RESEARCH NOTE

Vasomotor symptoms monitoring with a commercial activity tracking watch [version 1; referees: awaiting peer review]

Darrell O. Ricke

Group 48 Bioengineering Systems and Technologies, MIT Lincoln Laboratory, 244 Wood Street, Lexington, MA, 02420-9108, USA

Abstract

Personal fitness/health tracking devices that include electrodermal activity sensors enable tracking of vasomotor symptoms (hot flashes). Multiple conditions are associated with vasomotor symptoms. This article describes nighttime tracking of vasomotor symptoms for an individual over a two-year period. This volunteer was a participant in a longitudinal study on volunteers wearing physiological monitors. Personal tracking of vasomotor symptoms will provide new insights on the differences between conditions and impacts on individual's health.

Corresponding author: Darrell O. Ricke (Darrell.Ricke@ll.mit.edu)

Author roles: Ricke DO: Conceptualization, Data Curation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Project Administration, Resources, Software, Supervision, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

How to cite this article: Ricke DO. Vasomotor symptoms monitoring with a commercial activity tracking watch [version 1; referees: awaiting peer review] F1000Research 2017, 6:2155 (doi: 10.12688/f1000research.13348.1)

Copyright: © 2017 Ricke DO. This is an open access article distributed under the terms of the Creative Commons Attribution Licence, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Grant information: This material is based upon work supported by the Assistant Secretary of Defense for Research and Engineering under Air Force Contract No. FA8721-05-C-0002 and/or FA8702-15-D-0001. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Assistant Secretary of Defense for Research and Engineering. Assistant Secretary of Defense for Research and Engineering has no involvement in this report.
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Introduction

Continuous tracking of electrodermal activity (EDA), also known as galvanic skin response (GSR), values with commercial fitness devices for individuals with vasomotor symptoms (hot flashes) provides a path forward for future studies with fine resolution monitoring. This can improve upon the current reliance on the use of personal diaries (Regestein et al., 2015). There are multiple conditions associated with vasomotor symptoms including menopause/early menopausal transition (Hale et al., 2014), medications (Quinestrol, tramadol, etc.), chemotherapy and Tamoxifen, hyperthyroidism, infections (Inflammatory Bowel Disease – IBD, etc.), and more. Multiple studies have characterized hot flashes in premenopausal and menopausal women using self reported methods, laboratory polysomnographic recording, and some specially designed devices (Freedman, 2014). However, it is difficult for an individual to track and accurately report nighttime vasomotor symptoms without the aid of a physiological monitoring device (Freedman, 2014). Emerging commercial and custom devices with EDA meters will greatly facilitate the nighttime monitoring of hot flashes for individuals for more informative longitudinal studies of conditions with associated vasomotor symptoms. This report illustrates the potential fine-resolution monitoring of nighttime vasomotor symptoms using commercially available activity-tracking devices with an EDA sensor.

Methods

MIT Lincoln Laboratory conducted a longitudinal study on volunteers wearing physiological monitors (June 15 2014 to October 2 2016). The study protocol and written consent form were reviewed and approved by the MIT Committee on the Use of Humans as Experimental Subjects (COUHES). The commercial devices in the study include the Basis B1 watch and Basis Peak watch monitors for tracking heart rate, sleep with predicted sleep phases (light, deep, and REM – rapid eye movement), activity, skin temperature, and perspiration (EDA/GSR) without the use of electrodes or gel. The Basis B1 and Peak watches are no longer commercially available, but similar devices with EDA/GSR sensors are available.

Vasomotor symptoms started disrupting the sleep of a female volunteer on November 23, 2015, calling attention to their occurrence. After November 23, 2015, the volunteer started personally logging the occurrence of vasomotor symptoms, noting that the recorded EDA signals reflected the logged hot flash intensities and durations.

Results

Figure 1 shows data from eight days around this time period. Freedman (Freedman, 1989) identified a good agreement between an increase of 2 μS/cm in 30 s time period with volunteer

![Figure 1](image_url). Eight nights illustrating nighttime hot flashes tracked with Basis Peak watch. Vertical axis shows EDA values in μS/cm.
self-reports for vasomotor symptoms. For November 15\textsuperscript{th}, the EDA median value was 6.8e-4 μS/cm and average value of 4.9e-2 μS/cm. For November 16\textsuperscript{th}, the EDA median value was 6.8e-4 μS/cm and average value of 1.9e-2 μS/cm. Across all nights tracked, the EDA median value was 3.7e-4 μS/cm illustrating baseline EDA values for this volunteer. The longitudinal data collected indicates that the volunteer’s vasomotor symptoms may have been occurring as early as June 2014, but went unnoted until higher intensity vasomotor symptoms caused sleep disruptions. A review of all sleep time data indicates an increase in sleep interruption minutes as reported by Basis (52/1957=2.9% for EDA range 10-15 μS/cm and 15/311=4.8% for EDA range 15-25 μS/cm compared to 3823/258119=1.5% for EDA < 1 μS/cm). This is consistent with volunteer observations. Nights like November 23 and 24, 2015 cause sleep disruptions. Figure 2 illustrates over two years of nighttime EDA values while this volunteer was sleeping. Starting in December 2015, the volunteer started self-tracking EDA values and vasomotor symptoms. Daytime peaks were associated with both exercise and vasomotor symptoms. The volunteer reports that daytime vasomotor symptoms and sleep-disrupting vasomotor symptoms were consistent with recorded EDA peaks but they did not record these observations. Nighttime EDA peaks well above baseline values were observed in clusters from June 2014 until November 2016. Note that nights with low EDA values still occur frequently for this volunteer, indicating nights free of vasomotor symptoms. The volunteer did not take hormone or

![Figure 2. Volunteer’s nightly Basis watch EDA values for 1.5 years.](image-url)

Heatmap of each minute of volunteer’s nighttime Basis EDA values tracked with Basis B1 or Basis Peak watch and line plot of nightly maximum EDA values in μS/cm.
Discussion
Longitudinal studies of large numbers of volunteers will provide new foundations for tracking vasomotor symptoms associated with menopause and other conditions. Continuous tracking of EDA values with readily available commercial tracking devices will provide a path forward for future fine-resolution longitudinal studies of conditions associated with vasomotor symptoms. Insights into understanding and treating vasomotor symptoms will be greatly advanced by these longitudinal studies, as the different causes of vasomotor symptoms may vary in intensities and durations. EDA is also reported as a sensitive index of sympathetic nervous system activity (Poh et al., 2010). In addition, commercial devices with EDA meters will be valuable personal monitoring tools to premenopausal and menopausal women and individuals experiencing vasomotor symptoms.

Data availability

Consent
Written informed consent was obtained from the volunteer for the publication of her details.

Competing interests
No competing interests were disclosed.

Grant information
This material is based upon work supported by the Assistant Secretary of Defense for Research and Engineering under Air Force Contract No. FA8721-05-C-0002 and/or FA8702-15-D-0001. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Assistant Secretary of Defense for Research and Engineering. Assistant Secretary of Defense for Research and Engineering has no involvement in this report.

The funder had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Acknowledgments
I thank Emily Simons for graphics layout support and Paula Collins for careful review of this manuscript.

References


Page 4 of 5
The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com