LUND UNIVERSITY
School of Economics and Management

Department of Informatics

Exploring the Acceptance of Wearable Technology Among the Elderly

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Authors: Xuan Zhang
Shiyi Feng

Supervisor: Odd Steen

Grading Teachers: Avijit Chowdhury
Betty Saenyi

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AUTHORS: Xuan Zhang and Shiyi Feng

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ABSTRACT (MAX. 200 WORDS):
This study explores the acceptance of wearable technology among the elderly, utilizing the Smart Wearable Acceptance Model (SWAM) developed by Li et al. (2019) as the theoretical framework. Through qualitative research methods, key factors influencing acceptance were identified, including perceived ease of use, perceived usefulness, facilitating conditions, social influence, and self-reported health conditions, as well as spousal influence. The study found significant differences in perceived usefulness and social influence between the age groups of 60-70 and over 70. These factors interrelate and collectively impact the acceptance and use of wearable devices among the elderly. The findings indicate that core functionalities such as heart rate and blood pressure monitoring significantly enhance device acceptance, while complex features are often overlooked. Spousal support and the elderly's knowledge of device functionalities also significantly affect their willingness to use these devices. Ultimately, this

research has important implications for promoting the widespread adoption of wearable technology among the elderly population.

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1 Introduction

The World Health Organization has highlighted the increasingly grave issue of aging populations(World Health Organization, 2022). This phenomenon is not confined to developed nations but is also prevalent in low and middle-income countries, where it is anticipated to have an even more pronounced impact in the future (World Health Organization, 2022). Notably, China's aging rate is significantly faster compared to other nations at similar developmental stages (Feng et al., 2020). Accompanying the challenges of an aging population are the health issues faced by the elderly, such as chronic diseases (World Health Organization, 2022) and accidental falls (World Health Organization, 2017). Particularly in the post-pandemic era, long-covid poses an increased risk to the already vulnerable elderly demographic (CDC, 2021). Fortunately, technological advancements offer new possibilities in combating these health challenges: With the rapid development of AI and IoT technologies, an increasing array of tech products is playing a significant role in healthcare. Among these, wearable devices stand out. Wearable devices refer to electronic gadgets that can be worn on the body, often in the form of clothing or accessories, to perform various functions (Lynch, 2023). These devices primarily find application in monitoring, screening, detecting, and predicting health issues (Canali, Schiaffonati and Aliverti, 2022). They hold immense potential in elderly healthcare, enhancing senior welfare, and contributing economic benefits to nations and societies (Tedesco, Barton and O'Flynn, 2017; Pando, 2019). However, their effectiveness depends on the elderly's willingness to accept and adopt them. Consequently, scholars have begun to explore the factors that promote or hinder their adoption among the elderly (Farivar, Abouzahra and Ghasemaghaei, 2020; Ma, Gao and Yang, 2022; Chandrasekaran, Katthula and Moustakas, 2021; Paolillo et al., 2022; Pang et al., 2016), and some have based their studies on traditional technology acceptance models like TAM (Ahmad et al., 2020; Chen et al., 2023; Lazaro et al., 2020) or proposed new models (Li et al., 2019) to explain the attitudes and behaviors of the elderly. However, current research has gaps and limitations, which will be discussed in detail in section 1.1. Therefore, this study aims to delve into two primary concerns: first, the applicability of the SWAM model, a smart wearables acceptance model developed by Li et al., in the context of the inherent heterogeneity within the elderly population; second, it seeks to elucidate the significant yet overlooked factors, such as the elderly's knowledge, that influence their acceptance and usage of digital devices, thereby addressing the research gaps. The findings are expected to facilitate the widespread adoption of smart wearable technology among the elderly, ultimately benefiting those in need.

1.1 Research Problem

In recent years, scholars have increasingly focused on the acceptance of wearable devices by the elderly. Current research on this topic primarily falls into several categories: Some scholars, drawing on theories from sociology and other fields, investigate the factors influencing the elderly's attitudes, perceptions, and behaviors towards wearable devices (Farivar, Abouzahra and Ghasemaghaei, 2020; Ma, Gao and Yang, 2022; Chandrasekaran, Katthula and Moustakas, 2021; Paolillo et al., 2022; Pang et al., 2016); others, based on technology acceptance models like TAM, UTAUT, and UTAUT2, test, expand, and refine

these traditional models in specific contexts (Ahmad et al., 2020; Chen et al., 2023; Lazaro et al., 2020).

These studies have not developed new models specifically predicting the elderly's acceptance of wearable technology. Models like TAM, UTAUT, and UTAUT2, which target a broad range of technologies and general users, do not adequately consider the unique characteristics of wearable devices and the specific traits of the elderly demographic (Li et al., 2019). Addressing this gap, Li et al. (2019) developed a smart wearables acceptance model (SWAM) to predict the elderly's intention to accept wearable devices, considering the characteristics of both the devices and the elderly. Using structural equation modeling(SEM), they empirically tested the model, finding that perceived usefulness, compatibility, facilitating conditions, and self-reported health status significantly and positively influence the elderly's intention to use such technology.

However, including SWAM (Li et al., 2019), existing research has the following limitations. Firstly, most studies treat the elderly as a homogeneous group. They do not differentiate between different age groups within the elderly population, even when the age range spans over 20 years, from 50 to 74 years old (Lazaro et al., 2020b). Yet, studies show significant differences in technology acceptance among different age segments within the elderly population, with age directly impacting technology acceptance (Niehaves and Plattfaut, 2014) and varying needs for wearable devices (Chen and Li, 2022). Therefore, different age groups of the elderly should not be treated as a homogeneous group in research (Niehaves and Plattfaut, 2014).

