Assessing User Experience on Fitbit Sleep Data Visualization: A Pilot Study

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Introduction

The collection of patient-generated health data (PGHD) has become more common through smartphone apps and wearables.[1] One such device is the Fitbit wearable watch, which measures several types of health data including time in activity, sleep, and other specific health metrics such as breathing rate, heart rate variability, skin temperature, and resting heart rate. To help users manage and comprehend their health data, the watch syncs with the Fitbit app and displays the recorded health data in visualizations. However, a gap exists in evaluating the true usefulness of the visualizations that the Fitbit app generates. This study and addressed the gap by collecting user feedback with a specific focus on Fitbit data visualizations to identify areas of improvement.

Methods

Five participants from the Medical Sciences Baccalaureate Program (MSBP) at the University of Cincinnati (UC) College of Medicine were recruited via convenience sampling for two rounds of sleep data collection using a Fitbit Inspire 2 watch. These pre-medicine undergraduate college students were chosen because they had previously participated in our Sleep and Well-being survey. Three participants participated in each round of data collection for two weeks. The first round was conducted in March 2022 and the second was conducted in July 2022. One of the participants was repeated and participated in both rounds of data collections to observe any changes between the two rounds. After data collection, an online focus group and semi-structured interviews were conducted in the first and second round, respectively, to understand the participants' user experience and opinions toward the Fitbit sleep data visualization. Of note, focus groups are a qualitative user research method initiating a discussion between several participants to gather their insights on a specific topic.[2] Comments from both methods were combined to assess user feedback in four areas: (1) User awareness of sleep quality before using the Fitbit device, (2) User comprehension of the sleep data displayed in app visualizations, (3) User satisfaction level with the app visualization, and (4) Proposed changes after using the sleep tracking device. Participant feedback was reviewed, broken down into multiple pieces, and recorded on virtual sticky notes on the online platform "Miro" (www.miro.com). Relevant ideas were then clustered into groups based on similarities by the lead designer (2nd author CT). Groupings related to negative experiences were categorized as user pain points, and groupings related to positive feedback were categorized as sweet points. In order to understand the usefulness of the visualizations provided by Fitbit, the themes of current Fitbit use were used to inform several design suggestions to improve Fitbit sleep data visualization. The themes and design proposal were reviewed for accuracy and quality by two other master level design researchers in the last author's lab.

Results

Participants were generally satisfied with the Fitbit sleep data visualizations (Figure 1). Five major sweet points were determined from the affinity diagramming: (1) Most of the data shown in the app interface is understandable to users; (2) The displayed sleep score is a simple way to quickly gauge the sleep quality; (3) Sleep stage breakdown and summary statistics are helpful to understand sleep patterns; (4) The sleep score trend graph is a useful comparison tool between nights of sleep; and (5) The data visualizations on the app are generally aesthetically appealing. On the other hand, four major pain points were also determined as listed in Table 1. Based on these pain points, four suggestions were proposed to improve the interface design and the overall user experience (Figure 2). First, adding user training materials (e.g., tutorials) and making the materials highly accessible on the interface could help users understand essential terms and learn how to comprehend the visualizations. Second, the composition of the sleep scores can be displayed by graphics (e.g., a pie chart) instead of text-only to improve the score interpretability. Third, the Fitbit app can better aid in sleep pattern comprehension by adding benchmarks for Heart Rate and Time Asleep charts. Finally, the app can show recommendations and actionable information to encourage users to improve their poor sleep scores.

Discussion

While data visualization has a great potential to make positive impact on laypersons' understanding of their PGHD, as shown in this pilot study, some visualizations left users with more questions. Based on our findings, design recommendations were proposed to improve the usability, usefulness, and comprehension of Fitbit sleep data visualization, most applicable in research settings to support PGHD collection and analysis, for example with a customized dashboard. Our future work includes conducting a more rigorous evaluation to collect user feedback,

expand the scope to other types of PGHD, and developing separate Fitbit data dashboards for various user groups (researchers, clinicians, and patients) with machine intelligence to support research project conduction, shared decision making, and self-care management.

Table 1. Users' pain points determined from affinity diagramming.

Pain points	Descriptions	Suggestions and Proposals (Figure 2)
Explanations for the sleep data take users too many steps to access	The Fitbit app does provide explanations. However, it takes too many steps to access them. Some users won't find answers proactively and might not have the patience to read the text explanation.	Provide tutorials on users' first time entering the sleep section of the app. Also, the tutorial could be activated any time users wish to understand their sleep score.
The calculation of sleep scores is unclear to the users	Even though Fitbit claims the sleep score is calculated based on Time asleep, Deep and REM, and Restoration, users don't know the calculation details. Therefore, users are confused about: How are the sleep score numbers generated? How is the heart rate transferred into a number and included in the sleep score? Why did the sleep score worsen even if the user slept more the previous night? What's different between 80 and 83 as both are in the "Good" range?	Display and explain the composition of the sleep score in a simple way in order to make it more understandable.
Users are unsure of what a baseline sleep pattern is	Though the app includes the benchmark for sleep stages, users don't know what a standard sleep pattern is. If they got a bad sleep score, how does it compare with sleep quality? Does it calculate depending on gender, age, or weight?	Let the user know whether their sleep pattern is typical or not through benchmarks. Additionally, add benchmarks for heart rate and sleep time charts and describe how the benchmark is generated.
Users are unsure of how to improve their sleep scores	After receiving the sleep score, users have no idea how to increase their score. Users would like to get some instructions for improving their sleep quality. Though there are some tips on the app, they're not customized and hard to find.	1. Give recommendations with actionable information to improve sleep scores. 2. Provide individualized tips that users can follow to improve sleep quality instead of just showing sleep data. 3. Recommend professional consulting resources to give users accurate knowledge to improve sleep.

