Heliyon 10 (2024) e32978

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Why do generation X customers use wearable fitness technology equipment after recovering from coronavirus? The role of perceived health risks

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ARTICLE INFO

Keywords:
Value
Technology acceptance model (TAM)
Generation X
Covid-19 pandemic
Wearable fitness technology equipment (WFTE)
Perceived health risks
Subject classification codes: M31
I12
D83

ABSTRACT

The health sector has prioritized the physical health of vulnerable Generation X individuals at high Coronavirus risk. Despite vaccination efforts, both infected and healthy people continue facing health threats. Unlike other industries devastated by COVID-19, wearable fitness technology equipment (WFTE) is essential for health-focused individuals. This research examined customers' intention to use WFTE using an adapted Technology Acceptance Model (TAM) framework. A key contribution is the inclusion of perceived health risk and its impact on WFTE value perceptions and usage attitudes post-pandemic. The study gathered qualitative data from coronavirus patients and survey data from 513 participants. Structural equation modeling analysis supported the theoretical model. While the standard TAM evaluated intent to use WFTE, this study uniquely examined how WFTE's functional, hedonic, and symbolic value shapes its perceived value. Perceived health risk was found to significantly impact perceived WFTE value and usage attitudes after the pandemic recovery. Findings offer managerial implications to boost WFTE adoption among the vulnerable Generation X demographic.

1. Introduction

Multiorgan effects or autoimmune difficulties might persist for weeks to months following an illness in some patients, particularly those with severe Covid-19 pandemic. An individual's cardiovascular, respiratory, endocrine, immune, cutaneous, and central nervous systems might all be affected by multiorgan impacts. Due to these side effects, those infected with Coronavirus may be at a higher risk than the general population for developing new health issues such as diabetes, heart disease, and neurological diseases. The impact of wearables on users' psyches is nuanced and moderated by several variables. For instance, it has been proven that wearable devices may increase exercise, rapid positive changes in behavior, and help people achieve a healthy body mass index [1]. The impact of Coronavirus has been proven through many studies, especially with older customers [2]. However, the interest in health risks has not been analyzed much in the behavioral sciences, especially among Generation X (Gen X) customers with wearable health monitoring products.

WFTE is a technology device, so the Technology Acceptance Model (TAM) is suitable when analyzing the intention to use. However, most of the current studies using the TAM theoretical framework are generally about the perceived usefulness of the technology [3]

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https://doi.org/10.1016/j.heliyon.2024.e32978
Received 27 August 2023; Received in revised form 25 May 2024; Accepted 12 June 2024
Available online 13 June 2024

rather than analyzing each valuable feature of the technology closely. Despite the widespread curiosity, much-related research fails to define the notion of "value," which has become one of the most misused and misrepresented ideas in the social sciences and management literature [4]. Many authors in the field of marketing have attempted to define "perceived value," including Holbrook [5]; Woodruff [6]. Zeithaml [7] provides an often-used definition of "value" by stating that it is "a consumer's entire evaluation of a product's usefulness based on perceptions of what is received and what is provided in exchange for that commodity." Value is directly proportional to how much a product's intended purpose is met [7,8]. Functional, which comes from the helpful word, means a product or service that can fulfill a customer's desire or need. According to Frenzen and Davis [9], how well a product or service meets its practical needs influences customers' buying decisions. Some shoppers prioritize practical considerations while making a purchase. Other studies have examined consumers' hedonic and utilitarian aspects [10,11].

Extending the TAM theoretical framework, this study aimed to analyze consumers' Intention to use WFTE, in which the values of a WFTE, such as functional value, hedonic value, and symbolic value, were considered as perceived usefulness of technology. Moreover, this research examined the relationship between perceived health risks and Generation X customers using WFTE after recovering from Coronavirus. It is considered that this work offers both theoretical and practical advances. Theoretically, by developing and validating an integrated framework of technology acceptance and health behavior, this study provides a complete understanding of consumers' acceptance of WFTE. It has the potential to provide theoretical foundations for future healthcare wearable device adoption research. Practically, wearable device managers and social planners may use this research as a reference to develop more effective strategies or policies to encourage the use of wearable technology in the healthcare sector.

The following sections explore the research on how TAM has been used and the hypotheses development. In the third section, this study examined the boundary condition of the proposed method. The study's results were then reconstructed for use in this study. Finally, this research discusses the result as well as the conclusion.

2. Literature review

2.1. Wearable fitness technology equipment

The development and commercialization of wearable healthcare equipment have been relatively slow due to the need for a comprehensive review in the field to guide rational design and development [12]. Wearable sensors for health monitoring have seen rapid progress, but challenges remain in their fabrication [13]. Integration of biosensing and artificial intelligence has shown promise in improving wearable sensor design for health monitoring [14]. Wearable fitness trackers with optical heart rate sensing technology have been validated for accuracy in monitoring heart rate during exercise in different age groups [15]. Wearable technology, such as smart EM devices, offers multifunctional capabilities and potential opportunities for future development [16]. Next-generation wearable sensors have the potential to transform diagnostics by enabling real-time and continuous measurement of physical parameters and biochemical markers [17]. The application of IoT technology in smart wearable fitness equipment and artificial intelligence health management shows promise for intelligent health monitoring systems [18]. Overall, wearable technology has demonstrated potential for intelligence augmentation through human-machine symbiosis, offering context sensitivity, mobility, hands-free interaction, and constancy of operation.