Moreover, while many studies discuss the characteristics of wearable devices themselves, such as convenience and compatibility (Li et al., 2019; Lazaro et al., 2020; Yu-Huei, Ja-Shen and Ming-Chao, 2019), and the elderly's perceptions, like cost perception (Chen et al., 2023), many factors significantly influencing the elderly's intention to accept technology have not been discussed in the context of wearables. For instance, the impact of the elderly's own knowledge about wearable devices on their acceptance and adoption, and the influence of social and family support on their adoption of wearable devices. In fact, compared to younger people, relevant technological knowledge is a stronger predictor of technology acceptance behavior for the elderly (Stibe, Krüger and Behne, 2022), and support from partners can promote the use of digital technology among the elderly (Ma, Cui and Zhang, 2023).

Additionally, current research on wearable devices is predominantly focused on developed countries (Niknejad et al., 2020; Moore et al., 2021); groups from different countries and backgrounds may exhibit variations (Huang et al., 2019). Therefore, research on the acceptance of wearable devices needs more evidence from developing countries.

1.2 Research Motivation

The significance and necessity of this study can be seen from the two perspectives.

Firstly, despite the nascent stage of the wearable device market, it has immense potential and possibilities (Tedesco, Barton and O'Flynn, 2017). It promises not only to enhance the health of the elderly (Lee et al., 2021) but also to reduce national healthcare costs (Pando, 2019), thereby yielding economic benefits for the entire nation and society. Unfortunately, the

elderly's diminished interest in embracing such devices hinders the realization of these benefits as anticipated. To effectively promote the acceptance and adoption of these devices among the elderly, it is imperative to delve deeply into the factors influencing their attitudes and behaviors. By exploring the mechanisms behind their actions and desires, and understanding the real challenges and dilemmas faced by the elderly, we can illuminate the design and promotion of wearable device products and services, thereby enhancing their welfare.

Secondly, as discussed in section 1.1, current research on this topic is riddled with gaps. Studies based on models like TAM, UTAUT, and UTAUT2, which explore the elderly's intention to accept wearable devices (Ahmad et al., 2020; Chen et al., 2023; Lazaro et al., 2020), are limited. The SWAM model (Li et al., 2019) represents an advancement and improvement, yet it still has limitations. For instance, as detailed in section 1.1, some factors significantly influencing the elderly's acceptance of technology have not been discussed in the context of wearables. Therefore, it is necessary to fill gaps in the current literature, and contribute to the field of Information Systems.

1.3 Purpose

Based on the discussion above, this research sets forth the following specific objectives: to examine the applicability of the SWAM 's core assumptions and factors in real-world contexts through qualitative research methods; to evaluate other critical factors, such as the elderly's knowledge and spousal influence, which have not been sufficiently considered in existing research but affect the elderly's acceptance and adoption of digital devices; to compare different age groups in the elderly population on the acceptance of smart wearable devices.

1.4 Research Questions

Based on the discussion above and to achieve the research objectives, this study proposes the following research questions:

1. How applicable is the Smart Wearables Acceptance Model (SWAM) in explaining the acceptance and usage of wearable devices among different segments of the elderly population?

2. How does the elderly’s knowledge about wearable technology specifically influence their acceptance and use of smart wearable devices?

3. How do spouses specifically influence the acceptance and use of smart wearable devices among the elderly?

4. What differences exist among different age groups within the elderly population in terms of their acceptance of smart wearable devices?

1.5 Delimitation

The defined scope of this study delineates its boundaries and focal points, ensuring both concentration and feasibility. The specific scope of the study is as follows:

1. Geographic and Demographic Scope: This research focuses on elderly residents in a senior community in Kunming, China. Although global aging is a widespread issue, China's aging population is growing significantly faster than other similarly developed nations (Feng et al., 2020). This study aims to provide more evidence from developing countries on the adoption and use of wearable devices by the elderly, thus limiting its scope to elderly residents in a senior community in Kunming, China.

2. Sample Selection: The study's sample consists of individuals aged 60 and above, divided into two age groups: 60-70 years and above 70 years. To highlight the differences in acceptance of smart wearable devices among different age groups, the study is confined to these specific age ranges.

3. Research Variables: The primary variables include perceived usefulness of smart wearable devices, compatibility, facilitating conditions, self-reported health status, knowledge level, and spousal influence. The study does not consider other potential factors influencing technology acceptance, such as educational level or economic status.

2 Theoretical Foundation

2.1 General Theories and Models of Technology Acceptance

2.1.1 Technology Acceptance Model (TAM)

To comprehend individuals' acceptance behaviors towards technology, Davis, in 1989, introduced the Technology Acceptance Model (Davis, 1989), founded upon the Theory of Reasoned Action (TRA) from psychology. This model elucidates how users come to accept and utilize new technologies. TAM's foundational premise relies on two principal notions: Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Perceived Usefulness reflects the users' assessment of how a technology amplifies their work performance capabilities, implying that if users believe the technology aids them in accomplishing tasks more efficiently or achieving specific goals, they are likelier to adopt and utilize it. Perceived Ease of Use represents the users' subjective evaluation of the effort required to learn and use the technology, not only directly influencing its acceptance but also indirectly affecting users' intention through perceived usefulness. TAM posits that these perceptions directly impact users' attitudes and intentions towards technology use, subsequently influencing actual usage behaviors: a technology deemed both useful and easy to use is more likely to be accepted and utilized by users.

