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Factors Affecting the Use of Smart Wearables in Veterans

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ABSTRACT

Aims Smart wearable provides a significant advantage to medicine and health, leading to a better quality of life for people who suffer from various chronic diseases and physical, motor, and mental limitations. But the use of smart wearables is accompanied by challenges. The present study aimed to investigate the factors affecting the use of smart wearables for veterans.

Participants & Methods This study was qualitative research and implemented by a content analysis method. The research sample was ten veterans, trustees, and manufacturers related to smart wearables, and data collection was done by the semi-structured interview method. Data analysis was done using the content analysis method and MAXQDA 2022 software.

Findings Three categories (stewardship, producers, and consumers) and 18 sub-categories (policymaking, economics, needs assessment, industry support and encouragement, internal and external communication, notification system, investment, product feature, product approval, processor, responsiveness, improving the quality of life, attitude of veterans, ability, security, education, convenience and durability, and veterans' organizations) were extracted.

Conclusion Stewardship, developers, designers, and manufacturers in the field of wearable technology should have a deeper understanding of consumer behavior and thus facilitate the use and social acceptance of smart wearables for veterans.

Keywords Wearable Electronic Devices; Veterans; Trustee; Security Measures

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Introduction

Nowadays, smart systems and advanced tools have grown significantly in the direction of real-time monitoring of patients and control of their conditions. The capabilities of these smart systems are essential in storing and transmitting information in various branches of health and treatment [1].

Smart technologies are generally used to monitor the symptoms and condition of patients. Also, treatment follow-up, remote treatment, nursing and treatment staff monitoring systems, surgical robots, and many other fields of medical sciences are used [2]. One of the distinguishing features of these technologies is that they are always with the patient; Therefore, the doctor has full-time access to the condition of his patients and receives information about them everywhere [3].

New information technologies are not only on the path of growth and development like other sciences, but their use in the health field can help improve society's health, equal distribution of services and facilities, and healthy life indicators [4]. One of the recent technologies in this field is wearable technologies that can monitor the vital signs of patients, athletes, premature babies, children, people with mental health conditions, people who need long-term care, veterans, the elderly, and people who live in difficult areas and people who do not have access to healthcare services [5]. Research has shown that smart wearables provide a significant advantage to medicine and health and lead to a better quality of life for people who suffer from various forms of chronic diseases, physical, movement, and mental limitations [6].

These technologies can help reduce hospital and nursing costs and provide care for the needy. Therefore, investing in the production of smart textiles is a dual-purpose process, which is both an approach for economic prosperity and support for the well-being and health of society [7].

From the daily capabilities and management of chronic diseases in acute conditions by smart wearables, we can refer to the study by Kapoor *et al.* in 2020. This research mentions the preparation of information related to COVID-19 and the tracking of physiological parameters using smart wearables. This study aimed to develop robust monitoring systems, health stimulation, new diagnostic and clinical decision-making tools, wider penetration of wearables for tracking physiological parameters, and development of interactive chat services for public dissemination of information related to COVID-19, which showed that people, even in home quarantine can use such solutions to monitor and transmit parameters such as temperature, heart rate without visiting the hospital in person [8].

As vulnerable social capital, veterans need to receive support worthy of their position in the field of health and well-being. Considering the limitations of veterans from the point of view of motor performance, mental performance and environmental perception, we need to use accurate monitoring and performance induction tools to respond to their health needs. The preliminary triage of the veteran's status in the pre-hospital emergency, success in-home care, as well as the analysis of individual health trends are recorded in smart health monitoring systems.

The successful implementation of smart wearables requires careful identification and attention to the factors affecting the use of information technology. In Iran, the factors affecting the use of this category of technologies have not been thoroughly and comprehensively investigated, and we are at the beginning of the stages of making and using smart clothes. The achievement of this project, by measuring the influencing factors on information technologies and ranking the ideal options while providing information prerequisites for managers and policymakers in this field, provides a suitable guide map to the producers and designers of smart textiles to form a business environment and assess the needs of care priorities for veterans.

