

The User, the Watch, and the Bestseller: Study on the Utilization of Smart Medical Wearables and Their User Manuals

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Abstract. In this paper, we present a study on the utilization of smart medical wearables and the user manuals of such devices. A total of 342 individuals provided input for 18 questions that address user behavior in the investigated context and the connections between various assessments and preferences. The presented work clusters individuals based on their professional relation to user manuals and analyzes the obtained results separately for these groups.

Keywords. Smart medical wearables, user manuals, user study

1. Introduction

User manuals provide an essential guidance to the installation and utilization of modern consumer devices, yet they are also known as the “bestseller that no one reads” [1], as many individuals refrain from accessing them. At the time of writing this paper, regional and international regulations make it mandatory that all consumer devices are accompanied by user manuals (e.g., Guide of the Machinery Directive 2006/42/EC [2] in the EU). User manuals may be particularly impactful to the device they are shipped with, as their quality metrics may significantly affect perceived product quality [3].

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Among modern consumer devices, smart wearables have gained notable popularity over the recent years. This is particularly applicable to smart medical wearables, as citizens are becoming more conscious of their health and wellbeing. However, due to their increasing complexities and new functionalities, users may potentially access their user manuals more. According to a 2018 study in Bangladesh [4], more than 42% of the test participants stated that a user manual or external assistance might be needed to fully understand the functionalities of wearable devices in general. The work of Lowndes et al. [5] particularly emphasizes the importance of manuals for medical wearables. In this paper, we study how users interact with smart medical wearables and their user manuals.

2. Methods

The study was carried out as a questionnaire, following the methodology of our earlier work [6]. We collected demographic information (i.e., age and gender), as well as clustered the individuals based on their connection to user manuals: either user, professional user of such technical documentation (e.g., product developer), or technical writer (i.e., someone who creates user manuals). The 18 questions – regarding which every single individual provided input – were the following: Q01: Do you wear and use smart medical wearable devices for sleeping? Q02: Do you wear and use smart medical wearable devices for sports and training? Q03: Do you wear and use smart medical wearable devices during work? Q04: Do you wear and use smart medical wearable devices for other activities? Q05: Do you use smart medical wearable devices for sleep monitoring? Q06: Do you use smart medical wearable devices for heart rate monitoring? Q07: Do you use smart medical wearable devices for step counting? Q08: Do you use smart medical wearable devices for ECG monitoring? Q09: Do you use smart medical wearable devices for blood oxygen level measurement? Q10: Why do you usually open the user manual? Q11: What user manual format do you prefer? Q12: Where do you primarily seek information in the user manual? Q13: How intuitive do you find your smart medical wearable devices? Q14: How easily do you find what you're looking for in the user manual? Q15: How satisfied are you in general with the user manuals of smart medical wearable devices? Q16: If you encounter any abnormal medical value/measurement, how likely is it that you access the user manual for medical information? Q17: Do you find it acceptable to purchase a smart medical wearable device without a printed user manual? Q18: During the complete life cycle of the device, how many times do you access the user manual?

Questions Q01 to Q09 had binary answers (A1: no; A2: yes). The options for Q10 were A1: for health concerns; A2: to explore novel functionalities; A3: to customize the device; A4: to reset the device; A5: for troubleshooting; A6: other reason. For Q11, A1: printed; A2: PDF; A3: static HTML; A4: interactive HTML. For Q12, A1: in texts; A2: in figures. From Q13 to Q17, each had five symmetric options, with a neutral choice in the middle. For Q13, A1: completely unintuitive; A2: unintuitive; A3: neutral; A4: intuitive; A5: completely intuitive. The rest followed this logic, ranging from difficult / dissatisfied / unlikely / unacceptable to easy / satisfied / likely / acceptable. The input for Q18 was an integer. If an individual usually does not access the user manual at all for such devices (e.g., out of three devices, only accessed it for one), then the input was 0.

3. Results and discussion

A total of 342 individuals provided input for the 18 questions. 174 were male, 166 were female, and 2 identified as “other”. The average age of the individuals was 32, ranging from 18 to 88. 172 were users, 88 were professionals, and 82 were technical writers. We collected data from Austria, China, France, Germany, Hungary, Italy, Montenegro, Poland, Sweden, the UK, and the US. The obtained results are summarized in Table 1 – apart from Q18, for which the input was numerical, and not a set of options.