Since its inception, TAM has continuously evolved through four pivotal stages—introduction, validation, extension, and elaboration (Lee, Kozar, and Larsen, 2003). Due to its credibility, scholars have widely applied and further extended TAM to various domains and different users, including elucidating elderly individuals' intentions towards using digital technologies and systems, such as mobile health applications (van Elburg et al., 2022), digital marketing (Zhang et al., 2023), and mobile payments (Yang, Yang, and Chang, 2023).

2.1.2 UTAUT and UTAUT2

Aiming to enhance the model's predictive capability, Venkatesh et al. (2003) proposed the Unified Theory of Acceptance and Use of Technology (UTAUT) in 2003, synthesizing prior models and theories, including TAM, Theory of Planned Behavior (TPB), and Innovation Diffusion Theory (IDT), among others. This model aims to explain and predict technology acceptance and usage behaviors. It is anchored by four key constructs: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. Performance Expectancy, akin to TAM's "Perceived Usefulness," denotes the extent to which users believe that using the technology will enhance their job performance or achieve certain goals, emphasizing the actual value and benefits technology offers to users. Effort Expectancy, corresponding to TAM's "Perceived Ease of Use," reflects users' perception of the effort needed to use the technology, focusing on its accessibility and user-friendliness. Social Influence measures the degree to which individuals believe that important others (such as friends, family, colleagues, or superiors) think they should use the new technology. This construct captures the impact of interpersonal relationships and social expectations on individuals' technology acceptance decisions. Facilitating Conditions refer to the individual's

perception of the availability of resources and support that would aid in using the technology, including technological infrastructure, user support, and relevant resources.

Venkatesh, Thong, and Xu (2012) introduced UTAUT2, an expansion of the original UTAUT model, incorporating three additional key constructs: Hedonic Motivation, Price Value, and Habit, aimed at more comprehensively explaining consumers' acceptance and use behaviors towards information technology products and services. Hedonic Motivation refers to the pleasure and satisfaction individuals experience from using the technology. It focuses on the intrinsic enjoyment derived from the use of technology, rather than solely achieving a work efficiency or performance goal. Price Value represents the individual's assessment based on a trade-off between the perceived costs (including acquisition and usage costs) and benefits brought by the technology. It reflects consumers' evaluation of the product or service's cost-effectiveness. Habit denotes the behavioral pattern formed by individuals due to frequent and automatic use of a technology. It highlights the influence of past behaviors on current technology usage intentions and actual usage behaviors.

Despite the widespread application of TAM, UTAUT, and UTAUT2 by many scholars across different fields, generic technology acceptance models have not fully considered how the unique physiological, psychological, and social characteristics of elderly users might affect their interactions with technology products or services (Chen and Chan, 2014).

2.2 Senior Technology Acceptance Model (STAM)

To address the gap in understanding the elderly's adoption of technology, Chen and Chan (2014) developed the Senior Technology Acceptance Model (STAM), building upon the foundations of TAM and UTAUT. This model incorporates constructs from previous models, such as Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Gerontechnology Self-efficacy, and Gerontechnology Anxiety, while directly addressing the impact of Facilitating Conditions on technology acceptance. Uniquely, STAM also integrates age-related health and capability features specific to the elderly, including self-reported health status, cognitive abilities, attitudes towards aging, life satisfaction, social relationships, and physical function.

Although STAM provides a novel theoretical framework for the study and application of gerontechnology, it does not specifically mention smart wearable devices, leading to a lack of targeted factors in the research on the acceptance of smart wearables (Li et al., 2019).

2.3 Smart Wearable Acceptance Model (SWAM)

To explore the factors influencing the elderly's acceptance of wearable devices, Li et al. (2019) developed the Smart Wearable Acceptance Model (SWAM) through structural equation modeling, tailored specifically for the elderly population. The model comprises core elements such as Perceived Ease of Use and Perceived Usefulness, reflecting the effort participants invest in adopting smart wearable systems and the benefits they derive from their use. Facilitating Conditions refer to the favorable circumstances in the existing technological infrastructure and environment that encourage individuals to use information systems.

Compatibility denotes the consistency of a technology's technical functions with other existing products and its alignment with users' needs and lifestyles. Social Influence measures the extent to which family members or significant peers believe the participant should accept the technology. Perceived Social Risk and Perceived Performance Risk involve the risks associated with adopting smart wearable systems, such as being labeled negatively or feeling embarrassed. Health Status reflects the current health condition and circumstances of the participants, directly and significantly affecting the acceptance of smart wearable systems. In validating the model with survey data, it could explain 68.7% of the variance in the elderly's intentions to use smart wearables, demonstrating SWAM's effectiveness in predicting the acceptance of smart wearable systems among the elderly.

This model employs a quantitative research method for testing but does not account for the situational characteristics of wearable device use, nor does it provide insights into the elderly's perceptions of the model's core elements and the complex interplay between these elements and their intentions. Therefore, qualitative research will be conducted on this basis, placing it within a qualitative context to form a multi-faceted understanding of the elderly's adoption of wearable devices.

Furthermore, the models mentioned, including SWAM, in addressing the elderly's acceptance of smart wearable devices, have overlooked some significant factors that could influence the elderly's technology adoption, such as their knowledge (Stibe, Krüger, and Behne, 2022) and spousal support (Marler and Hargittai, 2022; Ma, Cui, and Zhang, 2023).