Veterans suffer from varying degrees of functional limitations and impairments. Therefore, monitoring the movement status and physical and mental health of veterans is one of the severe concerns of healthcare and health service providers. By identifying and ranking the criteria and sub-criteria of information technology, the first step can be to use smart wearables for veterans. It is obvious that the current research only discusses information technology with passive supervisory and managerial roles and will not enter into the field of smart wearable requirements or production and technical aspects that are in the field of expertise of medical engineering and medical equipment specialists. The present study aimed to investigate the factors affecting the use of smart wearables for veterans.

Participants and Methods

This study is a qualitative content analysis that was conducted at the national level in 2022. The Statistical population was experts, policymakers, and providers of care services to veterans, who were identified after coordination with the organization of Martyrs Department, and expert professors from the two dimensions of the academic community and the policy-making community.

The main sampling strategy in this research was purposive sampling in the form of snowball sampling. Finally, ten people were selected. The interviews continued until the data reached the saturation level. The required information was collected through semi-structured in-depth interviews and group discussion sessions.

After coordinating with the interviewee and obtaining his consent to participate in the interview,

the interview time was set. The interviewee was approached at the appointed time, and the required information was collected through a semi-structured interview based on the interview guide. A voice recorder was used to record the interviews, and at the same time, key points were noted and recorded by the interviewer. The duration of the interview varied between 45 and 80 minutes.

Data analysis was done using the content analysis method and using MAXQDA 2022software. The analysis of the data from each interview was a guide for the next interview. In this way, sampling continued until data saturation, when no new codes were extracted, and finally, during two panel discussion group with the presence of supervisors, consultants and the research samples, the codes were finalized. All interviews were coded as the unit of analysis; words, sentences, or paragraphs from the interview texts were included as semantic units. Then, the related semantic units in terms of the main content were placed next to each other and named with a label as a code. Revision of the entire text after coding, comparing the codes in terms of similarities and differences, and categorizing them under categories and subcategories were done. The categories and subcategories were reviewed and corrected during three three-hour sessions with the principal members of the research team.

The data collection tool was a researcher-made questionnaire. The criteria of credibility, conformability, dependability, and transferability were used to evaluate the quality of the study. In this study, four techniques were used to check the credibility of the data. The long-term involvement of the researcher with the research topic and data (immersion in data by repeatedly reading the writings) was considered to gain a deeper understanding of the data. Then semantic units were extracted and categorized.

Then peer review was done, so in the encoding and coding stage, two other researchers were asked to participate in this stage, and at the end, their correction opinions were included.

Control by the participants (research samples) was another technique used. A part of the interview text along with the initial codes was seen by the participants, and the degree of similarity of the ideas extracted by the researcher from the interviews was compared with the opinion of the participants.

Triangulation was another technique used in the study to evaluate the value of data, which was in two forms: a triangulation of data sources (using different sources of texts and interviews to find data) and researcher triangulation (using two other researchers to analyze and interpret data).

In the selection of participants, transferability criterion was used by the maximum sampling technique. Conformability was also measured through the external check, which means that parts of the interview text, related codes, and emerging classes were examined and confirmed by two observers familiar with qualitative research. Also, the dependability criterion was done by taking notes as soon as possible and after each interview. After coordinating with the research unit and obtaining the necessary permits, the research started. Data analysis was done confidentially by the researcher. During the study, the ethical principles in the research, such as maintaining anonymity, confidentiality, and participants' right to leave the study, were observed.

Findings

The characteristics of the study participants are shown in Table 1.

Data analysis led to the extraction of three categories of stewardship, producers and consumers.

Table 1) Characteristics of the study participants

Row	Level of education	Veteran	Occupation	Work experience (Year)
1	Master	-	Researcher of orthoses and prosthetics technologies	30
2	Master	Veteran	Making artificial organs, orthoses, and prostheses, Dean of the faculty	24
3	PhD	Veteran	Dean of the faculty	39
4	PhD	Veteran	Faculty member	35
5	Master	-	Smart wearable manufacturer manager	15
6	PhD	-	Faculty member	28
7	PhD	-	Health economics researcher	11
8	Master	-	Administration expert of Foundation of Martyrs Department	25
9	Master	-	Smart wearable manufacturer expert	21
10	PhD	-	Smart wearable manufacturer expert	22

Stewardship category

In the stewardship category, 6 subcategories and 37 codes were obtained. The subcategory of the policymaker had the highest frequency and code. Among the codes extracted in the stewardship category, the codes of upper management support, inefficient regulations and procedures, enforceability, comprehensive information, product effectiveness, fair distribution, and access, and associations had the highest repetition and frequency (Table 2).

