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Research Article

Empirical Study Based on the Perceptions of Patients and Relatives about the Acceptance of Wearable Devices to Improve Their Health and Prevent Possible Diseases

Francisco D. Guillén-Gámez [1] and María J. Mayorga-Fernández [2]

[1] *Department of Research and Diagnostic Methods, Faculty of Education, Pontifical University of Salamanca, C/ Henry Collet, 52-70, 37007 Salamanca, Spain*
[2] *Department of Didactics and School Organization, Faculty of Education Sciences of Málaga, University of Málaga, Avda. Cervantes, 2, 29071 Málaga, Spain*

Correspondence should be addressed to Francisco D. Guillén-Gámez; fdguillenga@upsa.es

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In recent years, there has been a technological revolution affecting all areas of life, including health. Following this trend, a series of electronic devices called wearable technology have emerged with the aim of improving the quality of people's life. These devices are made up of tools that help to prevent the development of chronic diseases and fight against the aging of society by monitoring the vital signs of users. Despite the advantages of using these devices from medical and health points of view, it is necessary to know the opinion of users regarding their use. For this reason, this study has been proposed. The purpose of this study is to analyse the perceptions of the subjects involved in the research regarding the acceptance of wearable devices, taking into account variables, such as age and gender. To this end, a nonexperimental, ex post facto design has been composed that combines descriptive and inferential techniques, with a sample of 606 patients and relatives belonging to a public health centre in the community of Madrid.

1. Introduction

Current households increasingly rely on consumer electronic devices which are intended both for leisure and for improving daily housework. One type of technological device that is presently having a large impact is the wearable device (wearable technology). According to Vijayalakshmi et al. [1], in 2018, approximately 210 million units of wearable devices were produced, amounting revenues of more than USD 30 billion.

In recent years, the internet has passed through several phases: the first focused on information, while the second focused on people. However, different researchers predict that a new phase will occur, the next decade being the Internet of Things (IoT), in which there will be millions of wearable devices (including medical devices) that use big data and will be connected to the network in order to exchange data with one other [2, 3].

Raskovic et al. [4] and Yang et al. [5] define wearable technology as a set of electronic devices (for example, smart watches, sports shoes with built-in GPS, and wristbands controlling the state of health) that are incorporated in some parts of the body (for example, footwear, clothes, and smart glasses) and interact continuously with the user in order to perform a specific function. The launch of Google Glasses and Apple's Apple Watch has marked a turning point in the incorporation of these technologies in the daily routines of people. They have become particularly useful in the fields of medicine and health [6–8].

Health systems fight against the aging of the population and the development of chronic diseases, which can be prevented, such as hypertension, diabetes, and cardiovascular diseases [9, 10]. In response to these challenges, a multitude of researchers have found wearable technology and health-related apps to be a possible solution to improve the quality of people's life [11–13]. In this way, Canhoto and

Arp [14] affirm that wearable technology products can provide highly accurate metrics regarding the vital conditions of people. Consequently, users will be able to monitor and access information concerning their health more easily in order for physicians to both prevent diseases and help people, collecting evidence and objective data for the treatment of different types of diseases [15].

Due to the aging trend of the population of developed countries, these wearable technologies will allow different life situations of patients or elderly people to be monitored, specifically in terms of the vital signs that guarantee their health and well-being [16, 17]. For example, these devices can measure a user's heart rate, blood pressure, respiratory function, and the level of calories burned during exercise and steps walked, among other aspects [18, 19]. As Yetisen et al. [13] state, medical data can be sent to a healthcare provider to receive therapeutic feedback or can act automatically by other devices in the network.

Despite the advantages of using wearable devices from medical and health points of view, it is necessary to know the opinion of users regarding the acceptance of these devices according to medical use and prevention of future diseases since there is currently little research that focuses on this study problem. In order to broaden this issue, the present study has been raised, objective of which is to analyse the perceptions of the subjects involved in the research regarding the acceptance of wearable devices as health tools in relation to their age and gender.

2. Theoretical Framework

2.1. Development of Instruments to Measure the Acceptance of Wearable Devices. Although the market for smart watches and other wearable devices is rapidly increasing, estimates show that current sales are still relatively low [20]. A lot of research has focused on the acceptance of consumers of new technologies and intelligent devices [21–23]. However, few studies have been carried out so far to measure the level of acceptance in the field of wearable health technologies.

For example, Chuah et al. [24] created a theoretical instrument based on the technological acceptance of smart watches. The instrument was completed by 226 students from the University of Malaysia, where 77.9% were female and the average age of the sample was 21.4 years. The instrument they created was composed of nine dimensions, among which the following four components stand out: perceived utility, ease of use, attitudes of use, and purchase intention. Among the findings, the authors found that the ease of use of smart watches is indirectly related to the attitude towards the use of these wearable devices. The same results regarding wearable technologies were found by Chae [25] and Basoglu et al. [26].

Along the same lines, Dehghani et al. [27] developed an instrument on the intentions of using wearable devices. To do this, the authors used a sample of 385 users, who answered a survey divided into six subdimensions, highlighting the attractive aesthetic scale, operational comfort, use of motivation, healthology, and intended use. The results showed that the aesthetic appeal was positively related to the intention of use, although the healthology dimension had no significant effect on the intended use, which was in contrast to the results obtained by Dehghani [28]. In addition, the intended and continued use of these devices was positively related to the actual use. Some of these findings are corroborated by the studies of Rauschnabel and Ro [29] and Chuah et al. [24], which determine that users see wearable devices as fashion accessories and that this significantly affects their intention to use them.

On the other hand, in recent years, new and increasingly sophisticated online attacks have appeared in order to hack the vulnerability of these technological devices and the confidentiality of information in databases [30–32], and different authors have investigated about it [33, 34]. For instance, Das et al. [35] discovered privacy leaks in Bluetooth activation between the exercise tracker and the smartphone, including user tracking, user activity detection, and identification of people. In the same context, Langone et al. [36] analysed the link between different wearable devices and communication via Bluetooth, and they identified several security problems in a set of commercial portable devices.

For this reason, any company or medical institution that uses wearable devices to monitor and save medical parameters of its patients should seek solutions, together with their creators, in order not to lose information and confidentiality of use [37–39]. Different investigations have analysed users' perception about the possible loss of privacy of their medical data when using wearable devices. For example, Spagnolli et al. [40] and Wen et al. [41] claim that privacy loss in sharing this data or the fact that someone can access it significantly threatens the acceptance of their use.

On the other hand, it is necessary to consider the theory of Ziefle and Wilkowska [21], who affirm that demographic variables, such as age, can significantly bias the acceptance and use made by patients of technological devices related to health and medical care. Some scholars have already investigated this topic [42, 43].

For example, Arning and Ziefle [44] evaluated the general attitude and confidence in the use of e-Health technologies, using a sample of 52 university students and 52 adults. They found that the adult group reported a significantly more positive attitude towards e-Health technologies than the younger group. However, contradictory findings were found in the research of Röcker et al. [45], who determined that older adults may be more resistant or undecided in adopting novel technological devices than young adults due to different cultural, educational, and cultural factors and previous experiences.

On the other hand, Rupp et al. [46] analysed, with a sample of 103 participants in an age range of 18 to 83 years, the motivation and confidence to use wearable technologies. Thus, they used different subdimensions, highlighting the reliability and privacy of these types of software. The authors determined that age influenced usability. They concluded that older adults often had more difficulty than younger adults learning the use of new technologies, which could even lead to anxiety. Similar results have been found with respect to mobile health services, with differences in the age of the user groups analysed [10, 47, 48].