2.4 Additional Factors Influencing the Elderly's Technology Acceptance

2.4.1 Knowledge Factors in the Elderly's Technology Acceptance

Within the context of technology adoption, "knowledge" is defined as an individual's specific understanding of a technology's functions and features, including a practical comprehension of how to operate and apply the technology (Stibe, Krüger, and Behne, 2022). An individual's knowledge about a technology or product initially influences their acceptance level of that technology or product, and based on this acceptance, further shapes their intention to use or adopt it. Ultimately, this intention translates into actual behavior (Stibe, Krüger, and Behne, 2022). Thus, knowledge provides the necessary background information for individuals to assess the usefulness and ease of use of a technology. Adequate knowledge can help alleviate uncertainties and potential anxieties about new technologies, boosting individual confidence, and thereby promoting the acceptance and adoption of technology. Without sufficient knowledge, individuals may struggle to form a positive attitude towards technology or to fully exploit its potential. More importantly, for the elderly, knowledge plays a more significant role in predicting their acceptance of technology, and their intentions have a more pronounced impact on actual behavior compared to younger groups (Stibe, Krüger, and Behne, 2022).

However, previous studies on the elderly's adoption of wearable devices have seldom considered the impact of the elderly's knowledge.

2.4.2 Spousal Influence in the Elderly's Technology Acceptance

Compared to younger people, the elderly often rely more on others' support to learn and use digital technology (Anderson and Perrin, 2017). Peers are usually cited as the preferred source of technology assistance for this age group (Friemel, 2016). Due to considerations of convenience or the inaccessibility of other external aids, the elderly frequently prefer spousal assistance, which provides them with the motivation and means to acquire digital knowledge and skills (Marler and Hargittai, 2022). Moreover, support between spouses is not unidirectional: not only can learning and using digital technology be facilitated by support from a spouse, but the intrinsic satisfaction and perceived social value gained from providing technological support to one's spouse can enhance the elderly's enthusiasm for using technology, further encouraging their continued participation in and support for each other's technological learning and usage (Ma, Cui, and Zhang, 2023).

Yet, existing research has rarely fully explored the impact of spousal support on the elderly's adoption of wearable smart devices. This study will incorporate the factor of spousal support.

2.4.3 Heterogeneity Within the Elderly Group

The elderly should not be viewed as a homogeneous group; instead, they are inherently heterogeneous. Specifically, age not only directly affects their acceptance of the internet but also influences the impact of other factors (such as performance expectancy) on their adoption intentions: the frequency of IT use among older adults is significantly lower than that of younger elderly individuals, and the expected performance of IT has a greater impact on the former's intentions to use the technology (Niehaves and Plattfaut, 2014). Additionally, elderly individuals of different ages have varying needs for wearable devices (Chen and Li, 2022).

However, existing studies have rarely considered the impact of heterogeneity within the elderly population due to age on their adoption of wearable devices. Therefore, this study will divide interview subjects into two groups based on age to explore how elderly individuals of different ages adopt wearable devices.

In summary, the theoretical foundation of this study encompasses a comprehensive review of various technology acceptance models, including the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and its extension, UTAUT2. These models elucidate the critical factors influencing technology adoption, such as perceived usefulness, ease of use, and social influence. Moreover, models specifically tailored to the elderly, such as the Senior Technology Acceptance Model (STAM) and the Smart Wearable Acceptance Model (SWAM), offer a more nuanced understanding of age-related characteristics impacting the acceptance of smart wearable devices. Despite their significant contributions, these models often overlook essential factors such as knowledge and spousal support. This study aims to bridge these gaps, providing a detailed perspective on the adoption of wearable technology by elderly individuals, and emphasizing the heterogeneity within this demographic.

3 Methodology

3.1 Research Approach

In order to address the questions of this study and better achieve the research objectives, a qualitative research methodology was chosen. Specifically, semi-structured interviews were used. Qualitative research focuses on processes, contexts, interpretations, meanings, or understandings and aims to describe and understand phenomena (Gilbert and Stoneman, 2016). This study involves concepts that are more suited to be described and addressed using qualitative research methods. This study addresses many concepts related to human cognition and behavior that often cannot be accurately represented by simple numbers and variables. For instance, studies of older adults' acceptance of technology have shown that their behavior is correlated with complex emotions and diverse experiences (Ahmad et al. 2020; Chen et al. 2023; Lazaro et al. 2020). In addition, understanding human behavior and cognition is inseparable from considering their cultural and social context (Sarto-Jackson, Larson, and Callebaut, 2017). In qualitative research, individuals and their behaviors are considered unique and contextual (Liamputtong, 2019). Therefore, qualitative research does not reduce the material to numbers and variables (Aspers and Corte, 2019), but rather takes full account of the relationships within a system or culture, or the face-to-face interactions between people in a particular social environment, emphasizing the importance of understanding the particular social setting.

3.1.1 Selection Method

In this study, a random sampling method was used to randomly select older people over 60 years of age from the elderly community in Guandu District, Kunming, to ensure the representativeness and randomness of the study sample. The subjects of the study were elderly people over 60 years old in the community in Guandu District. First, a roster of the senior community was obtained by contacting the community leaders, which contained the basic information of senior citizens who met the age requirement. Next, six older people were randomly selected from the roster using random sampling. The specific process involved assigning a unique number to all eligible older adults and using a random number generator to generate a set of random numbers to identify the specific population in the sample. The sampled older adults were then contacted by telephone to invite them to participate in the study. In the process of contact, the purpose, process, possible risks and benefits of the study were explained in detail and their voluntary participation was ensured. Before the formal interviews, informed consent was obtained from each interviewee to ensure that they understood the study information and agreed to participate. With this approach, randomization and representativeness of the sample was ensured, avoiding selection bias (Lohr, 2021) and increasing the credibility of the findings.