2.2. Generation X customer

In recent years, marketers have increasingly focused on how different generations use technology [19,20]. Generational cohort theory (GCT) categorizes people into generation groups based on birth years, hypothesizing similar thought, feeling, and behavior patterns ([21]. Generation X refers to those born between 1965 and 1980. Sometimes called the "middle child" generation, Gen X follows the famous baby boomers and precedes the millennials. With lower numbers than other groups, Gen X is often overlooked in generational discussions.

Gen Xers are often primary caregivers for children and elderly parents. Having grown up as "latchkey" kids during times of heightened stranger danger, Gen X is equipped to cope with social exclusion and quarantine [22]. They can model caution for parents and children by staying home. While baby boomers have higher coronavirus risk, millennials should not overlook risks as they age. Motivated by dependents like children needing virtual education support and elderly parents needing care, Gen X strives to maintain health. Indeed, 54 % of Gen X report extreme coronavirus anxiety. As the "forgotten" middle child generation caring for young and old, Gen X is uniquely motivated to use technology like WFTE to preserve health during the pandemic [23].

2.3. Theoretical model

The Technology Acceptance Model (TAM) has been widely used to understand user behavior and acceptance of various technological innovations. Several studies have applied and extended the TAM to investigate the adoption and continued usage of wearable fitness technology equipment. For example, Huang and Ren [24] explored the role of exercise self-efficacy in predicting users' intention to continue using fitness mobile apps, in addition to the original TAM constructs. Chiu and Cho [25] examined the impact of technology readiness on individuals' decisions to use health and fitness apps, incorporating perceived enjoyment. Cho et al. [26] integrated TAM with the Investment Model to understand sustained usage of health and fitness apps among users in China. Moreover, Lazaro et al. [27] proposed an acceptance model for smartwatch adoption among older adults by extending the TAM, highlighting the importance of user acceptance in the context of wearable technologies. Cheung et al. [28] focused on driving healthcare wearable

technology adoption among Generation Z consumers in Hong Kong, combining generation cohort theory with the TAM. Tsai et al. [29] studied technology anxiety and resistance to change in older adults using a wearable cardiac warming system, confirming the validity of the extended TAM in determining technology acceptance behavior among older users. Furthermore, Clubbs et al. [30] applied the Theory of Planned Behavior and the TAM to analyze a university employee fitness tracker program, emphasizing the role of perceived ease of use in predicting physical activity. Cai et al. [31] developed a model to explain factors influencing continuous behavior while using fitness apps, incorporating expectation-confirmation theory, TAM, and the Post-Acceptance Model of Information Systems Continuance. Lastly, Acikgoz et al. [32] explored the psychological predictors of intention to use fitness apps among European users, drawing upon the TAM and innovation diffusion theory. These studies collectively contribute to the understanding of user acceptance and behavior towards wearable fitness technology equipment, highlighting the importance of factors such as self-efficacy, technology readiness, user experience, and psychological drivers in shaping users' intentions and actual usage behavior.

Recent studies using the TAM framework have focused on perceived usefulness rather than thoroughly examining each valuable component of a technology [3]. Additionally, despite extensive research, "value" remains poorly defined in social science and management literature [4]. Zeithaml [7] defined value as a consumer's evaluation of a product's usefulness based on perceived benefits and costs. For WFTE, customers perceive value through the product's benefits, especially Generation X customers recovering from coronavirus who live in a digital world. Many Gen X customers now use wearables to monitor health and enable better lifestyles. They are committed to achieving daily activity goals with devices like the Apple Watch. Wearables with motion sensors can track fitness levels when synced to smartphones.

Demand for high-technology sports products has significantly increased worldwide amid shifts in how people view and engage with these brands [33]. Luxury sports goods are gaining popularity as customer tastes broaden and demand for self-expression grows. Customers value high-tech products for social bonding and self-expression of personality traits to distinguish themselves [34]. Cobranding allows businesses to strategically partner to deliver superior products than any single company could alone.

Many Generation X customers are interested in WFTE because of COVID-19 impacts and the product's perceived value and ease of use. COVID-19 can cause lasting multiorgan effects and autoimmunity, increasing risks for conditions like heart disease. Thus, this research examined whether TAM predicted WFTE usage based on perceived health risks post-COVID. The research model, as Fig. 1, incorporated valuable components beyond perceived usefulness to thoroughly assess WFTE adoption among Generation X.

2.4. Hypotheses development

2.4.1. Attitude and intention to use WFTE

Behavioral intention has been extensively studied in the literature from various angles. According to Frik and Mittone [35], behavioral intentions describe the mental preparations that lead to action. In addition to its diagnostic utility, behavioral intent may be understood as a real-world buying signal [36]. The current study's definition of WFTE intent is the adoption of WFTE in daily activities. Previous research on the connection between attitudes and behavior has often included behavioral intentions as a variable; however, studies examining the impact of behavioral intentions to utilize technological devices on the behavioral intention to protect their health.