Although the vast potential of these technologies to know and even improve health seems obvious, it is very interesting to find out to what extent certain variables, such as gender, influence their acceptance of use. Zhang et al. [49] conducted an investigation with 436 participants, where they found significant differences between men and women. In terms of the technical dimension, men valued it more positively and even considered it irreplaceable, highlighting their higher level of acceptance and the value of the device as an innovative invention. In contrast, women considered its usefulness most important when referring to the health dimension. Other studies coincide with these results, where women have a lower use attitude than men [24, 45, 50, 51]. On the contrary, Wu et al. [52] conducted a study involving 120 Amazon consumers. The results showed that, for men, the attitude of use of portable technology was less favourable than that for women, as also found in a workplace study by Rooney et al. [53].

Other studies highlight the preference for one type of device or another according to gender and age. According to Arning and Ziegle [44], older women opted for blood pressure metres, while younger women opted for home robots. On the other hand, young men had significant differences regarding the use of smart clothes, while the use of such smart clothes was rejected by older men.

There is some research, on the other hand, which indicates that the gender variable is not decisive for using wearable devices since there are no significant differences in use between men and women [54–56].

3. Methods

3.1. Design. This is a nonexperimental, ex post facto study that combines descriptive and statistical techniques in order to measure the perceptions of patients about their acceptance of wearable devices. The statistical measurement techniques used have been the comparison of ranges through the Mann–Whitney *U* test, the Pearson correlation for quantitative variables, and Spearman correlation, when one of these variables is ordinal, and the nonparametric relation of discrete variables, the chi-squared test. The data analyses were performed in SPSS v.24.

3.2. Participants. The sample is of nonprobabilistic nature, intentionally. The collection of data was carried out in the first quarter of 2018. The sample consisted of a total of 606 patients and relatives belonging to a public health centre in the community of Madrid (Spain). The predominant gender of the participants in the study was female (60.2%) compared to 39.8% male. Regarding age, the sample obtained an average of 32 years, with a standard deviation of 10.55. In addition, Table 1 shows the number of devices per gender according to the part of the body where they prefer to wear the wearable device. It is observed that both sexes prefer on the wrist, followed by hanging on clothes.

Table 1: Number of devices per gender according to the part of the body where they prefer to wear the wearable device.

		Gender		Total
		Male	Female	
Where would you prefer to hang these devices?	Wrist	161	225	386
	Hanging clothes	37	41	78
	Integrated in clothes	17	51	68
	Smart glasses	19	19	38
	Shoes	13	23	36
Total		247	359	606

3.3. Procedure. In order to collect data on patients and relatives, the researchers visited the public health centre for a four-week period. The instrument was completed by all patients who were willing to fill it out at the door of the hospital, guaranteeing anonymity in the data processing. The database of the questionnaires was developed through Google Forms, where a digital tablet was used to fill out the surveys and, in this way, streamline the collection of data.

3.4. Instrument. An instrument has been developed to measure the perceptions and the patients' level of acceptance regarding the use of wearable devices to monitor health. The first section included demographic variables and general questions related to wearable devices. The instrument was composed of five dimensions. The first dimension was focused on the utility of using wearable devices and was composed of two items (maximum 10 points); the second dimension was focused on the comfort of wearing these devices on the body or clothes and was composed of three items (maximum 15 points); the third dimension was focused on feelings and emotions when using wearable devices and included five items (maximum 25 points); the fourth dimension was related to the safety and reliability of such devices and included two items (maximum 10 points); and the last dimension was related to the intentions of use and included three items (maximum 15 points). In total, the instrument consisted of 15 items where a Likert scale of five points of valuation was used, where value one represented "totally disagree" and five represented "totally agree" (maximum 75 points).

In addition, the psychometric properties of the questionnaire used for this investigation were analysed through reliability by internal consistency (Cronbach's α), where the parameters obtained were $\alpha = 0.82$ (instrument total), $\alpha = 0.77$ (utility), $\alpha = 0.82$ (comfort), $\alpha = 0.34$ (emotions), $\alpha = 0.77$ (intentions to use), and $\alpha = 0.56$ (privacy and reliability).

Regarding the variance, an exploratory factorial analysis (EFA) of the main axis with oblimin rotation was carried out. The results obtained with the sample adequacy index (KMO) was 0.879 and the Bartlet sphericity test was significant (sig = 0.001), indicating that the correlation matrix exceeds the conditions for performing this analysis. It has been found that the five factors explain 68.91% of the total variance.

For the confirmatory factorial analysis (CFA), several indices recommended by Brown [57] have been considered, which are shown in Table 2: the values for the statistical adjustment minimum discrepancy/degrees of freedom

Table 2: Confirmatory factor analysis indexes in the model.

χ^2_{SB}	gl	p	CMIN	IFI	CFI	RMSEA	NFI
448.067	83	<0.000	5.39	0.895	0.895	0.085	0.875

(CMIN/DF), incremental adjustment index (IFI), comparative adjustment index (CFI), and the average square root of the approach error (RMSEA).

In addition, it has been observed how the different subdimensions are correlated with each other, determining a good fit of the model [58], noting those that are related to the intention to use wearable devices: utility: intentions of use ($r = 0.75$); design: intentions of use ($r = 0.72$); privacy: intentions of use ($r = 0.72$); feelings: intentions of use ($r = 0.44$). The structure of the CFA is available in the appendix showing the correlations between the different dimensions (Figure 1).

4. Analysis of the Results

4.1. Exploratory Data Analysis. Figures 2(a) and 2(b) show the results obtained after carrying out the exploratory analysis of the data in relation to the acceptance level based on the place of the body where the participants would like to wear them (Figure 2(a)) and according to the purpose for which they would be used according to gender (Figure 2(b)).

In Figure 2(a), it can be seen that men's acceptance level in relation to the location or position of the wearable device on the body is higher than the acceptance level of women. It is noteworthy that, generally, both men and women prefer to wear these devices on the wrists (52.71% of men and 50.19% of women). In addition, the level of significance is less than 0.05 ($\chi^2 = 10.245$, gl = 4, sig. = 0.037), so the H0 is rejected; that is, the place where the device is worn according to sex is significant.

In terms of the level of acceptance in relation to the purpose of use, the percentages of men are greater in all the options proposed (Figure 2(b)), except in "others," where women usually use wearable devices for different purposes than those proposed (53.77% of women versus 48.33% of men). In the other options of use, men have higher scores than women: in the use to be fashionable, for example, men scored 48.83%, while women scored 44%. Regarding the purpose of keeping medical information, the percentage of males (51.80%) was higher than that of females (48.95%). Furthermore, since the level of significance is less than 0.05 ($\chi^2 =$ 13.118, gl = 4, sig. = 0.011), the H0 is rejected, so the proportion of men and women with respect to the purpose of using wearable devices is different between the different options.

As can be seen in Figure 3(a), the acceptance level of wearable devices for men is higher than that for women, regardless of their employment status, except in the case of the unemployed, whereby both men and women obtained very similar scores (men 49.44% and women 48.39%). On the other hand, male retirees have a higher level of acceptance than female retirees.

According to the age ranges, people under 30 have a greater number of devices (Figure 3(b)), regardless of whether they are men or women, although women have a greater number of devices at home. The level of significance is lower than 0.05 ($\chi^2 = 14.325$, gl = 3, sig. = 0.002), so the H0 is rejected; that is, the proportion of men and women regarding the number of wearable devices they have at home is different, taking into consideration three categories (one device, two devices, and more than three devices).