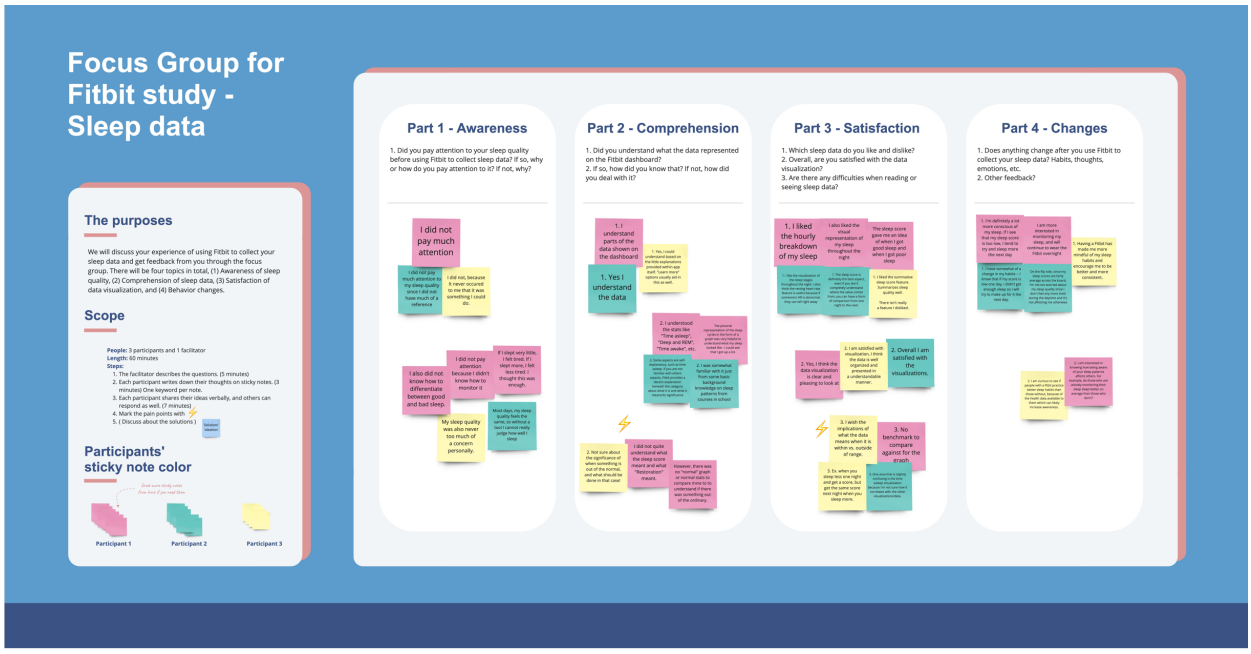

Figure 1. Focus group Miro board discussion

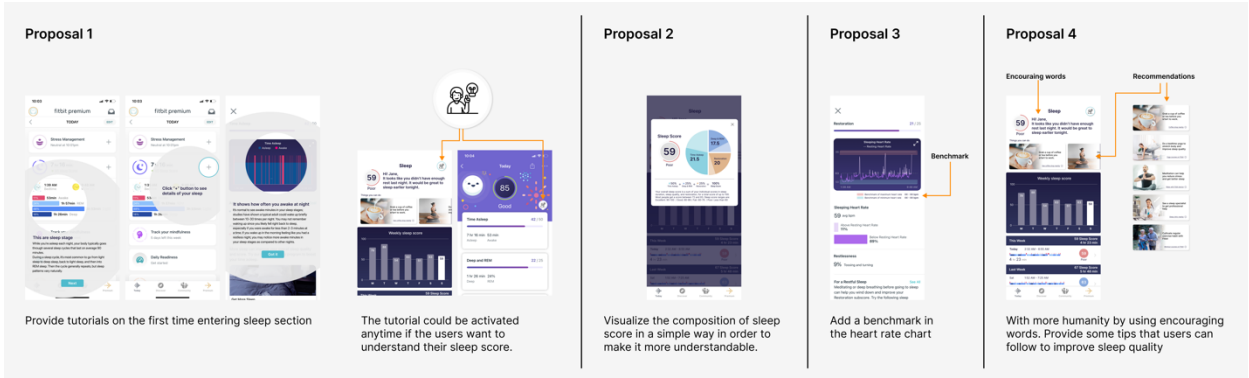

Figure 2. Design proposals for Fitbit app visualization improvements corresponding to each pain point

References

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