Table 1. Summary of the results.

	A1	A2	A3	A4	A5	A6
Q01	39.18%	60.82%				
Q02	31.58%	68.42%				
Q03	29.82%	70.18%				
Q04	44.44%	55.56%				
Q05	55.26%	44.74%				
Q06	25.15%	74.85%				
Q07	29.53%	70.47%				
Q08	21.35%	78.65%				
Q09	16.96%	83.04%				
Q10	11.4%	24.27%	10.82%	19.3%	22.81%	11.4%
Q11	20.76%	31.58%	28.36%	19.3%		
Q12	66.67%	33.33%				
Q13	2.92%	10.82%	25.15%	43.86%	17.25%	
Q14	4.97%	10.23%	23.1%	43.57%	18.13%	
Q15	7.6%	9.65%	23.39%	42.4%	16.96%	
Q16	4.97%	7.6%	21.64%	48.83%	16.96%	
Q17	8.77%	11.11%	20.76%	20.18%	39.18%	

For Q18, the mean value was 2.77, which did not deviate much between the three groups (2.71, 2.89, and 2.77, respectively). Only a single individual responded with 0, yet still had experience with the user manuals of such devices, and thus could provide valid answers. Due to the diversity of answers within the groups for Q18, there were no strong correlations between the mean values and the answers for the other questions. More than 97% of the answers for Q18 were between 1 and 5, with 1 as the most common answer (33.33%), followed by 3 (20.18%), 4 (16.96%), 2 (13.74%) and 5 (13.16%).

The results show that only 73.56% of those who wear such devices to bed use it for sleep monitoring (for the groups, 72.12%, 82%, and 68.52%, respectively). While some of the individuals revealed that they use it for other functions (e.g., alarm), systematic analysis of this phenomenon should be conducted in future work. From the different medical functions, the measurement of blood oxygen level is by far the most common. This can be easily explained by the COVID-19 pandemic and the era of wearing masks on a daily basis. Regarding the reason to access user manuals, exploring novel functionalities and troubleshooting lead the list, which is in alignment with previous results on smart wearable devices [6]. As for the format, PDF and static HTML are the most popular. Twice as many individuals seek information in the text than in figures, and the rate for figures drops to 25.3% when exploring novel functionalities is the primary reason, while it is 38.46% for troubleshooting. From Q13 to Q16, the answers are typically on the positive domain of the scale (i.e., A4 and A5), and the statistical analysis indicates no significant difference between the groups. Q17 reveals that the vast majority of individuals finds it acceptable to purchase a smart medical wearable device without a printed user manual. If we assign numerical values between -2 and 2 to the options, then the group means are 0.65, 0.63, and 0.89 – which means that this is mostly supported by

those who actually create such documents. Clustered by format preferences, the means for Q17 are 0.69, 0.96, 0.66, and 0.33, respectively, and these differences are statistically significant ($p < 0.01$) when analyzed by a two-tailed t-test.

4. Conclusions

In this paper, we presented our work on smart medical wearables and their user manuals. The results demonstrate notable deviation within the groups, signifying the diversity between the reported personal preferences of individuals, yet indicate statistically significant differences when clustered by specific choices, such as preferred user manual format. The obtained data shows that many individuals wear such devices for sleeping, yet not necessarily for sleep monitoring. The most popular function is the measurement of blood oxygen level. Although a high percentage of individuals is satisfied with these devices and their user manuals, an even higher percentage do not deem the printed format of such documents necessary. A particularly interesting finding of this work is that out of the 342 individuals, only the habit profile of a single person omits to access the user manuals of smart medical wearables.

In future work, a more in-depth analysis of personal preferences – and their underlying reasons – should be conducted. Human factors should be studied in more detail, such as the impact of device brand and prior experiences, as well as the level of comprehension of the technical content. Extensive qualitative analyses should be carried out in order to assist the proper interpretation of the obtained quantitative data.

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