

## Topic: Design Matters: The Impact of Soft Factors on Adherence to Wearable Devices in Medical Trials

Design ist wichtig: Der Einfluss von Soft-Faktoren auf die Adhärenz von tragbaren Geräten in medizinischen Studien

Wearable technologies, including smartwatches, are becoming an increasingly important tool in clinical trials, offering new opportunities for more continuous and detailed observation of patient health data [1]. For example, by leveraging data from consumer fitness trackers and applying advanced data analytics techniques such as machine learning, these devices have shown promise in predicting clinical outcomes related to inflammation, infection and insulin sensitivity, facilitating personalised healthcare interventions [2].

However, the integration of wearables into clinical and fitness applications is often challenged by low engagement and high dropout rates, which can compromise the reliability and completeness of data collected by these devices [3,4]. Although often seen as an unavoidable downside of using wearables [5], there may be multiple factors, including soft factors such as wearability, placement on the body and aesthetic issues, that influence device adherence [6]. Soft factors in this context can be defined as subjective, non-technical considerations that affect the usability or attractiveness of a product. Despite its importance, there is no research evaluating the effect of specific soft factors on adherence in medical trials. Although their focus was on activity trackers for general fitness and not for use in medical trials, Shih et al. [3] are the only ones to at least scratch this topic.

This work aims to identify and understand specific soft factors that affect long-term use, dropout rates and study adherence, with the aim of identifying potential strategies that could mitigate these challenges and improve the deployment of wearable technologies in future clinical trials.

In the light of that objective, this work consists of the following parts:

- Research on literature regarding wearables in clinical trials with a particular focus on soft factors and dropout rates.
- Develop and conduct a study with at least 20 participants investigating the influence of soft factors on trial adherence of at least four different smartwatches. Gather the subjective experiences of the participants through interviews or questionnaires.
- Collect and analyse real-world usage directly from the smartwatches, especially the duration and time of when the smartwatch is taken off.

The thesis must contain a detailed description of all developed and used algorithms as well as a profound result evaluation and discussion. The implemented code has to be documented and provided. An extended research on literature, existing patents and related work in the corresponding areas has to be performed.

**Advisors:** Madeleine Flaucher, M. Sc., Michael Nissen, M. Sc.,  
Dr. Heike Leutheuser, Prof. Dr. Bjoern Eskofier

**Student:** Benedikt Mader

**Start – End:** 01.03.2024 – 01.09.2024

## References

- [1] Ali K. Yetisen, Juan Leonardo Martinez-Hurtado, Barış Ünal, Ali Khademhosseini, and Haider Butt. Wearables in Medicine. *Advanced Materials*, 30(33):1706910, 2018. \_eprint: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/adma.201706910>.
- [2] Jessilyn Dunn, Ryan Runge, and Michael Snyder. Wearables and the medical revolution. *Personalized Medicine*, 15(5):429–448, September 2018.
- [3] Patrick C. Shih, Kyungsik Han, Erika Shehan Poole, Mary Beth Rosson, and John M. Carroll. Use and Adoption Challenges of Wearable Activity Trackers. *iConference 2015 Proceedings*, March 2015. Publisher: iSchools.

- [4] Ulrikke Lyng Beauchamp, Helle Pappot, and Cecilie Holländer-Mieritz. The Use of Wearables in Clinical Trials During Cancer Treatment: Systematic Review. *JMIR mHealth and uHealth*, 8(11):e22006, November 2020. Company: JMIR mHealth and uHealth Distributor: JMIR mHealth and uHealth Institution: JMIR mHealth and uHealth Label: JMIR mHealth and uHealth Publisher: JMIR Publications Inc., Toronto, Canada.
- [5] Gunther Eysenbach. The Law of Attrition. *Journal of Medical Internet Research*, 7(1):e402, March 2005. Company: Journal of Medical Internet Research Distributor: Journal of Medical Internet Research Institution: Journal of Medical Internet Research Label: Journal of Medical Internet Research Publisher: JMIR Publications Inc., Toronto, Canada.
- [6] Alexandros Pantelopoulos and Nikolaos Bourbakis. A survey on wearable biosensor systems for health monitoring. In *2008 30th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, pages 4887–4890, Vancouver, BC, August 2008. IEEE.