

There are some grammatical errors:
Line 45 "uses" should be "use"
Line 51 "a SMT" should be "an SMT"
Line 54 "is" should be "are"
Line 75 "from" should be "on"
Line 183 to 185, "Also, fever is defined as a rectal temperature ≥38°C by The American Academy of Pediatrics (AAP) there is no authoritative data for the cutoff point for fever obtained using NCFITs (11). " should be split into "Also, fever is defined as a rectal temperature ≥38°C by The American Academy of Pediatrics (AAP). There is no authoritative data for the cutoff point for fever obtained using NCFITs (11)."
Line 191 "determinating" should be "determining"

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Revision 1

AUTHORS' RESPONSE TO REVIEWERS

Authors' reply to reviewers

The next pages contain the authors' point-by-point reply to the comments of this revision round, as submitted with the revised manuscript. It is published as the authors wrote it.

Dear Reviewers,

Thank you for your comments to improve our article. We are pleased to know that our paper is considered for publication in the Iranian Journal of Pediatrics. Below, you will find point-by-point answers and revisions based on criticism that the referees raised.

Reviewer 1:

This article is well-structured, presenting a novel comparison between infrared smart mobile phone thermometers (SMT) and non-contact forehead infrared thermometers (NCFIT).

These questions can help stimulate further discussion, provide insight into the study's methodology, and identify potential areas for improvement or future research directions. Please check these questions and adjust the answers in the text of the article to clarify the readers:

1. What is the stated temperature accuracy of the devices used in the article? What might be the possible reason for the large difference between devices? Please explain it in the discussion.

The stated temperature accuracy of NCFIT is between range 32.0°C–42.9°C; while for SMT range is 32.0°C–42.0°C (Please see methods section).

Possible reason for the large difference between devices discussed (Please see discussion section)

2.As the measurement distance increases, the SMT reading decreases and the variance increases. What is the reason for this result?

Infrared thermometers have decreasing accuracy as distance increases. The factors that are thought to cause this are angular field of infrared thermal imager, difference between body temperature and ambient temperature, and atmospheric transmittances (Please see discussion section)

3.The results indicate a weak correlation between the NCFIT and SMT readings. How do you interpret this weak correlation and what implications does it have for the potential clinical usability.

The measurements of SMT from distances 2 and 8 cm are correlated so the device is consistent in its measurements, but SMT and NCFIT measurements are not correlated. This is probably due to the different angular field of infrared thermal image of the devices. We think that it will be valuable in clinical use for families to detect deviations in their children's baseline measurements, follow-up for antipyretic usage and to monitor different fever levels. (Please see both the conclusions in abstract and discussion sections)

4.The cut-off value for SMT was set at 36.15°C. Given this finding, please provide further discussion on the use of SMT for fever screening in pediatric patients and how this might impact clinical decision-making.

Both the results of the device at different cut-off values and the possible reflection of this in daily use are included in the result and discussion section. Thanks

5. Are there different measurement positions impact the measurement results? Please discuss this further with reference to recent research literature.

While using NCFIT, the device should point directly at the center of the person’s forehead and not at an angle. Especially in infancy, it is possible that the patient may have moved during the measurement that can affect the accuracy of the measurements. (Please see discussion section)

There are some grammatical errors:

Line 45 "uses" should be "use"

Spelling mistakes was corrected. Thanks

Line 51 "a SMT" should be "an SMT"

Spelling mistakes was corrected. Thanks

Line 54 "is" should be "are"

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It was corrected

Line 191 "determinating" should be "determining"

Spelling mistakes was corrected. Thanks

Reviewer 2:

Thank you for considering me as a reviewer for your prestigious journal. The study compares body temperature measurements using a non-contact forehead infrared thermometer (NCFIT) and an infrared smart mobile phone thermometer (SMT) in pediatric emergency room patients. This is an important and relevant topic, as accurate temperature measurement is crucial in assessing febrile illness in children.

Overall, this appears to be a well-conducted study that raises important concerns about the accuracy of the SMT in detecting febrile temperatures compared to NCFIT in children. The authors conclude that while the SMT may be useful for monitoring basal temperatures, it should be used cautiously for fever screening in pediatric patients. Their findings and conclusions seem reasonable based on the data presented.