Since its introduction, Theory of Planned Behavior (TPB) verifies that individuals' actions may be anticipated by their intentions toward a particular product, service, or technology [37]. Attitudes may be used to anticipate one's future action by guiding one's intention setting [38]. Attitude is the tendency to respond favorably or adversely to an event [20]. Previous studies on e-learning adoption found that attitude is a driver of behavioral Intention to utilize e-learning [39]. Attitude has been demonstrated to be an essential factor affecting behavioral intention [40,41]. Based on the findings of those studies, this study formed the following hypothesis.

H1. Attitude toward WFTE positively impacts Intention to use WFTE.

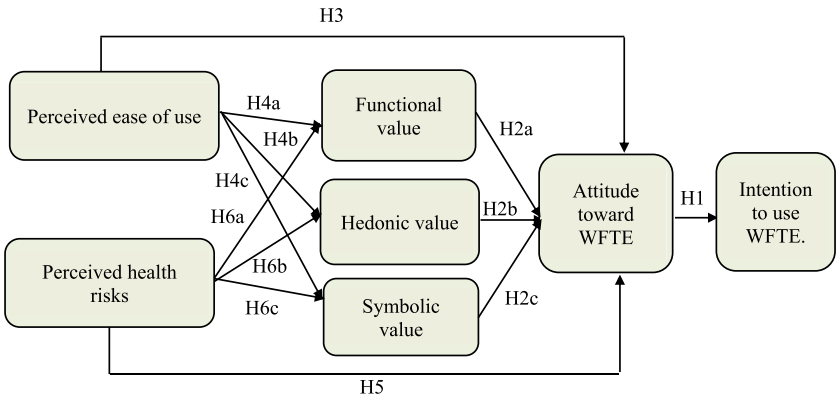

Fig. 1. Theoretical model.

2.4.2. Value of WFTE and attitude toward WFTE

The value of Wearable Fitness Technology Equipment (WFTE) can be broadly categorized into functional, hedonic, and symbolic values, each playing a crucial role in shaping users' attitudes towards these devices. Functional value is derived from the perceived usefulness, health management benefits, and the autonomy these devices offer in tracking and managing personal health, as highlighted by the significant influence of health consciousness, motivation, perceived compatibility, and technology accuracy on the intention to use WFTE [42]. Additionally, the ability of WFTE to motivate users towards a healthier lifestyle by monitoring physical activity underscores their practical utility [43]. Hedonic value, on the other hand, is associated with the pleasure and enjoyment users derive from using WFTE. This aspect is particularly emphasized by findings that hedonic benefits, alongside health and autonomy benefits, significantly impact the continued usage intention of wearable fitness tracking devices [44]. Moreover, Yang et al. [45] confirmed that hedonic factors positively influence the overall acceptance of wearable fitness devices in developing countries, indicating that the enjoyment aspect is a universal driver across different demographics. Symbolic value relates to the perceived social image and status conferred by owning and using WFTE. While some studies suggest that symbolic benefits do not significantly discriminate between low and high continued usage intentions of WFTE [46], the aspect of perceived social image has been found to positively affect the perceived value of fitness wearables [47]. This indicates a nuanced impact of symbolic value, where it may not directly influence continued usage but still affects initial adoption intentions by enhancing the perceived value of the technology. Attitudes towards WFTE are significantly shaped by these values, with attitude being the strongest predictor of WFTE continuous usage [48]. The integration of WFTE enhances service experiences through increased social interaction, gamification, and accountability, further influencing positive attitudes towards these technologies. However, it's crucial for the integration of such technologies to align with users' perceptions to avoid potential misalignments [49], emphasizing the complex interplay between functional, hedonic, and symbolic values in shaping attitudes towards wearable fitness technology equipment. Hence, the following hypotheses were proposed.

H2a. Functional value positively impacts the Attitude toward WFTE

H2b. Hedonic value impacts positively on Attitude toward WFTE

H2c. Symbolic value impacts positively on Attitude toward WFTE

2.4.3. Perceived ease of use, the value of WFTE, and attitude toward WFTE

Perceived ease of use refers to the physical and mental effort necessary to run a specific device [50]. In other words, if devices are easy to use and do not involve too much effort, they will be used more often. Some device limits, such as challenges and complicated manipulations, may cause dissatisfaction and rejection of these devices, especially among elderly and inexperienced users. Consequently, whether users are technically savvy, WFTE must be simple to comprehend and use [43]. Previous studies have shown that perceived ease of use correlates favorably with users' attitudes [51]. Perceived ease of use affects technology adoption directly and indirectly via customer attitudes and influences behavioral intention [2]. This result aligns with research showing a good correlation between user-friendliness and attitude [52]. Similarly, Aljedaani et al. [53] discovered that the acceptability of mobile wireless healthcare technology was impacted by the users' perceptions of how easy it was to use. Consequently, hypothesis H3 was proposed.