4.2. Analysis of Patients' Attitudes regarding the Acceptance of Wearable Devices. Tables 3–8 show the descriptive parameters obtained in each of the items that make up each dimension of the instrument, as well as the total values of the dimensions, including the mean (M), standard deviation (SD), asymmetry (A), kurtosis (K), and the correlation of age (r) in the different dimensions of the questionnaire, as well as the difference of ranks in order to check whether there are any statistically significant differences with respect to gender and its effect size calculated by Cohen (d). In this study, when the data were not fulfilled with the assumption of normality, nonparametric statistics were used, specifically the Mann–Whitney U test.

Table 3 shows how the total attitude towards the usefulness of wearable devices is medium high ($M = 6.88$), being slightly higher for males ($M = 7.13$) compared to females ($M = 6.70$). Specifically, the participants in the study perceive these devices as more useful to control/care for the health of elderly people (people with heart problems and hypertension (item 2, $M = 3.59$) versus utility for themselves (item 1, $M = 3.29$)). Regarding gender, significant differences have been found in this dimension (sig. 0.015). In terms of how age affects the perceptions of patients about the usefulness of wearable devices in their daily life, there is a significant effect in both genders towards total utility, with a small correlation ($r =$ -0.168); that is, the coefficient of determination (R^2) determines that the age variable represents 2.8% of the variability of the utility dimension of wearable devices ($R^2 = 0.028$).

Table 4 includes data on the attitudes of patients and family members regarding the convenience of using wearable devices. The total assessment of this dimension is medium high ($M = 9.49$), being practically the same average for both genders. The least valued item has been the design of these devices (item 2), since the participants in the study have an average of $M = 2.97$, with a lower score in women ($M = 2.84$) than in men ($M = 3.15$). Regarding gender, significant differences have been found in this dimension (sig. 0.021), while in terms of how age affects perception of the ease of use of these devices, there is a significant effect in both genders, although the correlation is small ($r = -0.186$); that is, the coefficient of determination (R^2) determines that the age variable represents 3.4% of the variability of the comfort-of-use dimension of wearable devices ($R^2 = 0.034$).

Table 5 presents the results obtained in relation to the dimension feelings and emotions when using wearable devices. The results show a high total valuation on this dimension ($M = 18.46$), not appreciating differences according to gender. The least valued item was item 3 of this dimension, related to the fear of providing information to the family doctor regarding health status through wearable devices ($M = 2.50$), placing the fair value at half the scale.

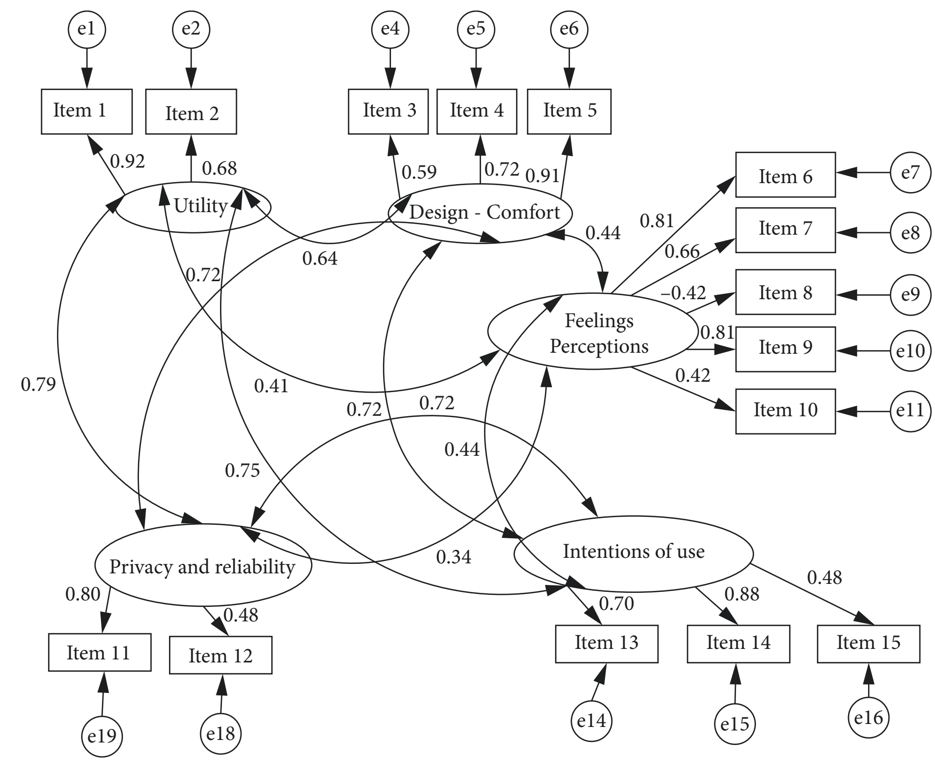

Figure 1: Structure of the CFA.

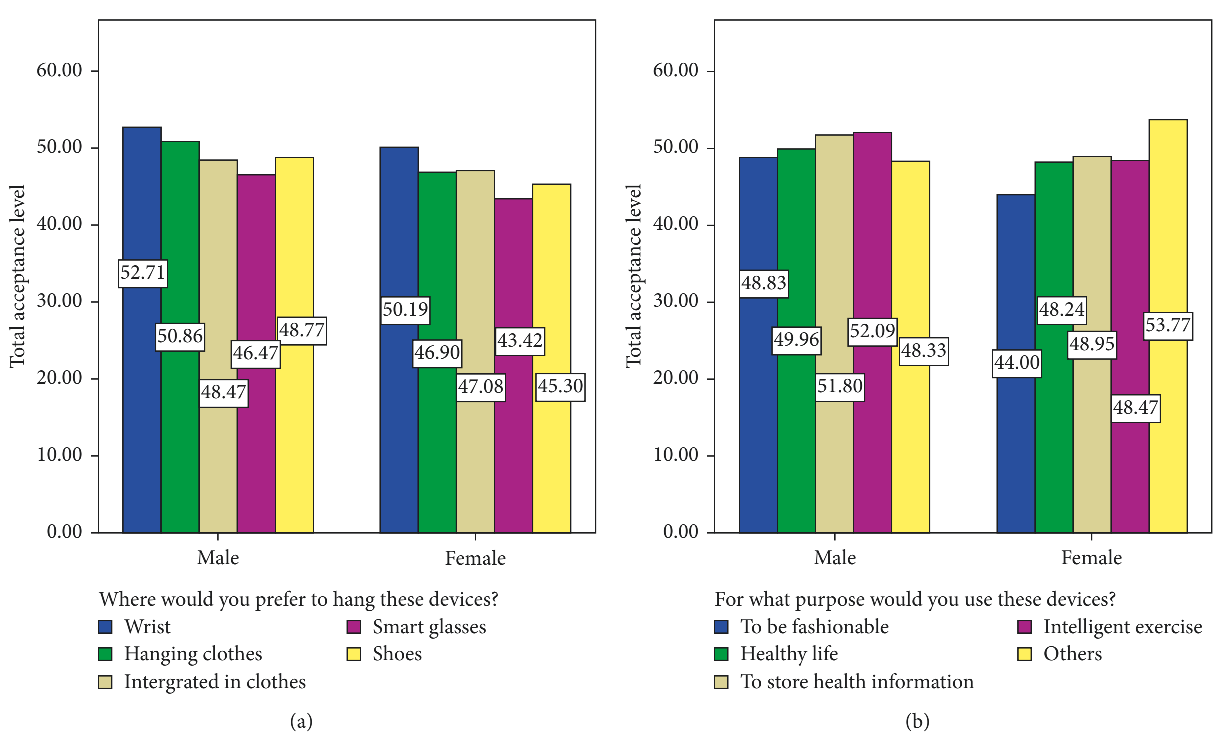

Figure 2: (a) Acceptance level according to gender and depending on the place of the human body. (b) Level of acceptance according to gender and according to the purpose of use.