Some quotes related to stewardship category are:

"The Martyrs Department Affairs should review policies and remove ineffective regulations and guidelines from the schedule so that they can provide proper support to domestic manufacturers to meet the needs of veterans with smart wearables and remove cumbersome laws and regulations. There is an old one that needs updating."

"Given the expensiveness of veterans' smart wearables,

it requires proper analysis to provide appropriate inancial resources."

Table 2) Subcategories and codes affecting the "stewardship" dimension

Category	Subcategories	Code (frequency)	Total number
Stewardship	Policy making	Being on the schedule (3), upper management support (6), aging (2), benefiting the silent population of veterans (a population that does not refer to the foundation) (1), Formulation of policy (5), inefficient regulations and procedures (4), domestic producer support (2), resource analysis (3), sanctions (2), enforceability (5), cumbersome laws (6), the efficiency of regulations (4), evaluation and monitoring (3), product effectiveness (6), feedback (1), needs assessment and triage (4)	16 codes with a frequency of 57
	Economic dimension	Economic justification (1), priority for the allocation of financial resources (2), foundation income (5), attraction and provision of financial resources (3), support and insurance coverage (3), fair distribution and access (6)	6 codes with a frequency of 20
	Needs assessment	Clear statistics and information (4), determination of the type and number of smart wearables (2), the need for smart wearables based on power or accuracy work (3)	3 codes with a frequency of 9
	Industry support and encouragement	Supporting producers and investors (3), motivating students (2), motivating universities (4)	3 codes with a frequency of 9
	Internal and external communications	Manufacturers (3), associations (5), importers (2)	3 codes with a frequency of 10
	Notification system	Creating an inclusive network of veterans (4), familiarizing with facilities and equipment (3), comprehensive information (6)	3 codes with a frequency of 13

Considering the aging of veterans, the Martyrs Department has the necessary measures for the effectiveness of smart wearables for veterans and requires special services accordingly.

"The guardians of veterans pay attention to all veterans, including they have a silent population that rarely refers to the foundation or vice versa."

"Perhaps the most important pillar in policy-making is the continuous evaluation and monitoring of smart wearables."

"The trustees should create a fair distribution in veterans' benefits by attracting, allocating financial resources and appropriate coverage."

"One of the components that the guardians of smart wearables for veterans should pay attention to is the needs assessment, which is the condition of the veterans, the type and number of smart wearables."

This is with the support, promotion, and communication inside and outside the country.

"Also, considering the sanctions and exclusions abroad, the necessary measures for support and promotion and communication within the country and upstream support should be strengthened."

Producer category

In the producer category, 5 subcategories and 21 codes were obtained. The subcategory of responsiveness had the highest frequency and code. Among the codes, financial support, the high price of smart products, measurement of health indicators, service duration, periodic and continuous services, effective service, and online response had the highest frequency (Table 3).

Some quotes related to this category are:

"Manufacturers play an important role as one of the important dimensions in the supply cycle of smart wearables, and it is necessary to make investments with the financial support of domestic manufacturers and to attract ideas by the Martyrs Department."