H3. The WFTE's perceived ease of use positively impacts Attitude toward WFTE

The Technology Acceptance Model (TAM) applied in previous studies highlights the importance of perceived ease of use in determining the actual system use and, by extension, the perceived value of the technology. For instance, a study found that perceived ease of use positively correlates with the accessibility scale of Gratifications of Wearables Technology, indicating that easier-to-use wearable technologies are more likely to be adopted and valued by users [54]. This is further supported by findings that simple operation and appearance design significantly impact the perceived ease of use of sports wearable devices, which in turn affects users' attitudes and behaviors towards these devices [54]. Moreover, the perceived ease of use has been identified as a critical factor in users' acceptance of the multidimensional health and fitness features of wrist-worn wearable devices (WWDs), suggesting that when users find fitness functions easy to use without causing any difficulty, they tend to use those functions more [55]. This ease of use is crucial for enhancing the perceived value of WFTE, as it facilitates the adoption and effective utilization of the technology for health and fitness purposes. Additionally, research indicates that users with high positive technology readiness value the perceived ease of use more than the perceived usefulness in sports wearable technology, highlighting the significance of ease of use in the adoption process [46]. This is consistent with findings that perceived value is the strongest driver of usage intention for wearable fitness trackers, with ease of use being a key component of this perceived value [56]. In summary, the perceived ease of use is positively correlated with the value of WFTE [57]. Consequently, the following hypotheses are being investigated.

H4a. The WFTE's perceived ease of use positively impacts the Functional value of WFTE.

H4b. The WFTE's perceived ease of use positively impacts the Hedonic value of WFTE.

H4c. The WFTE's perceived ease of use positively impacts the Symbolic value of WFTE

2.4.4. Perceived health risks, the value of WFTE, and attitude toward WFTE

The definition of risk is "a mix of uncertainty and severity of result involved," which suggests that risk is a term that encompasses both possibilities and outcomes [58]. Risk is the possibility and significance of losses [59]. After the Covid-19 pandemic, worry, anxiety, fear, discomfort, and even prejudice all impact customers' risk perception and, in turn, their decision to take care of their health with wearable healthcare devices [60].

The coronavirus pandemic has heightened health risk perceptions and accelerated adoption of remote health monitoring tools like wearable fitness technology equipment. The pandemic motivated people to improve fitness habits to reduce risks from COVID-19 and future respiratory diseases. Rupp et al. [61] found increased consumer interest in leveraging WFTE like smartwatches and activity trackers to monitor vital signs, activity, sleep and detect signs of viral illness. This indicates an association between elevated health risk perceptions related to coronavirus and perceived value of WFTE for monitoring and managing wellbeing. Additionally, Shin and Biocca [62] noted surging WFTE sales during the pandemic as consumers sought personalized health insights, with Google search interest in fitness trackers increasing over 50 %.

Beyond known brand names, emerging WFTE like the Oura ring gained traction by providing early illness detection and all-day health data [63]. Its popularity reinforces the link between coronavirus health fears and demand for WFTE monitoring capabilities. However, attitudes toward adopting WFTE are shaped by more than just demand. As Yang et al. [64] discussed, privacy concerns became a bigger barrier during COVID-19 given risks of personal data misuse. Despite growing WFTE adoption overall, some consumers remained wary of sharing sensitive health information.

The pandemic has amplified appreciation of WFTE for tracking activity, vitals, sleep and identifying illness indicators. Additionally, higher perceived WFTE value likely improves attitudes toward adoption. Personalized health insights are valued for optimizing wellness during viral outbreaks. However, persistent privacy risks undermine attitudes, so higher perceived privacy risks related to WFTE data sharing will negatively predict attitude. In essence, coronavirus escalated the value of WFTE for mitigating health risks, but privacy concerns restrain acceptance for some consumers despite the benefits. Addressing these barriers around ethical data practices could enable WFTE to improve population health resilience both during and after the pandemic. Hence, this study proposed some hypotheses.

H5. Perceived health risk impacts positively on Attitude toward WFTE

H6a. Perceived health risk impacts positively on Functional value of WFTE

H6b. Perceived health risk impacts positively on the Hedonic value of WFTE

H6c. Perceived health risk impacts positively on Symbolic value of WFTE

2.5. Research method

2.5.1. Research procedures

Qualitative research involved discussions with nine coronavirus patients to develop suitable research concepts aligned to the background and refine scale constructs [65]. Discussions also confirmed theoretical relationships between constructs. Purposive sampling selected participants aged 42–66 interested in health tracking. Semi-structured interviews lasting 120 min were conducted in a research room per standardized guidelines. Moderators asked open-ended questions and follow-ups to explore motivations for using mobile health monitoring. Scales and model relationships were also verified for validity with participants.

For quantitative analysis, the partial least squares structural equation modeling (PLS-SEM) technique estimated the theoretical model. Following Hair Jr et al. [66], the measurement model was assessed for reliability and validity first. Next, the PLS-SEM model was evaluated on metrics including VIF, f^2, Q^2, R^2, model fit, and path coefficients. The qualitative findings informed development of applicable scales and constructs. PLS-SEM quantitatively tested the hypothesized relationships between constructs established through the literature review and qualitative research.

2.5.2. Measurement

Our measuring methodologies for our construct's pieces are being questioned in this survey. All indicators have been modified from previous research. The qualitative method evaluated the questions' readability in advance of the examination. For each of the 22-item questions, respondents were asked to choose between "strongly disagree" (=1) and "strongly agree" (=5) on a 5-point Likert scale. This study adopted two items that Tran and Nguyen [58] developed to measure perceived health risk (PHR). Meanwhile, perceived ease of use (PEU), attitude toward WFTE (ATU), and Intention to use WFTE (ITU), respectively, were measured using a modified version of three, four, and two items from research by Khoa [67]. Five items were adapted from research by Faschan et al. [68] to measure the functional value (FV). Symbolic value (SV) and hedonic value (HV) were measured by three items per construct, initially generated by Yang and Mattila [69].