Item 1 was the most valued, related to the anxiety/burden that can occur when using this type of device for the first time ($M = 4.40$). The same score was achieved for both men and women. Regarding gender, no significant differences were found in this dimension (sig 0.654). In terms of how age affects perception with respect to feelings of use of wearable devices, the correlation is zero; that is, the age variable does not affect perceptions related to feelings and

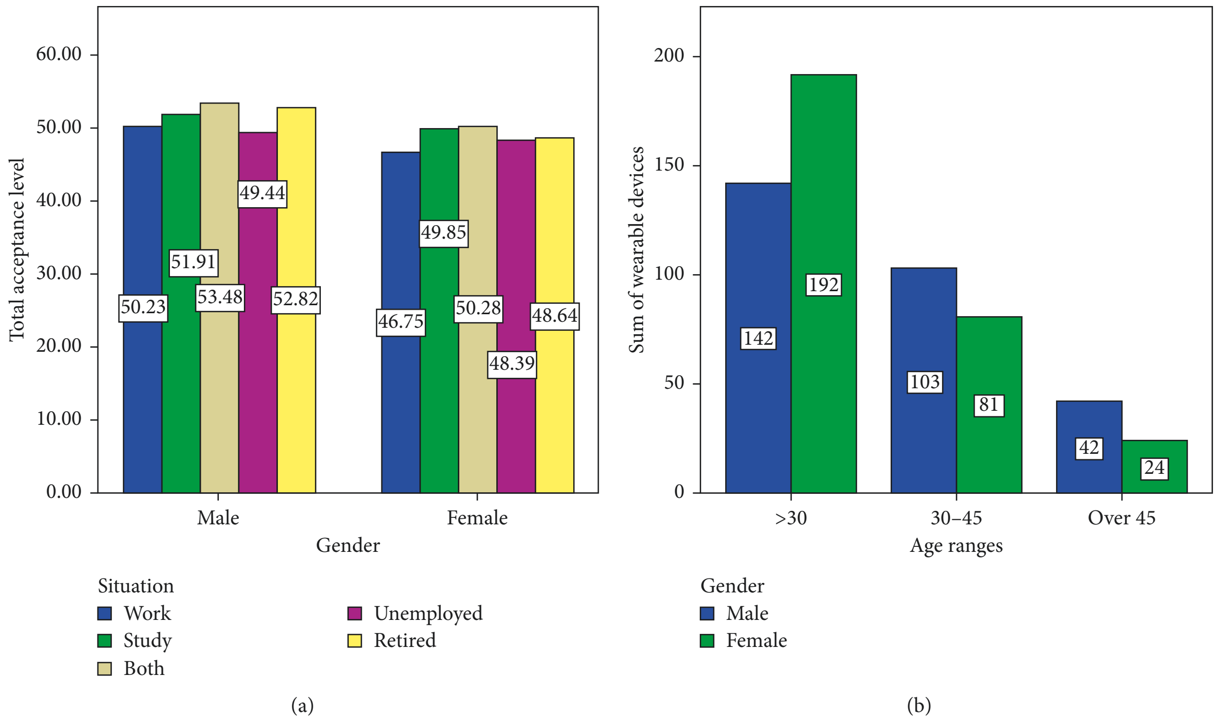

Figure 3: (a) Level of acceptance according to gender and depending on employment situation. (b) Cumulative number of devices according to gender and age ranges.

Table 3: Attitudes about the utility of using wearable devices.

	Gender	*M*	SD	*A*	*K*	Age (*r*)	Kolmogórov–Smirnov			Mann–Whitney *U*	
							KS	gl	Sig.	Sig.	*d* (Cohen)
Item 1	Male	3.46	1.23	−0.38	−0.71	−0.186**	0.160	247	0.001	0.003	0.235
	Female	3.17	1.24	−0.06	−0.97	−0.171**	0.155	359	0.001		
	Total	3.29	1.24	−0.18	−0.92	−0.172**	0.156	606	0.001		
Item 2	Male	3.67	1.21	−0.46	−0.83	−0.126*	0.204	247	0.001	0.146	—
	Female	3.53	1.18	−0.35	−0.79	−0.137**	0.168	359	0.001		
	Total	3.59	1.20	−0.39	−0.82	−0.130**	0.179	606	0.001		
Total	Male	7.13	2.22	−0.35	−0.79	−0.172**	0.151	247	0.001	0.015	0.197
	Female	6.70	2.18	−0.16	−0.85	−0.172**	0.129	359	0.001		
	Total	6.88	2.20	−0.23	−0.85	−0.168**	0.138	606	0.001		

The correlation is significant at the **0.01 and *0.05 levels.

Table 4: Attitudes about the comfort of using wearable devices.

	Gender	*M*	SD	*A*	*K*	Age (*r*)	Kolmogórov–Smirnov			Mann–Whitney *U*	
							KS	gl	Sig.	Sig.	*d* (Cohen)
Item 1	Male	3.34	1.18	−0.16	−0.87	−0.142*	0.166	247	0.001	0.409	—
	Female	3.26	1.16	−0.08	−0.88	−0.131*	0.165	359	0.001		
	Total	3.29	1.17	−0.11	−0.88	−0.134**	0.166	606	0.001		
Item 2	Male	3.15	1.29	−0.13	−1.02	−0.250**	0.155	247	0.001	0.004	0.229
	Female	2.84	1.30	0.18	−1.03	−0.144**	0.164	359	0.001		
	Total	2.97	1.31	0.05	−1.10	−0.186**	0.150	606	0.001		
Item 3	Male	3.37	1.24	−0.28	−0.88	−0.154*	0.169	247	0.001	0.018	0.188
	Female	3.14	1.20	−0.04	−0.93	−0.143**	0.159	359	0.001		
	Total	3.23	1.22	−0.13	−0.93	−0.144**	0.163	606	0.001		
Total	Male	9.85	3.21	−0.13	−0.85	−0.233**	0.092	247	0.001	0.021	0.188
	Female	9.24	3.11	0.02	−0.79	−0.155**	0.087	359	0.001		
	Total	9.49	3.17	−0.04	−0.83	−0.186**	0.083	606	0.001		

The correlation is significant at the **0.01 and *0.05 levels.

Table 5: Attitudes about feelings and emotions when using wearable devices.

