HARNESSING PHYSIOLOGICAL DATA FOR EARLY WARNING OF THREAT EXPOSURE

Wearables Detect Malaria Early In A Controlled Human-infection Study

Jaques Reifman U.S. Army Medical Research and Development Command **Sidhartha Chaudhury** Center for Enabling Capabilities, Walter Reed Army Institute of Research **Chenggang Yu** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. **Ruifeng Lu** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. **Kamal Kumar** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. **Samantha Hornby** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. **Christopher Duplessis** Malaria Department, Naval Medical Research Center **Joel Sklar** Malaria Department, Naval Medical Research Center **Judith Epstein** Malaria Department, Naval Medical Research Center, USA

Objective: Observational studies on the use of commercially available wearable devices for infection detection lack the rigor of controlled clinical studies, where time of exposure and onset of infection are exactly known. Towards that end, we carried out a feasibility study using a commercial smartwatch for monitoring heart rate, skin temperature, and body acceleration on subjects as they underwent a controlled human malaria infection (CHMI) challenge.

Methods: Ten subjects underwent CHMI and were asked to wear the smartwatch for at least 12 hours/day from 2 weeks pre-challenge to 4 weeks post-challenge. Using these data, we developed 2B-Healthy, a Bayesian-based infection-prediction algorithm that estimates a probability of infection. We also collected data from eight control subjects for 4 weeks to assess the false-positive rate of 2B-Healthy.

Results: Nine of 10 CHMI subjects developed parasitemia, with an average time to parasitemia of 12 days. 2B-Healthy detected infection in seven of nine subjects (78% sensitivity), where in six subjects it detected infection 6 days before parasitemia (on average). In the eight control subjects, we obtained a false-positive rate of 6%/week.

Conclusion: The 2B-Healthy algorithm was able to reliably detect infection prior to the onset of symptoms using data collected from a commercial smartwatch in a controlled human infection study.

Significance: Our findings demonstrate the feasibility of wearables as a screening tool to provide early warning of infection and support further research on the use of the 2B-Healthy algorithm as the basis for a wearable infection-detection platform.

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