3.2 Data Collection

Semi-structured interviews were conducted between March 15 and April 7, 2024 with six older adults in China. The semi-structured interviews were conducted in Mandarin

throughout. First, a random sample of older adults in the Guandu District community of older adults was screened to select older adults who met the age requirement and had a spouse. Telephone interviews were ultimately chosen because the interviewer and interviewee were not in the same location. Each interview lasted about 45 minutes and panelists recorded audio recordings with the consent of the interviewee in each semi-structured interview. Prior to any data collection, the interviewer sought informed consent from all participants and clearly explained the objectives, procedures, potential risks and benefits of the study to ensure participant ownership and understanding.

3.2.1 Participants

Six interviewees who were 60 years and above and had a spouse were selected through random sampling. The last six older adults were willing to be interviewed and agreed to be audio recorded during the interview for later use in coding.The groups were grouped according to age, one group was 60-70 years old and one group was 70 years old and above. Each group consisted of three older adults. In research on older adults and technology use, age-based grouping is commonly used to explain significant differences between factors that may influence technology adoption and use (Czaja et al., 2006).Czaja et al. emphasized that variables such as cognitive ability, previous experience with technology use, social environment, and health status may differ significantly among older adults of different ages. The mean age of the sample was 62.3 years. 67% of the sample was female. Marital status was 100%.

Due to time and resource constraints, the sample size for this study was only six individuals, which may not be sufficient to fully represent the diversity and complexity of the entire older adult population. In order to minimize the impact of this limitation on the findings of the study, the following measures were taken: firstly, the representativeness and randomness of the sample was ensured through a random sampling method. During the analysis process, in-depth interviews were conducted around an interview guide and as rich and multilayered information as possible was obtained through detailed transcription. Flick (2009) points out that despite the relatively small sample sizes of qualitative studies, the depth and credibility of the findings can be effectively enhanced through rigorous sampling and in-depth interviews. Furthermore, depth and quality of results are prioritized over quantity (Patton, 2015).

Qualitative research is often restricted by resources and time, which allows researchers to allocate resources more efficiently and focus on qualitative depth rather than exhaustive random sampling (Creswell and Poth, 2018). Thus, the recognition of each participant's unique experiences and perspectives is essential to constructing a comprehensive understanding of the research phenomenon (Creswell, 2013). Hence, by enabling a diversity of samples despite the small sample size, we were able to capture rich insights into the phenomenon of wearable device acceptance among older adults. Furthermore, given the resource intensive nature of qualitative research (Merriam & Tisdell, 2015), a controlled sample size helped to ensure that each interview was adequately analyzed and interpreted, thereby ensuring the quality of the study.

3.2.2 Material

Interview Script

At the initial stage of interviewee selection, we collected basic information about the interviewees, including gender, age, and marital status. On the day of the semi-structured interviews, we asked the same 17 questions to the six interviewees as the beginning of the interviews, which were taken from Table 1: SWAM. Questions obtained based on summarized definitions and adaptive interpretations from qualitative research on wearable technology for older adults. More detailed and in-depth questions were then asked based on their responses.

Questions:

Perceived Ease of Use (PEOU)

1. Do you find it easy or difficult to learn how to use smart wearables?

2. Can you describe any specific challenges you encountered the first time you tried to use a wearable device?

Perceived Usefulness (PU)

3. How do you find wearable technology useful in your daily life?

Facilitating Conditions (FC)

4. What support or resources are available to you to help you use wearable technology?

5. How does the current technology infrastructure in your home or community support the use of wearable devices?

Compatibility (COM)

6. What extent do you think wearable technology fits into your daily life and existing habits?

7. Can you give examples of how well wearable devices are integrated with other technologies you use?

Social Impact (SI)

8. How do your family and friends influence your decision to use or not use wearable technology?

9. What discussions or suggestions about wearable devices have you received from your social circles?

Perceived Social Risk (PSR) and Performance Risk (PR)

10. Do you have any concerns about privacy and security when using wearable technology?

11. What is your opinion of the accuracy and reliability of the data provided by wearable devices?

Self-reported health condition

12. How does your current health condition affect your decision to use wearable technology?

13. How does wearable technology affect your ability to manage a chronic disease or health condition?

Spousal Influence

14. How does your spouse or partner influence your decision to use wearable technology?

15. Can you describe any instances where your spouse's support or lack thereof has influenced your use of wearable devices?

Elderly Knowledge of Smart Wearable Devices

16. How knowledgeable are you about different types of wearable technology?

17. What sources of information have been most helpful in informing you about wearable devices?

Table 1: SWAM

Categories	Definition	Adapted Interpretation for Qualitative Research on Wearable Technology Among Older Adults
From SWAM (Text providing details is in Chapter 2)		
Perceived Ease of Use (PEOU)	Efforts that a participant demonstrates when trying to adopt smart wearable systems (Davis et al., 1989).	Ease of use would encompass the usability and intuitiveness of wearable systems for older adults, focusing on minimal learning effort.
Perceived Usefulness (PU)	Benefits that a participant gains from using such systems (Davis et al., 1989).	Usefulness would be related to the extent wearable technology improves quality of life for older adults through health monitoring and emergency features.
Facilitating Conditions (FC)	Degree to which existing technical infrastructure and conditions motivate system use (Venkatesh et al., 2003).	For older adults, this would consider access to technical support, affordability, and the accessibility of wearable technology.
Compatibility (COM)	Degree to which smart wearables are compatible with users' existing electronics and daily lives (Bradford and Florin, 2003).	Compatibility would assess the integration of wearables into older adults' existing routines and compatibility with other devices.