2.5.3. Participants

Minimum sample sizes are not based on randomization in the PLS-SEM models and may be run with small sample sizes using bootstrapping approaches, although the sample size dramatically affects the outcomes and accuracy of the models [66]. Data were collected from June 2021 to March 2022.

In order to compile accurate data, the researchers included customers who had been afflicted with Coronavirus before and were interested in their health. Individuals were given access to the online poll through a link on Google Forms. The sampling method in quantitative research is also purposive. The study selected respondents based on two main screening questions: "Have you ever been infected with Coronavirus?" and "Do you care about health in the post-Covid era?" If one of the two questions above is answered "No," the survey will stop immediately.

The study sample consisted of 55.6 % male and 44.4 % female participants. The highest proportion of participants in the survey was between the ages of 57–66. (55.9 percent). In addition, 46.2 % of those who participated in the survey are retired. Overall, the sample

description is appropriate, as older and middle-aged adults with Coronavirus are at high health risk [70]. Moreover, 54.97 % of participants have bachelor's degrees, and 67.25 % of respondents have experience with wearable devices for three years or more. Respondents' demographic information is included in Table 1.

3. Result

Table 2 showed that all measures of internal consistency and reliability (Cronbach's alpha, Composite Reliability, and rho A) were more than 0.7 [71]. The Average Variance Extracted (AVE) scores all went over the threshold of 0.50, and all of the outer loading values were above the 0.7 limits [72], proving the measuring model's reliability [73]. The convergent validity of the measurement model was further shown by the outer loading values and the AVE [66]. Before the analysis, this study checked to ensure collinearity was not a significant issue [74].

In agreement with Henseler et al. [72], this research investigated discriminant validity using the correlations' heterotrait-monotrait ratio (HTMT). When all the HTMT ratios were less than 0.85, the discriminant validity of the measurement model was achieved. As in Table 3, all HTMT ratios fell below 0.85; the measurement model was considered discriminately valid.

This study evaluated the variance inflation factor (VIF) and correlation coefficient (r) to check the multi-collinearity between the research constructs. The VIF readings were below the threshold of 5, indicating that multi-collinearity is not an issue [75]. In contrast, values less than three are optimal [76]. Kock [77] recommended using a comprehensive collinearity test to examine potential methodological bias. They noted that VIFs larger than 3.3 indicated pathological multi-collinearity. A high degree of multi-collinearity like this might suggest that the model uses a centralized data-gathering or biasing strategy. In contrast, a model is considered free of biases or standard method bias when all VIF values from the multi-collinearity test are equal to or lower than 3.3. Table 4 shows the inner VIF values, which are lower than 3.3. Moreover, multi-collinearity is often presented when the absolute value of the Pearson correlation coefficient is close to 0.8 [78,79]. According to the value in Table 4, the relationships between the research constructs are significant at the 0.01 level, and the highest r value is 0.741, which is less than 0.8. Consequently, there is no multi-collinearity in this research model.

Before testing the hypotheses, outlier data were analyzed to ensure more reliable outcomes. The finite mixture (FIMIX) method was used for a robustness study on PLS-SEM and to test for unobserved population heterogeneity. The model selection criteria established by FIMIX-PLS ultimately allow the user to decide how many data segments should be set aside for this purpose [66]. The results of the structural model and its significance are shown in Table 5; the percentile bootstrapping approach was performed with a total of 5000 subsamples, and 95 % confidence intervals were supplied.

Intention to use WFTE is influenced favorably by one's attitude ($\beta = 0.511$, *t-value* $= 11.385$, *p-value* $= 0.000$); hence, hypothesis H1 was supported. As a result, hypothesis H3 is also supported when positive and statistically significant effects of the WFTE's perceived ease of use on Attitude toward WFTE were found ($\beta = 0.177$, *t-value* $= 4.553$, *p-value* $= 0.000$). Two results were supported by TAM and other studies [19,80,81]. As a result, this study may accept H2a, H2b, and H2c. In a statistically significant way, Functional value impacts positively on Attitude toward WFTE ($\beta = 0.234$, *t-value* $= 6.706$, *p-value* $= 0.000$), Hedonic value impacts positively on Attitude toward WFTE ($\beta = 0.278$, *t-value* $= 6.792$, sig. $= 0.000$), and Symbolic value impacts positively on Attitude toward WFTE ($\beta = 0.29$, *t-value* $= 7.789$, *p-value* $= 0.000$). Moreover, H4a, H4b, and H4c were supported, in which WFTE's perceived ease of use positively impacts on Functional value of WFTE ($\beta = 0.339$, *t-value* $= 7.867$, *p-value* $= 0.000$), WFTE's perceived ease of use impacts positively on Hedonic value of WFTE ($\beta = 0.361$, *t-value* $= 7.563$, *p-value* $= 0.000$), and WFTE's perceived ease of use impacts positively on Symbolic value of WFTE ($\beta = 0.321$, *t-value* $= 6.843$, sig. $= 0.000$). Perceived health risk also positively impacted Attitude toward WFTE ($\beta = 0.131$, *t-value* $= 3.394$, *p-value* $= 0.001$); therefore, this result lends credence to H5. As a result, this research found H6a, H6b, and H6c to be supported; perceived health risk positively impacts the Functional value of WFTE ($\beta = 0.465$, *t-value* $= 10.288$, sig. $= 0.000$), Hedonic value of WFTE ($\beta = 0.231$, *t-value* $= 4.576$, *p-value* $= 0.000$), and Symbolic value of WFTE ($\beta = 0.288$, *t-value* $=$

Table 1
Respondents' demographic characteristics.