	Gender	M	SD	A	K	Age (r)	Kolmogórov–Smirnov			Mann–Whitney U	
							KS	gl	Sig.	Sig.	d
Item 1	Male	4.30	0.97	−1.46	1.69	−0.054	0.327	247	0.001	0.610	—
	Female	4.30	1.05	−1.50	1.52	−0.124*	0.351	359	0.001		
	Total	4.40	1.02	−1.49	1.59	−0.095*	0.341	606	0.001		
Item 2	Male	4.05	1.09	−0.99	0.17	−0.041	0.260	247	0.001	0.124	—
	Female	3.92	1.08	−0.71	−0.34	−0.116*	0.235	359	0.001		
	Total	3.97	1.09	−0.82	−0.17	−0.083*	0.245	606	0.001		
Item 3	Male	2.47	1.20	0.37	−0.83	−0.045	0.181	247	0.001	0.0708	—
	Female	2.53	1.27	0.51	−0.72	0.020	0.205	359	0.001		
	Total	2.50	1.24	0.46	−0.75	−0.008	0.195	606	0.001		
Item 4	Male	4.27	0.97	−1.24	0.83	−0.021	0.325	247	0.001	0.427	—
	Female	4.18	1.07	−1.24	0.78	−0.040	0.308	359	0.001		
	Total	4.22	1.03	−1.25	0.84	−0.031	0.314	606	0.001		
Item 5	Male	3.46	1.21	−0.33	−0.81	0.075	0.174	247	0.001	0.795	—
	Female	3.48	1.21	−0.48	−0.69	0.025	0.222	359	0.001		
	Total	3.47	1.21	−0.42	−0.74	0.046	0.203	606	0.001		
Total	Male	18.55	2.93	−0.52	0.26	−0.029	0.132	247	0.001	0.654	—
	Female	18.40	2.95	−0.68	0.47	−0.073	0.122	359	0.001		
	Total	18.46	2.94	−0.62	0.38	−0.055	0.125	606	0.001		

The correlation is significant at the **0.01 and *0.05 levels.

Table 6: Attitudes about the privacy and reliability of wearable devices.

	Gender	M	SD	A	K	Age (r)	Kolmogórov–Smirnov			Mann–Whitney U	
							KS	gl	Sig.	Sig.	d
Item 1	Male	3.01	1.09	−0.10	−0.67	−0.193**	0.176	247	0.001	0.008	0.208
	Female	2.79	0.96	0.13	−0.42	−0.077	0.191	359	0.001		
	Total	2.88	1.03	0.05	−0.56	−0.124**	0.182	606	0.001		
Item 2	Male	3.37	1.22	−0.43	−0.74	−0.048	0.216	247	0.001	0.005	0.222
	Female	3.10	1.25	−0.05	−0.98	−0.098	0.153	359	0.001		
	Total	3.21	1.25	−0.20	−0.94	−0.076	0.179	606	0.001		
Total	Male	6.38	1.94	−0.17	−0.58	−0.122	0.118	247	0.001	0.001	0.259
	Female	5.89	1.85	0.09	−0.58	−0.104*	0.105	359	0.001		
	Total	6.09	1.91	0.00	−0.62	−0.107**	0.103	606	0.001		

The correlation is significant at the **0.01 and *0.05 levels.

Table 7: Attitudes about the intended use.

	Gender	M	SD	A	K	Age (r)	Kolmogórov–Smirnov			Mann–Whitney U	
							KS	gl	Sig.	Sig.	d
Item 1	Male	3.23	1.25	−0.27	−0.95	−0.221**	0.187	247	0.001	0.001	0.257
	Female	2.99	1.23	−0.01	−0.90	−0.122*	0.156	359	0.001		
	Total	3.13	1.25	−0.11	−0.96	−0.160*	0.158	606	0.001		
Item 2	Male	3.58	1.40	−0.49	−1.08	−0.177	0.231	247	0.001	0.001	0.311
	Female	3.13	1.39	−0.02	−1.24	−0.093	0.158	359	0.001		
	Total	3.31	1.41	−0.20	−1.26	−0.105**	0.188	606	0.001		
Item 3	Male	2.65	1.37	0.35	−1.07	−0.130*	0.182	247	0.001	0.001	0.207
	Female	2.35	1.25	0.62	−0.58	−0.029	0.196	359	0.001		
	Total	2.47	1.30	0.51	−0.82	−0.072	0.191	606	0.001		
Total	Male	9.55	3.31	−0.14	−0.90	−0.179**	0.085	247	0.001	0.001	0.321
	Female	8.47	3.19	0.13	−0.66	−0.104*	0.082	359	0.001		
	Total	8.91	3.28	0.04	−0.81	−0.134**	0.078	606	0.001		

The correlation is significant at the **0.01 and *0.05 levels.

Table 8: Analysis of the variance (ANOVA) of the acceptance of wearables.

Source	Type III sum of squares	*df*	Mean square	*F*	Sig.	Partial eta-square
Corrected model	26185.603[a]	108	242.459	4.041	0.001	0.468
Intercept	202671.885	1	202671.885	3378.109	0.001	0.872
Number of devices	1186.873	3	395.624	6.594	0.001	0.038
Body part	1140.518	4	285.130	4.753	0.001	0.037
Age intervals	444.255	2	222.127	3.702	0.025	0.015
Interest in wearable devices	1514.057	2	757.028	12.618	0.001	0.048
Number of devices* body part	1827.908	12	152.326	2.539	0.003	0.058

[a] $R^2 = 0.468$ (adjusted $R^2 = 0.352$).

emotions of patients about the acceptance of wearable devices, as their opinions were unanimous in all age ranges.

Table 6 analyses the perceptions of the research participants regarding the privacy of users when using these devices and the reliability of the software. It can be seen how this dimension has a medium global assessment ($M = 6.09$). It was slightly higher for males ($M = 6.38$) compared to females ($M = 5.89$), meaning therefore that there were significant differences in this dimension with respect to gender (sig. 0.001).

Regarding how age affects the perception of the respondents about the privacy and reliability of the software, it can be observed that there is a significant effect on both genders towards the perception of use, with a small correlation ($r = -0.107$); that is, the coefficient of determination (R^2) determines that the age variable represents 1.14% of the variability of this dimension ($R^2 = 0.01$).

Table 7 shows how the intentions of use of patients and family members on wearable devices in general terms of the dimension are medium high ($M = 8.91$). Specifically, it can be observed that users feel that they would be quite motivated to use wearable devices if they obtained a good performance when monitoring the vital signs of their physical exercises ($M = 3.13$). Regarding the purchase option, it can be observed that users would accept buying these devices to improve their quality of life if they were cheaper and affordable at their salary ($M = 3.31$). In addition, users do not show themselves willing to let themselves be carried away and bought by the opinion of others when buying wearable devices since the average obtained in item 3 is average ($M = 2.65$). Regarding gender, it can be observed that there are statistically significant differences with respect to the intention of use (sig. = 0.001). Regarding age, it is clear that there is a negative correlation with respect to the intention to use and buy ($r = -0.134$; results that coincide with Figure 3(b)). Therefore, the age variable would explain 1.15% of this dimension.

On the other hand, the variance of the variable acceptance of wearables (dependent variable, DV) is analysed. To do this, it is taken into account as independent variables (IV): number of wearable devices (one, two, and more than two); part of the body where the device is carried; age of the sample (under 30 years, between 30 and 45 years, and over 45 years); interest in wearable devices (much, little, and nothing). The Levene equality test determined that the variances of error in the RV were different between groups (sig. 0.002); therefore, a contrast of means was made by Bonferroni. Partial eta-square (η) was calculated to determine the size of the effect. According to Richardson [59], the partial eta-squared values of approximately 0.01, 0.06, and 0.14 indicate small, medium, and large effects, respectively.