Social Influence (SI)	Extent to which family and friends influence an individual's use of smart wearables (Taylor and Todd, 1995; Venkatesh et al., 2003).	This could explore the impact of social support and peer perceptions on older adults' adoption of wearable technology.
Perceived Social Risk (PSR) and Performance Risk (PR)	Perceived stigmatization and functional risks associated with using wearables (Chan et al., 2012; Fraile et al., 2010) .	Concerns about privacy, data security, and social stigma regarding the use of wearables by older adults would be explored.
Self-reported Health Conditions	Current health status and conditions, such as chronic diseases (Chen & Chan, 2014) .	This dimension would probe how health conditions affect the perceived need and willingness to adopt wearable health monitoring.
Additional		
Spousal Influence	The extent to which a spouse contributes to or influences an older adult's engagement with and use of technology (Marler and Hargittai, 2022).	This dimension explores how the support, encouragement, and participation of a spouse in technology-related activities influence the adoption and effective use of wearable technology by older adults.
Elderly Knowledge of Smart Wearable Devices	Older adults' specific (narrow) knowledge of a certain technology, including its functions and features, as well as a practical understanding of how to operate and apply the technology (Stibe, Krüger and Behne, 2022).	This would assess the influence of older adults' pre-existing digital literacy and their experiences with technology on their acceptance and effective use of wearable technology.

These concepts and dimensions from the literature provided the theoretical background for the interview guide. This table served as the basis for our interview questions and subsequent coding of the data.

4 Results

4.1 Overview of Coding and Analysis of Interview Data

The recordings of six semi-structured interviews were divided into two groups based on the age of the interviewees. Each group was transcribed verbatim into text, with personal sensitive information of the interviewees redacted. Subsequently, two researchers segmented the two sets of texts into several fragments. During segmentation, efforts were made to ensure that each segment pertained to a common major topic, event, or closely related topics or events. Then, coding guidance and segment analysis were conducted following the encoding scheme outlined in Table 1, which incorporates the literature foundation proposed by the SWAM model (Li et al., 2019), including seven constructs affecting the adoption of wearable devices：Perceived Usefulness (PU), Facilitating Conditions (FC), Compatibility (COM), Social Influence (SI), Perceived Social Risk (PSR) and Performance Risk (PR), Self-reported Health Conditions and Perceived Ease of Use (PEOU), and two additional categories： Spousal Influence(Marler and Hargittai, 2022)， Elderly Knowledge of Digital Technology and Products(Stibe, Krüger and Behne, 2022).

To enhance the reliability of the encoding process, initially, two researchers independently coded a set of interview texts. Subsequently, they exchanged their respective sets of texts and independently coded them once again. Following this, the discrepancies in the coding schemes provided by the different researchers were discussed, and the encoding scheme was adjusted based on the outcomes of these discussions. Then, the two researchers independently encoded the two sets of texts according to the finalized encoding scheme. Encoding was considered complete when the two researchers reached a basic consensus on the coding of each segment.

4.2 Overview of Interview Results

All six interviewees either used or are currently using wearable smart devices. Thus, both the content of the interviews and the results of the coding originate from discussions with all interviewees. Table 2- Table 10 present the recurring themes in the discussions of interview texts for participants aged 60-70 under the current coding scheme, along with the original interview excerpts corresponding to each theme within each category.

Table 2: 60-70 Participants (PEOU)

Perceived Ease of Use(PEOU)		
Themes	Explanation	Example Quotes
Intuitiveness and Simplicity of Operation	Interviewees generally found the basic functions (e.g., time reminder, heart rate monitoring, blood pressure measurement) easy to understand and use. These functions are directly related to their daily life needs and health managemen	"For me, the most commonly used must-have features are simple and all easy to understand. Especially the ones that are the most useful features for you, there's nothing hard to understand."
Avoidance and Challenges of Complex Functions	Often avoid features that are too complex or unnecessary for them, such as music playback or games	"... There are also complex features that I have a hard time trying to understand and won't be able to use."
Learning Threshold	Although the initial learning threshold of the device may be high, users' continued learning and adaptability suggests that once users adapt to the device, they may perceive its ease of use. That is to say, continued adaptation and learning can change their perception of the device's ease of use	".... Especially at the beginning when I tried it I had absolutely no idea how to use it and had some difficulties."
Subsequent Learning Ability and Effects	Some seniors feel that once they get started, then subsequent learning is not so difficult; some seniors think that although they are able to use it after getting started, they still need to spend time to keep learning, otherwise they will soon forget how to use it!	"When I first bought the bracelet, I needed on-the-spot instruction from the salesperson, and after that it was all up to me to learn how to use it, and I learned how to use it."

Table 3: 60-70 Participants (PU)

Perceived Usefulness (PU)		
Themes	Explanation	Example Quotes
Physiological Health-Related	Devices enable older people to manage their health more proactively, preventing health crises by monitoring important physiological parameters such as blood pressure and heart rate in real time. This proactive health management reduces reliance on traditional medical care and provides a way to conduct daily health monitoring at home, a feature that increases autonomy and security in the lives of older adults, especially for those with chronic conditions.	"I have underlying medical conditions myself, and the bracelet provides basic information and some range of values that can be readily accessed without having to go to hospitals and clinics for specialized measurements"
Psychological Health-Related	Often avoid features that are too complex or unnecessary for them, such as music playback or games	"I have a serious underlying disease, I used to be anxious every time I got dizzy, wondering if I was going to faint again at any time,, and now even if I feel sick sometimes, as long as I look on my bracelet and see that my blood pressure isn't too far out of the normal range, I don't worry about it, and I should eat and drink ...."