Table 3) Subcategories and codes affecting the "producers" dimension

Category	Subcategories	Code (frequency)	Total number
Producers	Investment	Financial support (6), valuing domestic production (4), attracting ideas (2)	3 codes with a frequency of 12
	Product feature	Product type production according to needs (3), the high price of smart products (6), training capability (5), easy maintenance capability (4), update capability (5), durable product (4)	4 codes with a frequency of 27
	Product approval	Determining standards (7), high-level technologies (5), product molding appearance (5)	3 codes with a frequency of 17
	Processor	Measuring health indicators (6), proportional weight (5), sensor attached or close to the body (4)	3 codes with a frequency of 15
	Responsiveness	Service duration (6), product guarantee (5), repair or replacement of parts (3), periodic and continuous services (7), effective service (6), remote data management (3), online response (6), product training (5)	8 codes with a frequency of 35

"The feature of the product in terms of prostheses, ergometers or exoskeletons and liquid prostheses and smart prostheses or computer legs and neurological rehabilitation equipment affects product production."

"The high price of smart wearable products and the training, maintenance, updating and durability of

these products are also effective factors in using smart wearables."

"One of the most important components of the manufacturer is the approval of the product, including standards, appearance, and high-level technology."

"The processors used should be able to measure health indicators, and on the other hand, the wearable (product) should have the right weight."

"Manufacturers must be responsible for the product, provide service in the required time and guarantee the product, and have the necessary commitment during repair or replacement."

Consumer category

In the consumer category, 7 subcategories and 34 codes were obtained. The subcategory of responsiveness had the highest frequency and code. The subcategories of improving the quality of life and convenience and durability had the highest frequency and code. Among the extracted codes, creating and improving communication in society, accessible training, information, and awareness of smart wearable services had the highest repetition and frequency (Table 4).

Table 4) Subcategories and codes affecting the "consumers" dimension

Category	Subcategories	Code (frequency)	Total number
Consumers	**Improving the quality of life**	Creating and improving communication in society (7), Mass communication tools (6), mental health (3), improving sensory deprivation (4), improving movement deprivation (6)	8 codes with a frequency of 35
	Attitude of veterans	Paying attention to religious issues (1), acceptance of defects due to self-sacrifice (5), belief in technology (3) product trust (4), influence from other veterans (6), risk aversion (6), bias (3)	7 codes with a frequency of 28
	Ability	Level of need for rehabilitation (5), technology literacy (4), physical ability (6)	3 codes with a frequency of 15
	Security	Physical security (6), data security (5), security for the elderly (3), no accidents (2)	4 codes with a frequency of 16
	Education	Accessible training (6), easy training (7), justification of veterans (5)	3 codes with a frequency of 18
	Convenience and durability	Physical comfort of the product (6), simplicity and ease of use (5), processing on the body (4), processing close to the body (2), appropriate size (6), convenient updating (6), responsive service (6)	7 codes with a frequency of 35
	Organizations of veterans	Information and awareness of smart wearable services (7), up-to-date knowledge of regulations and instructions (5)	2 codes with a frequency of 12

Some related to this category are:

"Veterans, as consumers of smart wearables, need to improve their quality of life, and in fact, this smart wearable can improve their communication in society."

"Smart wearables should improve sensory and movement deprivation."

"The veteran's attitude towards the use of smart wearables is an important issue that some veterans do not have much desire to use smart wearables due to their belief and attention to religious issues."

"On the other hand, the level of literacy and ability of the veteran himself and his belief in technology is another issue that can be both an obstacle and a facilitating factor for smart wearables."

"Veteran comrades and friends who use the products have a great influence to encourage the use of these products."

"Our society is conservative and biased towards new and complex products."

"The physical ability of the veteran and the level of technology literacy are also important factors in the use of smart technologies."

"Security is also an important factor that the use of the product has physical and mental security for a person."

"Convenience and durability is another factor for veterans to use smart wearables."

"The organizations of the veterans can have a great effect on smart wearables as well, such as the organizations of the members' knee down or knee up, hand amputation, etc."

"Another factor that is usually not done correctly is informing the veterans, who usually do not have enough and timely information about products, especially smart wearables, so those who are closer to the sources, benefit more, and those who are far away from power centers and product production centers or policymakers, they are usually deprived of this product."

Discussion

Adding technical functions to clothing can often bring many challenges and issues [9]. Knowing these challenges helps decision-makers, consumers, and manufacturers provide better products and buy and use more confidently. New products always bring new challenges that, in the absence of a suitable answer, may delay their practical development, enter the market or face problems, and remain at the research level.