Characteristics		Frequency	Percent
Gender	Male	285	55.6
	Female	228	44.4
Age group	42–46	62	12.1
	47–51	38	7.4
	52–56	126	24.6
	57–66	287	55.9
Occupation	Office worker	129	25.1
	Wife house	147	28.7
	Retired people	237	46.2
Education level	High school	132	25.73
	Bachelor	282	54.97
	Post-graduated	99	19.30
Experience with wearable devices	Less than one year	23	4.48
	1–2 years	145	28.27
	3–5 years	224	43.66
	More than five years	121	23.59

Table 2
Convergent validity and reliability.

Construct	Cronbach's Alpha	rho_A	Composite Reliability	AVE	Outer loading
ATU	0.725	0.759	0.830	0.554	[0.721–0.856]
FV	0.880	0.881	0.913	0.678	[0.764–0.897]
HV	0.709	0.721	0.837	0.631	[0.767–0.839]
ITU	0.844	0.845	0.928	0.865	[0.927–0.933]
PEU	0.912	0.913	0.945	0.851	[0.912–0.937]
PHR	0.832	0.836	0.922	0.856	[0.918–0.932]
SV	0.891	0.892	0.933	0.822	[0.883–0.936]

Table 3
Discriminant validity.

	ATU	FV	HV	ITU	PEU	PHR	SV
ATU							
FV	0.837						
HV	0.824	0.467					
ITU	0.631	0.521	0.542				
PEU	0.824	0.701	0.618	0.845			
PHR	0.840	0.790	0.586	0.520	0.716		
SV	0.806	0.562	0.305	0.413	0.556	0.567	

Table 4
VIF value.

	r							VIF				
	PHR	PEU	FV	SV	HV	ATU	ITU	ATU	FV	HV	ITU	SV
PHR	1	0.624**	0.675**	0.489**	0.450**	0.660**	0.435**	2.236	1.638	1.638		1.638
PEU	0.624**	1	0.627**	0.502**	0.501**	0.683**	0.741**	2.178	1.638	1.638		1.638
FV	0.675**	0.627**	1	0.497**	0.370**	0.669**	0.448**	2.186				
SV	0.489**	0.502**	0.497**	1	0.245**	0.640**	0.358**	1.484				
HV	0.450**	0.501**	0.370**	0.245**	1	0.595**	0.425**	1.408				
ATU	0.660**	0.683**	0.669**	0.640**	0.595**	1	0.504**				1.000	
ITU	0.435**	0.741**	0.448**	0.358**	0.425**	0.504**	1					

Note.
** Correlation is significant at the 0.01 level (2-tailed).

Table 5
Results of research hypotheses and model fit.

	β	Standard Deviation	*t-value*	Hypothesis	Result
ATU - > ITU	0.511	0.045	11.385	H1	Accepted
FV - > ATU	0.234	0.035	6.706	H2a	Accepted
HV - > ATU	0.278	0.041	6.792	H2b	Accepted
SV - > ATU	0.290	0.037	7.789	H2c	Accepted
PEU - > ATU	0.177	0.039	4.553	H3	Accepted
PEU - > FV	0.339	0.043	7.867	H4a	Accepted
PEU - > HV	0.361	0.048	7.563	H4b	Accepted
PEU - > SV	0.321	0.047	6.843	H4c	Accepted
PHR - > ATU	0.131	0.039	3.394	H5	Accepted
PHR - > FV	0.465	0.045	10.288	H6a	Accepted
PHR - > HV	0.231	0.050	4.576	H6b	Accepted
PHR - > SV	0.288	0.050	5.763	H6c	Accepted

Model fit	**R^2**	**R^2 Adjusted**	**Q^2 predict**	**Fit indies**	
ATU	0.715	0.713	0.384	SRMR	0.072
FV	0.528	0.526	0.345	NFI	0.747
HV	0.287	0.284	0.175		
ITU	0.262	0.260	0.223		
SV	0.302	0.299	0.244		

5.763, *p-value* = 0.000). Fig. 2 points to the relationship between the research constructs in this study.

In Table 5, the goodness of the in-sample fit was determined by computing the R^2 value. The model explained 71.5 % of the variation in Attitude toward WFTE. Further, all R^2_{FV}, R^2_{HV}, R^2_{ITU}, and R^2_{SV} were greater than 20 %; therefore, there is a well-established statistical metric to quantify how well the regression predictions match the actual data points, especially in social science and behavior [66]. The Q^2 premise value for ATU, FV, HV, SV, and ITU was robust and not zero. This result meant the model had some predictive value. The Normed Fit Index (NFI) was also used (the NFI for this model is 0.747). All the numbers that came out of NFI were between zero and one. Closer NFI values approaching 1 suggest a more optimal model [82]. Moreover, the root mean square residual (RMSR) is 0.072, less than 0.08; hence, no model misspecification exists [83].