Table 8 shows how the corrected model determines that it is significant (sig. 0.001), presenting a large effect size ($\eta = 0.468$). That is, the model proposed with the different independent variables used explains 35.2% of the variance of the variable acceptance of wearables. In addition, it is observed how the variable number of devices presents a significant level in the proposed model, with an effect size of 0.872; the variable part of the body where the device is worn is significant with an effect size of 0.037; the age range is also significant, with a small effect size ($\eta = 0.015$); the interest in wearable devices is also significant with a large effect size ($\eta = 0.048$), as well as the interception number of devices * body part ($\eta = 0.058$).

5. Discussions

The goal of this research is to analyse the perceptions of the subjects involved in the research regarding the acceptance of wearable devices as health tools in relation to their age and gender. When analysing the data of this study, we can see how men have a higher level of acceptance of the use of wearable devices according to their location. There are also gender differences in relation to the purpose of use, with men showing a greater level of acceptance based on their work situation, as well as significant differences according to age. The only exception is in the case of women under 30 years of age, who have a greater number of wearable devices in home than men. It is also noteworthy that women over 45 years are those with the lowest level of acceptance of use of these devices. This is confirmed by the results obtained by Arning and Ziefle [44] who emphasized that the older the woman, the less health devices they said they used.

These data are contrary to those obtained by Wu et al. [52] and Rooney et al. [53], who affirm that men have a lower perception of use than women regarding the use of wearable devices. On the other hand, the studies of Duval and Hashizumo [50], Röchker et al. [45], Chuah et al. [24], and Whitehead et al. [51] are corroborated since in general terms women had lower perceptions than men.

All the dimensions analysed in this study have obtained a medium or high average rating. This may be the result of a positive perception of the patients and family members involved in the study regarding the advantages and usefulness of these devices, but this perception does not have to be positively related to actual use, according to the results of Dehghani et al. [27]. Similarly, the age variable significantly influences all dimensions, except in the dimension of feelings and emotions. Although it is true that the age variable explains a very small percentage of the variability of the dependent variable, they are significant values to be taken into account. Thus, they corroborate the results of Ziefle and Wilkowska [21], Xue et al. [42], Guo et al. [43], and Deng [60] since age can significantly affect the acceptance and use of technological devices related to health and medical care.

In this study, the physical attractiveness of wearable devices, included in the design and comfort dimension, is positively related to the intention of use, supporting the data obtained by Dehghani et al. [27] and Dehghani [28]. This implies that the use of these devices is influenced by fashions and is not focused on their use as a real concern for health issues. This theory is supported by Rauschnabel and Ro [29] and Chuah et al. [24] since, according to their studies, wearable devices are fashion accessories, which significantly affects the intention of use.

The privacy and reliability of the use of software has a global average rating, being higher in men than in women, which implies that, as in the studies of Spagnolli et al. [40] and Wen et al. [41], the loss of privacy harms acceptance of use, especially more in women than in men. Therefore, according to different authors, it is necessary to focus on increasing confidentiality and the avoidance of possible hacks to lose information [37]. One of the possible solutions to introduce this identification and authentication could be biometric science, specifically facial authentication [61]. Through authentication servers, users are identified and authenticated and then can access the system. This could offer a new way to improve attacks on internet networks [62, 63]. In order to achieve this, it would be necessary to create a logical security system with barriers and procedures that allow any computer attack on the network of networks to be stopped.

6. Conclusions

Nowadays, according to Swan [2] and Hänsel [3], the technological revolution has evolved to such an extent that we are now in the so-called Internet of Things decade, and new technological devices, such as wearable devices, have emerged along these lines to improve the quality of people's life [11–13]. However, there are still few studies that corroborate the advantages of these devices in the field of health [21–23]. Therefore, the importance of conducting research on the perceptions of patients and family members regarding the acceptance of wearable devices as health tools has been analysed in relation to the age and gender of participants.

In general terms, it can be concluded that although men still have a greater interest in technologies, this interest is also increasing in young women. This may be due to the fact that, in recent years, women are becoming more visible in all areas of life, both public and private and thus, their acceptance and use of new technologies is growing.

Although the perception of the use of wearable devices is positive, it does not have to be related to actual use, which can be influenced by age, since technologies advance at a dizzying pace, which in many cases, the population cannot continue, besides being a question of trends or "fashions."

Privacy is another fundamental issue for the use of such devices, as there is no excessive confidence on the part of the population regarding the confidentiality of the data and fears that may be caused by the lack of knowledge of device wearables.

The main limitation of this study has been that the information has not been differentiated between family members and patients. This may show a bias in the study because there may be exogenous factors that affect internal validity. Therefore, it would be interesting to analyse the results of one group and the other subjects independently since both can provide interesting information.

In addition to conducting the study by differentiating the constituent subjects of the sample, future research could also involve the carrying out of a parallel study where a control group and an experimental group are selected, with a phase of training and awareness about wearable devices, in order to identify any differences between the two research groups. It would also be interesting to analyse the influence of other variables, such as whether they do any sports or whether they are smokers. Another possible line of research could be to control other types of factors, such as how loyalty to a certain brand of technological devices, such as Apple, influences perception regarding the use of wearable devices [64, 65].

Appendix

Instrument Items: Attitudes towards Wearable Devices in Medical Health

Utility dimension:

(1) I consider that wearable devices are useful for the care of my health (measuring pulsations, body temperature, and sleep cycles).

(2) They are useful for controlling/caring for the health of the elderly (people with heart problems, hypertension, etc.).

Comfort Dimension

(3) Health applications on wearable devices seem easy to learn how to use.

(4) I consider the design of wearable devices to be elegant.

(5) I think they are comfortable to wear and do not disturb.

Feelings and Emotions dimension:

(6) I do not think that using wearable devices for the first time is going to produce feelings of anxiety or overwhelmingness.

(7) I think they are entertaining due to the multitude of health and medical apps that can be used.

(8) I would not be afraid to provide information about my health status monitored in wearable devices to my general practitioner.

(9) I consider that I will not feel strange when wearing this type of device on the body.

(10) I believe that older people/adults would not like to wear these devices on the body, for example, to monitor their heart rate and its vital signs.

Privacy dimension:

(11) I consider that they are reliable devices (they measure correctly).

(12) Being devices that help to control and prevent diseases or health problems, I do not mind sharing this confidential information.

Intention Dimension

(13) My motivation in using these devices would increase if I obtained a healthier life rhythm when doing physical exercise.

(14) If wearable devices were more economically affordable, I would buy them.

(15) If most people in my immediate environment used it, I would be more inclined to use it.

Data Availability

The data used to support the findings of this study are included within the supplementary information file.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Supplementary Materials

The SPSS document "data" contain the information collected from patients and physicians about their perceptions towards wearable devices. The file contains 21 items about the demographic questions as well as the questionnaire items. In addition, the file has the blocks of each dimension which have been calculated from the sum of the items that make up each block. (*Supplementary Materials*)

References

[1] K. Vijayalakshmi, S. Uma, R. Bhuvanya, and A. Suresh, "A demand for wearable devices in healthcare," *International Journal of Engineering and Technology*, vol. 7, no. 1–7, pp. 1–4, 2018.

[2] M. Swan, "Sensor mania! the internet of things, wearable computing, objective metrics, and the quantified self 2.0," *Journal of Sensor and Actuator Networks*, vol. 1, no. 3, pp. 217–253, 2012.