Dunne, researcher in smart wearables, believes that in countries with a history of activity in this field, design obstacles and challenges are the most crucial reason for the lack of practical development [10]. In the present study, in determining these obstacles, three main groups play a role: stewardship and politicians, manufacturers of smart wearables, and veterans who are wearable consumers. One of the

things that manufacturers should pay attention to is the smart wearable feature (product).
In addition, veterans and other users have accepted that they must be successful in a competitive market with other products. These features include, production as needed, the high price of smart products, the ability to train, the ability to maintain easily, and the ability to update and durability of the product.
Among them, the high price of smart wearable products has the highest frequency and has played the most significant role in preparing smart wearable products. Paying attention to the high price of smart products (cost-effectiveness for the consumer) is something that the manufacturer should pay attention to. Many factors, such as design layers, comfortable to use, Range of Motion (ROM), beauty, and the final price, will affect the usage of smart wearables [10].
In this research, the issue of price and the economic issues affecting the use of smart wearables by veterans were mentioned, such as economic justification, priority for the allocation of financial resources, foundation income, attracting and providing financial resources, support, and insurance coverage, fair distribution and access have been effective in this case.
The income and support of the foundation have the highest frequency and the most role in the preparation of smart wearable products under the subcategory of economic issues.
The dual nature of smart wearables i.e., the combination of hard technology with soft clothing, means that if it is too technical and does not follow the latest fashion, it may not be accepted by the user, and if more emphasis is placed on its covering and appearance aspects, it will reduce its technical functionality [11].
The current research results have focused on both aspects; factors such as setting standards and high-level molding technologies (product appearance) have been influential in the use and acceptance of body wear by veterans.
People with significant technical experience are likely to have more confidence and enthusiasm to work with wearable technologies [12]. Also, technological experience may be an important factor in reducing anxiety levels in using wearable systems [13]. Paying attention to technology literacy has affected veterans' willingness to use smart wearables in the present study.
Culture has a significant impact on people's behavior, beliefs, and decisions. Therefore, it is not surprising that culture affects people's acceptance and use of wearables. Duval *et al*., in evaluating the adoption of smart clothing, stated that religion and users' attitudes affect the high acceptance of artificial intelligence in Japan; for example, Shinto values show that objects may be "naturally" alive and have a soul, be it a rock, a tree, a toy, or a computer [14].
In this research, in examining the attitude of veterans, the factors that can be effective in their use of technological products such as smart wearables include things such as paying attention to religious issues, acceptance of defects due to self-sacrifice, belief in technology, product trust, influence from other veterans, risk aversion, and bias.
Social influences have a significant impact on people's choices. People value their relationships with their relatives, such as family, friends, and colleagues at work, and they tend to act according to the opinions and beliefs of those close to them. In this regard, a study showed that People were less willing to use smart clothes when their social network or environment did not approve of it [15]. In the current research, the creation of veteran organizations is mentioned. Veterans in these organizations are affected by each other.
In addition, information and awareness of smart wearable services and up-to-date information on regulations and instructions are done in these organizations. Veteran friends who use the products have a significant impact on the veteran's desire towards these products.
As for panic alarm systems in the form of necklaces or wrist pendants, it has been reported that some older people are ashamed to wear them and may reject these systems so as not to appear dependent or old-fashioned [16, 17]. As people age, they experience physical, cognitive, emotional, and social changes. For example, many older people are not used to technology and have difficulty understanding computer systems [16]. In the results of the present research, it is mentioned that aging should be considered in the policies related to the purchase of smart wearables by policy makers.
Most seniors are not used to technology. It is difficult for them to understand computer systems. They even stated that they are afraid of computers because they think that as soon as they make a mistake, it will cause harm [12].
The influential factor, in this case, is accessible training, specific training, and justification of veterans regarding wearables. Duval *et al*. [14] evaluated the impact of human needs on people's perceptions. The evaluation of this need is based on Maslow's Hierarchy of needs in such a way that people try to satisfy the most basic needs (lower) and are strongly attracted to smart clothes, which have functions such as monitoring exercise activity and regulating body temperature that meets physiological needs, and generally, be effective in improving the quality of life. In the current research, factors such as improving communication in society, improving sensory deprivation, and improving movement deprivation have been mentioned. Papa *et al*. showed that utility has a significant effect on the use of smart wearables [18].
Acceptance by users depends on many variables, from device capabilities and physical form of smart

clothing to emotional factors related to identity and body image. In general, smart clothing should simultaneously provide the basic capabilities of a clothing and electronic functions and consider human aspects for effective interaction with users and the environment [19, 20].