4. Discussion

Further research on prospective wearable technology users' perceptions and practices is essential for market growth and development. This research presents a model incorporating TAM that accounts for factors driving wearable fitness technology acceptance intentions. The model can aid understanding of wearable adoption and has practical implications for convincing potential users by highlighting key drivers, especially as the market is still emerging.

Findings reveal relationships between customers' positive emotional responses to sensory and functional product features and purchase choices. Understanding customer attitude influences on decisions can help solve marketing challenges. The evolving conceptualization of value expands beyond intrinsic and instrumental nature values to include human-nature relational values like preferences and virtues [84]. Relational values enable applying social science theories to consumption contexts. For example, value dimensions like economic, functional, and service value have been shown to influence solar energy purchase intentions [85]. Luxury research highlights hedonism, escapism, conspicuousness, quality, and usefulness as high-tech product motivators Ostovan and Khalili Nasr (2022). Evaluating multidimensional consumer values allows better understanding of purchase intentions. Beyond functional value, products also offer symbolic and hedonic value [86].

A key finding is the role of perceived health risks in influencing Gen X consumption post-COVID-19 [87]. Concerns over health risks can motivate older recovered customers to use monitoring devices. Perceived health risks represent an external factor shaping technology acceptance attitudes [88]. Understanding how Gen X health concerns influence purchase behavior will build theoretical relationships and practically guide communication about health benefits to older consumers.

Perceived risks relate to subjective perceptions shaped by social, cultural and contextual factors, unlike objective real risks defined by probabilities [89,90]. Perceived risks can override real risks in changing attitudes and actions [91]. Perceived health risks can promote wearable advancements for remote patient monitoring, assessing at-risk groups, reducing hospital transmission, and enabling telehealth during COVID-19. Findings indicate higher perceived health self-risk increases wearable value perceptions and continued usage. With lower perceived risk, Gen X relies more on wearables for added feedback.

Methlagl et al. [56] found that perceived ease of use significantly improved perceived value. Choosing technological over traditional media offers utilization advantages [92,93]. Pairing WFTE utility and enjoyment boosts appeal and popularity. Hedonic and utilitarian qualities have been examined, with enjoyment enhancing productivity, pleasure and utility [94,95]. Confirming TAM, this research found ease of use and attitudes significantly influence wearable adoption intentions and continued usage. Understanding user perceptions guides design and communication for practitioner adoption and retention efforts.

Findings also reveal perceived value influences attitudes and preferences [2]. As learned predispositions, attitudes change with new experiences and are linked to actions. Consumer behavior research shows perceived product value directly affects impressions and purchase choices [96]. In conclusion, the hedonic value of a product is predicted to be affected by its novelty and coolness, whereas the practical worth of a product is predicted to be affected by its meaningfulness [97]. In turn, the utilitarian and hedonistic values of the consumer are anticipated to affect their opinion of the product [98].

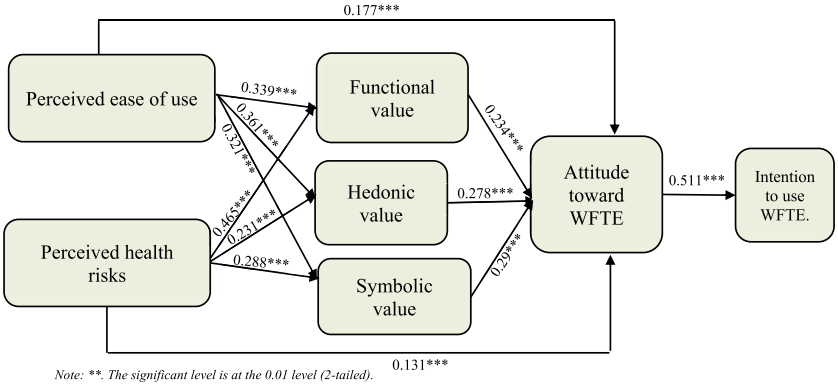

Fig. 2. The research results.
Note: **. The significant level is at the 0.01 level (2-tailed).

5. Conclusion

The World Health Organization (WHO) has published the first official definition of a post-COVID-19 condition. Therefore, patients with a previous COVID-19 infection and symptoms that have persisted for over two months and cannot be attributed to any other cause suffer from post-COVID-19 illness. A person's long-term health might deteriorate due to this disease, making it difficult to return to work or socialize. The aftermath of COVID-19 may have severe repercussions for people's physical and emotional health and their ability to make a living. In contrast to other industries seriously affected by the Covid-19 pandemic, WFTE has become necessary and ordinary when people understand nothing more important than health. The remote monitoring of Covid-19 patients can soon identify the stages of health decline and take them to the hospital for treatment when necessary. Accordingly, the newly diagnosed Covid-19 patient is at risk of being taken home with a device designed to monitor some critical health indicators. Health data collected equipment remotely monitored by a group of medical staff, and patients were hospitalized when these health indicators showed that their condition was deteriorating. This study had some theoretical contributions, managerial implications, limitations, and further research below.