However, the lack of a true reference standard is a significant limitation, as is the fact that adults were not included. Additionally, using a lower fever cut-off based on certain guidelines may have yielded different results for the SMT's performance. But overall, this manuscript provides valuable data on the limitations of smartphone thermometers that should be considered prior to adopting their use clinically, especially for fever detection in children.

Methods:

- Lack of a true reference standard (e.g. rectal temperature) to validate measurements

Although rectal measurement is a true reference standard in children, it was not used in the study due to ethical concerns because it is not recommended in routine practice. This is included as a limitation

- Limited to the pediatric population, no data on adults

In our study, the pediatric age group seen in the emergency department was targeted and 1116 children were included, adults were not included, the results can not apply to the general population and are limited to pediatric patients. Throughout the article, it was mentioned that the study results could be attributed to the pediatric patient group.

We added this evaluation as a limitation of our study (Please see discussion)

- Not accounting for potential confounders like ambient temperature/humidity

The ambient temperature and humidity levels were not included in the study, but the measurements of both devices were made in the same room and immediately after each other, suggesting that the difference between the two devices cannot be caused by this. We added this evaluation as a limitation of our study (Please see discussion)

- Cut-off for fever based on 38°C, which may be too high based on some guidelines

Cut-off value 38°C is based on the CDC guideline ‘General Instructions: how to use an infrared thermometer’.

Reference number 11 : Lai F, Li X, Wang Q, Luo Y, Wang X, Huang X, et al. Reliability of Non-Contact Infrared Thermometers for Fever Screening Under COVID-19. Risk Manag Healthc Policy. 2022;15:447-456.

Cut-off for fever varies in articles, if lower cut off measurements are taken, the probability of the device detecting fever may increase, but it does not change the fact that there is a statistical difference in the measurements between the two devices.

We added this evaluation as a limitation of our study (Please see discussion)

New data was also generated by taking different fever threshold levels such as 37.5°C and 36.65°C based on literature and reviewer suggestions. (Please see result section)

- Limited to a single center

Despite being a single center, we have a high number of patients. We added this evaluation as a limitation of our study (Please see discussion)

Results:

The biggest weakness is the lack of a true reference or "gold standard" measurement of core body temperature to compare the NCFIT and SMT readings against. Without this, it is difficult to definitively conclude which device is more accurate.

Although rectal measurement is a true reference standard in children, it was not used in the study due to ethical concerns because it is not recommended in routine practice. This is included as a limitation

Discussion:

- More context on why a 1.2°C difference between NCFIT and SMT is clinically significant.

Difference between devices considered statistically, not clinically, significant. However, it was noted in the discussion that the difference between the two device is greater than 1°C, which is above the ±0.5 limit accepted in the literature. (please see discussion section)

- Discussing the potential impact of using a lower fever threshold (e.g. 37.5°C) on the findings

In addition, threshold values ≥36.65°C stated in the study of Lai et al. and ≥37.5°C were also taken for comparison.

When the threshold values for fever was taken as 36.65°C, NCFIT detected fever in 545 patients, while SMT detected fever in 26 patients; when the threshold values was taken as 37.5°C, NCFIT detected fever in 68 patients while SMT detected fever only in one patient. Also, the cut-off values for SMT with their sensitivity and specificity are also given in Results section (Table 3 is updated). (Please see results and methods section)

- Addressing generalizability to other populations (adults, different settings)

The results can not apply to the general population and are limited to pediatric patients. Throughout the article, it was mentioned that the study results could be attributed to the pediatric patient group This is included as a limitation

- Comparing their findings to prior studies evaluating NCFIT accuracy.

We compare our findings and add new articles (Please see in discussion section)

- Discussing practical implications - under what circumstances the SMT may still be acceptable to use.

Nevertheless, the fact that the measurements in the SMT device are consistent within itself raises the possibility of using this device for follow-up purposes for families who know basal body temperature measurement (Please see discussion section)

We thank the editorial board and the reviewers for their time and constructive comments. With the above-mentioned revisions which undoubtedly improved the manuscript, we hope that it is now suitable for publication.

Best regards

2 Revision 1

0 comments

No public comments in this round.