In 2003, Park and Jayaraman, with the aim of investigating how to increase the quality of life with wearable technologies, using a hierarchical analysis method, stated that one of the most essential requirements for the design and development of smart clothes is user-friendliness, and mentioned the following criteria and sub-criteria: wearability criterion with the sub-criteria of comfort in putting on and taking off clothes, easy access to the body, maintaining range of motion, light weight of clothes, non-irritation of the skin by clothes; durability criterion with the sub-criteria of flexibility and bending, resistance to wear, corrosion, heat, electrical resistance, mechanical, tensile; maintenance criterion with sub-criteria of washability, dimensional stability, software upgrade, rechargeable battery; performance criteria with sub-criteria of dimensions, data rate, fault tolerance, cost, privacy personal, the possibility of manipulation, the measure of capabilities with the sub-measures of monitoring vital signs, communicating seamlessly with external devices, increasing the safety, and quality of patient care [21].

The current research mentions the factors affecting the acceptance of smart wearable technology by veterans. These factors include: Physical comfort, simplicity, ease of use, processing on the body, processing close to the body, appropriate size, convenient updating.

On the other hand, manufacturers need to consider the responsiveness of manufactured products to increase their acceptance of products. Factors affecting responsiveness in this research include service duration, product guarantee, repair or replacement of parts, periodic and continuous services, effective service, remote data management, online response, and product training. Among these factors, service duration, periodical and continuous services, and the online response has the highest frequency.

Attention to security and ethical considerations is a significant obstacle to providing smart medical services. The main concern in health care includes data protection, prevention of errors related to information, conversation records, and location tracking, which can adversely affect users' privacy [22]. Paying attention to the veteran's physical security, data security, and security for old age are the things that have been mentioned in the current research.

In recent years, due to the complexity of medical decisions, the use of auxiliary tools to support decisions has increased.

Many diseases require online and long-term monitoring of health and vital signs, which is made possible by smart clothes. According to the statistics presented recently, the most use of smart clothes is more than any application in the field of health care and medicine [23].

The achievements of communication technology confirm that changes can be made in the country's healthcare services from a physician-centered model to a smarter, decentralized, patient-centered method, remote health care as a new model of care, and new solutions, especially in the field of care. It has brought medical problems; if innovative wearable systems are integrated with the telemedicine system, they can warn medical staff when threatening changes occur for patients [24]. In addition, patients can benefit from continuous long-term monitoring as part of the relevant diagnostic process. Innovative wearable systems can automatically monitor vital signs during daily life, including while resting, sleeping, or during daily activities, and notify the physician when necessary [20]. In this case, the patient can communicate with the specialist doctor in different physical and mental situations. In the current research, they are paying attention to the product's effectiveness, and the ability to create feedback with the doctor is essential in choosing smart wearables.

Limitations

It was difficult to reach veterans and managers who know about smart wearables and their use.

Suggestions for future research

- Investigating the cost-benefit of using smart wearables among veterans
- Investigating the increase in the quality of life of veterans who use smart wearables
- Investigating the relationship between the use of smart wearables and the satisfaction and stress reduction of veterans

Conclusion

Our findings provide a deeper understanding of consumer behavior for policy makers, developers, designers and researchers in the field of wearable technology, thereby increasing the social acceptance of wearables and the penetration of these products into the mass market. The true purpose of creating technology must be clearly understood by developers, designers, and manufacturers in this field. Of course, it should not be assumed that if the technology cannot be used by consumers and is not accepted by them, it is unacceptable, but the causes of non-use should be analyzed.

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