Aid in Daily Affairs	The reminder function of the bracelet helps users better manage their daily lives and schedules, such as for reminding them to pick up and drop off their children, take their medication times, etc. This facilitation of daily life significantly improves the quality of life for older adults, especially for those who may face memory challenges.	"As I get older I can't remember things, I always forget when to take my meds, set an alarm on my bracelet and it tells me when it's time to take my meds."

Table 4: 60-70 Participants (FC)

Facilitating Conditions (FC)		
Themes	Explanation	Example Quotes
Convenience of Sales Points	Whether sales points are convenient to visit	"I bought Huawei, a big brand, I often see it when I visit the mall..."
Accessibility of Repair Services	The ease with which people can access services that fix or maintain their devices	"We have several repair stores in the neighborhood of this residential building, I take the bracelet to fix it by myself when something goes wrong, and it's fixed in 10 or 20 minutes of waiting"
Economic Affordability	The capacity of individuals or households to purchase goods and services without experiencing financial hardship	"A couple hundred bucks for something that isn't that expensive, and I have a pension of a couple thousand."

Table 5: 60-70 Participants (COM)

Compatibility (COM)		
Themes	Explanation	Example Quotes
None/		“At the beginning of the use of smart phones when I am not very adaptive, but then once slowly used to get used to, can not be separated from, now smart phones have become part of my life, I although the use of smart bracelets not long, but I feel that it will also be like a smart phone slowly become a habit, may not be used in the future instead of adapting to the .... "

Table 6: 60-70 Participants (SI)

Social Influence (SI)		
Themes	Explanation	Example Quotes
Recommendations from the Younger Generation	Young family members see the benefits of smart wearable devices and therefore recommend them to the elderly.	"My son told me that this bracelet is very useful, it can measure blood pressure and heart rate."

Information Exchange among Peers.	The elderly communicate and share their experiences using the devices among their peers	"My friend showed me her bracelet when she came over to my house and said I should try one on."

Table 7: 60-70 Participants (PR)

Perceived Social Risk (PSR) and Performance Risk (PR)		
Themes	Explanation	Example Quotes
None/		".... The value measured by this bracelet is a little bit wrong with the one I took at the clinic, but the error is not big enough to affect my use"

Table 8: 60-70 Participants (Self-reported Health Conditions)

Self-reported Health Conditions		
Themes	Explanation	Example Quotes
None/		"I'm quite fit and don't need to go to the hospital, but when you're old, you should always still be uneasy about your body ...."

Table 9: 60-70 Participants (Spousal Influence)

Spousal Influence		
Themes	Explanation	Example Quotes
Shared Responsibility for Health Management	Elderly couples jointly manage each other's health, caring for and looking out for one another.	"Sometimes I get dizzy and wonder if I have high blood pressure again, my old partner said that the bracelet did not give the alarm, take some medicine and pay attention to rest, don't worry too much..."
Involvement of Spouses	Elderly couples learn and use smart wearable devices together.	"After I came back from buying the bracelet, my oldest partner always likes to study it to see how the device works, and asked me to teach him how to use it."

Table 10: 60-70 Participants (Elderly Knowledge of Smart Wearable Devices)

Elderly Knowledge of Smart Wearable Devices		
Themes	Explanation	Example Quotes
Recognition of Basic Functions	Respondents are able to describe the basic functions of smart wearable devices.	“Of course, I know what a smart wearable device does; I frequently use it to measure my blood pressure.”

Differences in Understanding of Functions	Respondents have varying degrees of understanding of different functions, with some functions being well-known and others remaining unclear.	“I know this gadget can measure blood pressure, but I'm unsure about the rest…”

Correspondingly, Table 11- Table 19 delineates the categories and themes for interview texts of participants aged over 70.

Table 11: Over 70 Participants (PEOU)

Perceived Ease of Use(PEOU)		
Themes	Explanation	Example Quotes
Basic Functions Operational Simplicity and Portability	Interviewees generally found the basic functions (e.g., emergency locator, heart rate monitoring, blood pressure measurement) easy to understand and relate to daily use. And easy to carry.	"The most common use for me is the location feature, where the children can find me at any time. And it's easy to carry around."
Challenges to Complex Functionality	Rejection of complex functionality	"There are complex features that I can't learn and don't need to use."
First contact learning gateway	Feedback from the interviewee's indicated that learning and memorizing operations with new technology becomes more challenging as they age.	"I often forget how to hang up the phone and my children hand me off many times."
Follow-up continuous learning capacity	Interviewees found it challenging to get started and needed to keep practicing how to use it or they would soon forget how to use it, but gradually learned how to use it through the help of family members.	"My children taught me patiently every time, and I would have used it more myself or I would have forgotten it."

Table 12: Over 70 Participants (PU)

Perceived Usefulness (PU)		
Themes	Explanation	Example Quotes
Daily Life Aids	Many interviewees mentioned that smart devices not only improved their health management, but also facilitated daily activities, e.g., location features and daily reminders.	"I often forget to do something too, and this device reminds me by picking up my youngest grandson from school."
Importance of health monitoring	Interviewees generally found health monitoring useful and helpful. And some interviewees indicated the presence of heart problems and the need for the device	"And then anyway, if the heart rate just changes in any way, like if there's a heart rate acceleration issue, he'll alert you in a timely manner.

	to alert them at critical moments.	