5.1. Theoretical contributions

In conclusion, findings demonstrate users' perceived health risks influence the value of WFTE and attitudes toward WFTE post-COVID-19. While this study applied TAM to assess WFTE usage intentions, it uniquely examined WFTE's functional, hedonic, and symbolic value to determine its overall perceived value instead of just perceived usefulness. Rather than perceived usefulness mediating technology attitudes, technology product values (functional, hedonic, symbolic) were used. As life improves via wealth and convenience, a product's usefulness to customers becomes just its functional value in usage behavior [86]. Products also offer symbolic and hedonic value. This study confirms two healthcare wearable values.

Additional insights relate to recovering Gen X users facing higher reinfection and mortality risks. While sports wearables have interested scholars, the product usage behavior of Gen X post-coronavirus infection is understudied. Contributions include demonstrating the antecedent role of perceived health risks on Gen X consumption post-COVID-19. As older adults, Gen X have ongoing health risks despite recovery, with concerns motivating wearable adoption. Additionally, perceived health risks represent an external factor shaping technology acceptance attitudes. For healthcare contexts, perceived health risks could be adapted in future technology acceptance studies to build relationships with factors like loyalty, word-of-mouth, and services.

5.2. Managerial implications

WFTE companies should consider user preferences when designing wearables. Some Gen X customers lack technical expertise, so wearables must be tested for elder-friendliness and their tech knowledge fostered. User interfaces should employ large text, clear colors, local language, voice controls, and video tutorials. COVID-19 has advanced health apps by adding AI to healthcare, raising hygiene awareness. Wearables aid infection prevention, like Apple's Cardiogram update to track COVID heart rate changes. Beyond technical aspects, wearable design should address user inclinations for clinical and home adoption. Systems should be small, embedded, easy to use and maintain.

Exercise features should be incorporated to encourage routine-building and self-management. Interactivity must also be enhanced to foster user communities. Developers can engage users by performance feedback or social connections via live streaming. This boosts enjoyment and entertainment value. Brand attributes should reflect user self-image. Findings show WFTE improves self-worth, so unique graphics should meet consumer identity needs. Early product positioning and loyal user base cultivation are also advised.

Perceived health risks drive value perceptions and attitudes about WFTE. While not advocating fear manipulation, fair health monitoring and protection advertising can convey positives to Gen X. Focusing on children's filial piety may also effectively frame wearables as caring gifts.

5.3. Limitations and further research

While this research presented meaningful implications, limitations exist including the sole use of health risks as an antecedent variable, the singular generational focus, and limited variance explained. Additional limitations were the lack of perceived accuracy measurement and use of multi-item constructs. To build on these findings, future research should test health risks as a moderator, examine other generational cohorts like Baby Boomers, incorporate device accuracy perceptions, expand health and demographic predictors, employ multi-item measures, collect longitudinal adoption data, compare generations, and investigate social influence roles. Addressing these limitations and research areas will further theoretical understanding of health risk perceptions in technology acceptance models and provide additional practical insights into promoting vital wearable adoption among vulnerable older consumers facing ongoing pandemic threats.

Ethics statement

Ethical approval has been obtained from the Industrial University of Ho Chi Minh city; the real protocol number is 153/2022/IUH. Informed consent was obtained from all participants in this study. Participants were free to leave the survey at any time. I respect participants' privacy rights in ethical research. As a result, the data provided do not identify individuals based on their answers. The

poll was entirely anonymous, with no information that could be used to determine participants' identities.

Funding

This research received no external funding.

Data availability statement

Data available on request due to restrictions, e.g., privacy or ethics.

CRediT authorship contribution statement

Bui Thanh Khoa: Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Tran Trong Huynh:** Writing – original draft, Visualization, Software, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix. Questionnaire items

Construct	Research Item
Perceived health risks	• My health will likely be affected by COVID-19 if I do not use a WFTE.
	•COVID-19 will seriously damage my health if I do not use a WFTE.
Perceived Ease of Use	•My interaction with a WFTE is clear and understandable.
	•Interacting with a WFTE does not require much mental effort.
	•I find it easy to get a WFTE to do what I want.
Symbolic value	•Using a good WFTE is considered a symbol of social status.
	•Using a good WFTE helps me to express myself.
	•Using a good WFTE helps me communicate my self-identity
Hedonic value	•I use a WFTE for the pure enjoyment of it.
	•Using a good WFTE gives me much pleasure.
	•I use a WFTE for self-indulgence
Functional value	•WFTE is bought for its excellent quality.
	•I value good quality over prestige when considering the purchase of a WFTE.
	•I would never buy a WFTE that many people prefer, but that does not meet my quality standards.
	•WFTE is bought for its excellent customer service.
	•It is important to me that the WFTE stores I shop in provide outstanding service.
Attitude toward WFTE	•I think WFTE is desirable.
	•I like WFTE.
	•In general, I am optimistic about WFTE.
	•In general, WFTE is good
Intention to Use WFTE	•Assuming I must buy a WFTE, I intend to use it.
	•I predict I will use it because I must buy a WFTE.

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