[3] K. Hänsel, N. Wilde, H. Haddadi, and A. Alomainy, "Challenges with current wearable technology in monitoring health data and providing positive behavioural support," in *Proceedings of the 5th EAI International Conference on Wireless Mobile Communication and Healthcare*, pp. 158–161, ICST (Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering), London, UK, October 2015.

[4] D. Raskovic, T. Martin, and E. Jovanov, "Medical monitoring applications for wearable computing," *Computer Journal*, vol. 47, no. 4, pp. 495–504, 2004.

[5] H. Yang, J. Yu, H. Zo, and M. Choi, "User acceptance of wearable devices: an extended perspective of perceived value," *Telematics and Informatics*, vol. 33, no. 2, pp. 256–269, 2016.

[6] S. Horng, P. S. Porter, and K. Samani, "Emergency providers see big potential for Google Glass," *ED Management*, vol. 26, no. 5, pp. 55–58, 2014.

[7] T. D. Aungst and T. L. Lewis, "Potential uses of wearable technology in medicine: lessons learnt from Google Glass," *International Journal of Clinical Practice*, vol. 69, no. 10, pp. 1179–1183, 2015.

[8] A. Khushhal, S. Nichols, W. Evans et al., "Validity and reliability of the Apple watch for measuring heart rate during exercise," *Sports Medicine International Open*, vol. 1, no. 6, pp. E206–E211, 2017.

[9] D. E. Bloom, E. Cafiero, E. Jané-Llopis et al., *The Global Economic Burden of Noncommunicable Diseases*, PGDA Working Papers 8712, Program on the Global Demography of Aging, 2012.

[10] Z. Bo and Y. Li, "Wearable medical devices acceptance and expectance of senior population in China," in *Proceedings of the 17th International Conference on Electronic Business*, pp. 241–251, ICEB, Dubai, UAE, December 2017.

[11] Y.-L. Zheng, X.-R. Ding, C. C. Y. Poon et al., "Unobtrusive sensing and wearable devices for health informatics," *IEEE Transactions on Biomedical Engineering*, vol. 61, no. 5, pp. 1538–1554, 2014.

[12] H. Kalantarian and M. Sarrafzadeh, "Audio-based detection and evaluation of eating behavior using the smartwatch platform," *Computers in Biology and Medicine*, vol. 65, pp. 1–9, 2015.

[13] A. K. Yetisen, J. L. Martinez-Hurtado, B. Ünal, A. Khademhosseini, and H. Butt, "Wearables in medicine," *Advanced Materials*, vol. 30, no. 33, article 1706910, 2018.

[14] A. I. Canhoto and S. Arp, "Exploring the factors that support adoption and sustained use of health and fitness wearables," *Journal of Marketing Management*, vol. 33, no. 1-2, pp. 32–60, 2017.

[15] P. M. Carrera and A. R. H. Dalton, "Do-it-yourself healthcare: the current landscape, prospects and consequences," *Maturitas*, vol. 77, no. 1, pp. 37–40, 2014.

[16] C. C. Y. Poon, Q. Liu, H. Gao, W.-H. Lin, and Y.-T. Zhang, "Wearable intelligent systems for e-health," *Journal of Computing Science and Engineering*, vol. 5, no. 3, pp. 246–256, 2011.

[17] Y.-M. Fang and C.-C. Chang, "Users' psychological perception and perceived readability of wearable devices for elderly people," *Behaviour & Information Technology*, vol. 35, no. 3, pp. 225–232, 2016.

[18] N. Wang, E. B. Yi, and S. Bagchi, "On reliability of android wearable health devices," 2017, http://arxiv.org/abs/1706.09247.

[19] S. Kye, J. Moon, T. Lee et al., "Detecting periodic limb movements in sleep using motion sensor embedded wearable band," in *Proceedings of 2017 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, pp. 1087–1092, Banff, AB, Canada, October 2017.

[20] IDC, *IDC Forecasts Slower Growth for Wearables in 2018 Before Ramping Up Again through 2022*, IDC, Framingham,

MA, USA, 2018, https://www.idc.com/getdoc.jsp?containerId=prUS44276818.

[21] M. Ziefle and W. Wilkowska, "Technology acceptability for medical assistance," in *Proceedings of 2010 4th International Conference on Pervasive Computing Technologies for Healthcare (Pervasive Health)*, pp. 1–9, Munich, Germany, March 2010.

[22] M. Ziefle and A. K. Schaar, "Technology acceptance by patients: empowerment and stigma," in *Handbook of Smart Homes, Health Care and Well-Being*, pp. 167–177, Springer, Berlin, Germany, 2017.

[23] J. I. Campbell, I. Aturinda, E. Mwesigwa et al., "The technology acceptance model for resource-limited settings (TAM-RLS): a novel framework for mobile health interventions targeted to low-literacy end-users in resource-limited settings," *AIDS and Behavior*, vol. 21, no. 11, pp. 3129–3140, 2017.

[24] S. H.-W. Chuah, P. A. Rauschnabel, N. Krey, B. Nguyen, T. Ramayah, and S. Lade, "Wearable technologies: the role of usefulness and visibility in smartwatch adoption," *Computers in Human Behavior*, vol. 65, pp. 276–284, 2016.

[25] J. M. Chae, "Consumer acceptance model of smart clothing according to innovation," *International Journal of Human Ecology*, vol. 10, no. 1, pp. 23–33, 2009.

[26] N. Basoglu, A. E. Ok, and T. U. Daim, "What will it take to adopt smart glasses: a consumer choice based review?," *Technology in Society*, vol. 50, pp. 50–56, 2017.

[27] M. Dehghani, K. J. Kim, and R. M. Dangelico, "Will smartwatches last? Factors contributing to intention to keep using smart wearable technology," *Telematics and Informatics*, vol. 35, no. 2, pp. 480–490, 2018.

[28] M. Dehghani, "Exploring the motivational factors on continuous usage intention of smartwatches among actual users," *Behaviour & Information Technology*, vol. 37, no. 2, pp. 145–158, 2018.

[29] P. A. Rauschnabel and Y. K. Ro, "Augmented reality smart glasses: an investigation of technology acceptance drivers," *International Journal of Technology Marketing*, vol. 11, no. 2, pp. 123–148, 2016.

[30] B. Cusack, B. Antony, G. Ward, and S. Mody, "Assessment of security vulnerabilities in wearable devices," in *Proceedings of 15th Australian Information Security Management Conference*, pp. 42–48, Edith Cowan University, Perth, Western Australia, December 2017.

[31] M. Rahman, B. Carbunar, and U. Topkara, "Secure management of low power fitness trackers," *IEEE Transactions on Mobile Computing*, vol. 15, no. 2, pp. 447–459, 2016.

[32] H. P. Fortify, "Internet of things security study: smartwatches," 2015, https://www.ftc.gov/system/files/documents/public_comments/2015/10/00050-98093.pdf.

[33] K. Lotfy and M. L. Hale, "Assessing pairing and data exchange mechanism security in the wearable internet of things," in *Proceedings of 2016 IEEE International Conference on Mobile Services (MS)*, pp. 25–32, San Francisco, CA, USA, June 2016.

[34] R. Goyal, N. Dragoni, and A. Spognardi, "Mind the tracker you wear: a security analysis of wearable health trackers," in *Proceedings of the 31st Annual ACM Symposium on Applied Computing*, pp. 131–136, Pisa, Italy, April 2016.

[35] A. K. Das, P. H. Pathak, C. N. Chuah, and P. Mohapatra, "Uncovering privacy leakage in ble network traffic of wearable fitness trackers," in *Proceedings of the 17th International Workshop on Mobile Computing Systems and Applications*, pp. 99–104, St. Augustine, FL, USA, February 2016.

