Evaluating High Frequency Remote Monitoring of Temperature Using Wireless Temperature Sensor Patches Versus Standard-of-Care Temperature Monitoring in Cancer Patients

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Introduction

- Patients undergoing chimeric antigen receptor transplants (CAR-T) or hematopoietic stem cell transplant (HCT) are at a significantly higher risk for fever-related sequelae.
- Quicker medical action on febrile immunocompromised patients has been shown to have positive benefit on morbidity and mortality in these patients, with an optimal window of under one hour from fever detection to intervention[1,2]
- The current standard of care (SOC) is for vitals, including temperature and blood pressure, to be checked on a four hour basis or per patient request as stated by CAR-T and HRT guidelines developed in 2018[3,4].
- FDA-approved high frequency remote monitoring temperature patches, like TempTraq® from BlueSpark Technologies are able to record temperatures every two minutes.

Aims and Objectives

1) To determine if data collection using patient applied high frequency remote monitoring temperature patches would provide more data points than the current standard of care for cancer patients.

Methods

This was a secondary analysis of a prospective study of 61 patients undergoing CAR-T (n=22) or HCT (39) therapy in the inpatient setting who were undergoing at least one week of inpatient monitoring. Patients were given an FDA-approved high frequency remote monitoring (HFRM) wearable sensor (TempTraq®, BlueSpark Technologies) to be worn in their axilla vertically or horizontally. They were instructed to replace the patch every twenty four hours, and data was transmitted from the patches using an in-room proprietary router device to a HIPAA-compliant cloud-based server. The patches transmitted data every 2 minutes. Each count of temperature measurement was noted and compared to total temperature measurement counts pulled from the medical record.

Both HFRM and SOC temperature counts from all patients were averaged and plotted as box plots (Figure 2). HFRM and SOC counts were also broken down into 7 day periods and averaged. Those numbers were then compared using a two variable t test assuming unequal variance and corrected for using a Bonferroni equation assuming a p value of <0.05 (Figure 3).

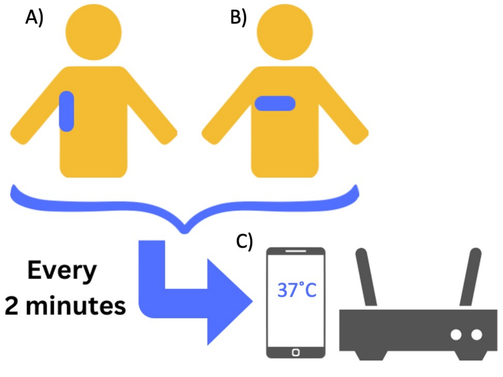

Figure 1. Method of high frequency remote monitoring patches data compilation. Patients were instructed on how to place TempTraq® patches in the axilla in either a vertical (A) or horizontal (B) manner, per product specifications. When activated, the patches transmitted temperatures every two minutes to a HIPAA-certified cloud-based server via phone application or specialized gateway router (C).

Results

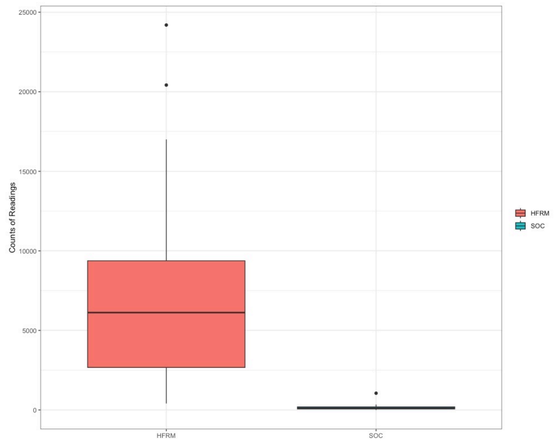

Figure 2. Analyzing average frequency of HFRM and SOC temperature counts. Temperature counts were counted from the HFRM patch server and SOC counts from medical records. The total number of counts per patient were analyzed and compared between the two methods.

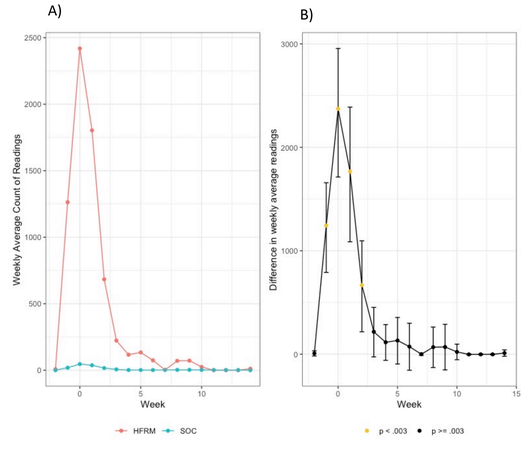

Figure 3. Determining significance of counts per week. The number of counts of HFRM and SOC for every patient, per week, were averaged and plotted (A). The data was then compared using a two sample T test assuming unequal variance, assuming a p value of <0.05 and adjusted using a Bonferroni correction for the 17 tests conducted, resulting in a p value of <0.003. These were plotted on the difference between HFRM and SOC values (B).

Conclusions

- The average number of counts for HFRM was significantly higher than the SOC over a 14 week course.
- In weeks -1-3, wearing a HFRM was shown to have statistically higher counts than SOC, perhaps showing that HFRM might be a better method for developing a more accurate representation of fever in patients undergoing CAR-T or HCT therapy. This is especially relevant considering the risk of infection in the first few weeks after CAR-T or HCT therapy.
- Some difficulties with HFRM devices discovered during this study, including proper device placement, patch adhesion during febrile events, and patient adherence to patch wearing. Additionally, collecting data with a patient's phone was found to be significantly more difficult than installing a Gateway router, limiting the level of data collection that could be done in the home environment.
- Future studies could attempt to show links between the frequency of counts and earlier detection of fever, and decreasing adverse outcomes for patients undergoing CAR-T or HCT therapy. Increasing the number of patients in the study would also help to increase the power of the study.

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