[36] M. Langone, R. Setola, and J. Lopez, "Cybersecurity of wearable devices: an experimental analysis and a vulnerability assessment method," in *Proceedings of 2017 IEEE 41st Annual Computer Software and Applications Conference (COMPSAC)*, pp. 304–309, Turin, Italy, July 2017.

[37] F. D. Guillen-Gamez, I. Garcia-Magarino, J. Bravo-Agapito, R. Lacuesta, and J. Lloret, "A proposal to improve the authentication process in m-health environments," *IEEE Access*, vol. 5, pp. 22530–22544, 2017.

[38] L. S. Anaya, A. Alsadoon, N. Costadopoulos, and P. W. C. Prasad, "Ethical implications of user perceptions of wearable devices," *Science and Engineering Ethics*, pp. 1–28, 2018.

[39] S. Banerjee, T. Hemphill, and P. Longstreet, "Wearable devices and healthcare: data sharing and privacy," *Information Society*, vol. 34, no. 1, pp. 49–57, 2018.

[40] A. Spagnolli, E. Guardigli, V. Orso, A. Varotto, and L. Gamberini, "Measuring user acceptance of wearable symbiotic devices: validation study across application scenarios," in *Symbiotic Interaction*, pp. 87–98, Springer, Cham, Switzerland, 2014.

[41] D. Wen, X. Zhang, and J. Lei, "Consumers' perceived attitudes to wearable devices in health monitoring in China: a survey study," *Computer Methods and Programs in Biomedicine*, vol. 140, pp. 131–137, 2017.

[42] L. Xue, C. C. Yen, L. Chang et al., "An exploratory study of ageing women's perception on access to health informatics via a mobile phone-based intervention," *International Journal of Medical Informatics*, vol. 81, no. 9, pp. 637–648, 2012.

[43] X. Guo, Y. Sun, N. Wang, Z. Peng, and Z. Yan, "The dark side of elderly acceptance of preventive mobile health services in China," *Electronic Markets*, vol. 23, no. 1, pp. 49–61, 2013.

[44] K. Arning and M. Ziefle, "Different perspectives on technology acceptance: the role of technology type and age," in *HCI and Usability for e-Inclusion*, pp. 20–41, Springer, Berlin, Heidelberg, 2009.

[45] C. Röcker, M. Ziefle, and A. Holzinger, "From computer innovation to human integration: current trends and challenges for pervasive health technologies," in *Pervasive Health*, pp. 1–17, Springer, London, UK, 2014.

[46] M. A. Rupp, J. R. Michaelis, D. S. McConnell, and J. A. Smither, "The role of individual differences on perceptions of wearable fitness device trust, usability, and motivational impact," *Applied Ergonomics*, vol. 70, pp. 77–87, 2018.

[47] L. Xiaorong, "Explaining the mobile health services acceptance from different age groups: a protection motivation theory perspective," *IJACT: International Journal of Advancements in Computing Technology*, vol. 4, no. 3, pp. 1–9, 2012.

[48] Y. Zhao, Q. Ni, and R. Zhou, "What factors influence the mobile health service adoption? A meta-analysis and the moderating role of age," *International Journal of Information Management*, vol. 43, pp. 342–350, 2017.

[49] M. Zhang, M. Luo, R. Nie, and Y. Zhang, "Technical attributes, health attribute, consumer attributes and their roles in adoption intention of healthcare wearable technology," *International Journal of Medical Informatics*, vol. 108, pp. 97–109, 2017.

[50] S. Duval and H. Hashizume, "Perception of wearable computers for everyday life by the general public: impact of culture and gender on technology," in *Embedded and Ubiquitous Computing–EUC 2005, Lecture Notes in Computer Science*,

L. T. Yang, M. Amamiya, Z. Liu, M. Guo, and F. J. Rammig, Eds., pp. 826–835, Springer, Berlin, Heidelberg, 2005.
[51] A. E. Whitehead, K. Umeh, L. Quayle, and D. Morlei, "Mobile technology usage mediates gender differences in physical activity," *International Journal of Sport Psychology*, vol. 48, no. 6, pp. 643–659, 2017.
[52] L. Wu, A. Fan, and A. S. Mattila, "Wearable technology in service delivery processes: the gender-moderated technology objectification effect," *International Journal of Hospitality Management*, vol. 51, pp. 1–7, 2015.
[53] L. Rooney, McGovern, and M. S. Unger, *Irish Adults' Willingness to Use Technology to Access Mental Health Information, Support and Services*, Applied Research for Connected Health, Clonskeagh, Dublin, Ireland, 2018, https://www.arch.ie/wp-content/uploads/2016/07/Mental-Health-Technology-Whitepaper-6th-april.pdf.
[54] A. K. Nehra, M. T. Gettman, M. E. Rivera et al., "A survey of perceptions and acceptance of wearable technology for health monitoring in a urological patient population," *Urology Practice*, vol. 4, no. 6, pp. 508–514, 2017.
[55] J. Blumenthal, A. Wilkinson, and M. Chignell, "Physiotherapists' and physiotherapy students' perspectives on the use of mobile or wearable technology in their practice," *Physiotherapy Canada*, vol. 70, no. 3, pp. 251–261, 2018.
[56] B. Sotillos-González, B. Buiza-Camacho, M. Herrera-Usagre et al., "Visión ciudadana sobre la prescripción de aplicaciones móviles de salud y el uso de tecnologías de la información y la comunicación en el entorno sanitario en Andalucía," *Journal of Healthcare Quality Research*, vol. 33, no. 4, pp. 225–233, 2018.
[57] T. A. Brown, *Confirmatory Factor Analysis for Applied Research*, Guilford Publications, New York, NY, USA, 2014.
[58] P. Barrett, "Structural equation modelling: adjudging model fit," *Personality and Individual differences*, vol. 42, no. 5, pp. 815–824, 2007.
[59] J. T. E. Richardson, "Eta squared and partial eta squared as measures of effect size in educational research," *Educational Research Review*, vol. 6, no. 2, pp. 135–147, 2011.
[60] Z. Deng, "Understanding public users' adoption of mobile health service," *International Journal of Mobile Communications*, vol. 11, no. 4, pp. 351–373, 2013.
[61] J. Valera, J. Valera, and Y. Gelogo, "A review on facial recognition for online learning authentication," in *Proceedings of 2015 8th International Conference on Bio-Science and Bio-Technology (BSBT)*, Jeju Island, South Korea, pp. 16-19, 2015.
[62] K. Niinuma, U. Park, and A. K. Jain, "Soft biometric traits for continuous user authentication," *IEEE Transactions on information forensics and security*, vol. 5, no. 4, pp. 771–780, 2010.
[63] A. A. Pawle and V. P. Pawar, "Face recognition system (FRS) on cloud computing for user authentication," *International Journal of Soft Computing and Engineering (IJSCE)*, vol. 3, no. 4, pp. 189–192, 2013.
[64] S. Belaid and A. Temessek Behi, "The role of attachment in building consumer-brand relationships: an empirical investigation in the utilitarian consumption context," *Journal of Product & Brand Management*, vol. 20, no. 1, pp. 37–47, 2011.
[65] R. Batra, A. Ahuvia, and R. P. Bagozzi, "Brand love," *Journal of marketing*, vol. 76, no. 2, pp. 1–16, 2012.