Table 13: Over 70 Participants (FC)

Facilitating Conditions (FC)		
Themes	Explanation	Example Quotes
Ways of solving difficulties	Almost reliant on young people in the family, with individual interviewees looking for information themselves	"When my daughter gets off work, I'm going to ask her to teach me how to use it."
Purchase Route	Purchased by children for interviewee	"I'm not very good with computers and the Internet, so my children helped me order online. They know better which brands work better for me."
Economic factors	Some interviewees were sensitive to price, but all found the price of the equipment to be acceptable compared to health.	"You don't care about the money when it helps your health."
Availability of maintenance and services	Interviewees relied on their children for help before they took them to the repair store.	"Let the kids help me with the fact that they can go online and in that neighborhood they can find this repair place."

Table 14: Over 70 Participants COM)

Compatibility (COM)		
Themes	Explanation	Example Quotes
None/		"At my age I don't want to spend too much time on learning how to use new devices, I want them to fit naturally into my daily life."

Table 15: Over 70 Participants (SI)

Social Influence (SI)		
Themes	Explanation	Example Quotes
Recommendations from professionals and family members	Older people are usually open to doctor's advice, especially when it comes to health management. And some interviewees also reported that they started using smart devices with the recommendation and support of their children.	"My doctor suggested I use this device to track my heart health, and he said it would be helpful in controlling my blood pressure."
Influence of peers	Interviewees reported seeing their friends or peers using smart devices and benefiting from them, which would increase the likelihood that they would try the technology.	"My friends in my fitness class started using the bracelet and they said it was really handy for monitoring heart rate and steps, so I got one too."

Table 16: Over 70 Participants (PR)

Perceived Social Risk (PSR) and Performance Risk (PR)		
Themes	Explanation	Example Quotes
None/		"Technology is moving fast and wearables are all high performance"

Table 17: Over 70 Participants (Self-reported Health Conditions)

Self-reported Health Conditions		
Themes	Explanation	Example Quotes
Health Self-Management and Device Adaptability	Interviewees expressed interest in smart devices that continuously monitor health conditions (e.g., heart rate, blood pressure), especially for those with chronic conditions such as heart disease or high blood pressure.	" My heart's not so good. I need this device to help me keep an eye on it in real time."

Table 18: Over 70 Participants (Spousal Influence)

Spousal Influence		
Themes	Explanation	Example Quotes
Managing health together	Managing health together was particularly important for the interviewees, especially if one or both of them had a chronic condition.	"We often go for walks together and care about each other's health."
Spousal support	The importance of spouses in the decision to use smart devices.	" He supports me in using it whenever it is good for my body."

Table 19: Over 70 Participants (Elderly Knowledge of Smart Wearable Devices)

Elderly Knowledge of Smart Wearable Devices		
Themes	Explanation	Example Quotes
Awareness of basic functionality	Their knowledge mainly comes from the young people in their families, especially their own children.	"My son told me that this smart bracelet can help me measure my blood pressure."
Differences in understanding of functionality	The interviewees were able to describe the basic functions of the devices.	"I know this device can monitor blood pressure and heart rate, but I think simple functions are the best."

4.3 SWAM Categories

The initial findings reported encompass the outcomes of the seven core concepts within the SWAM model. These include Perceived Usefulness (PU), Facilitating Conditions (FC), Compatibility (COM), Social Influence (SI), Perceived Social Risk (PSR), Performance Risk (PR), Self-reported Health Conditions, and Perceived Ease of Use (PEOU). For each concept, results have been outlined for discussion. Simultaneously, in order to better compare the attitudes and adoption of wearable smart devices between two distinct age groups of elderly individuals, the results for participants aged 60-70 and those over 70 will be presented separately.

4.3.1 Perceived Ease of Use (PEOU)

1)60-70
From the interview contents, we have discerned four overarching themes, deducing from literature and theoretical foundations that these themes all pertain to the category of perceived usability: (1) Intuitiveness and Simplicity of Operation, (2) Avoidance and Challenges of Complex Functions, (3) Learning Threshold, and (4) Subsequent Learning Ability and Effects. Regarding the theme of Intuitiveness and Simplicity of Operation, interviewees repeatedly mentioned the fundamental and core functions of wearable smart devices, such as heart rate monitoring and blood pressure monitoring, which are straightforward, easily comprehensible, and simple to operate. These basic and core functions are often directly linked to their daily life requirements and health management. The avoidance and challenges of complex functions reflect the interviewees' experiences with some of the functions provided by wearable devices being complex and difficult to understand, with interviewees expressing uncertainty about how to use these functions and their utility. They also believe it unnecessary to understand them because, judging from the "names" of these functions, they are not what they need, nor the purpose of purchasing and using wearable devices. The learning threshold refers to the difficulties encountered by interviewees when initially encountering such devices, sometimes even feeling "completely at a loss" on how to use them. When discussing subsequent learning ability and effects, some interviewees mentioned that once they grasp the basic operations at the outset, further learning and usage become less challenging. However, others expressed that although they could start using them later on, they still easily forget the specific operational steps.

2)Over 70
Addressing this category and summarizing what was repeatedly mentioned by the interviewees, four themes can be summarized (1) Basic Functions Operational Simplicity and Portability (2) Challenges to Complex Functionality (3) First contact learning gateway (4) Follow-up continuous learning capacity. By analyzing the interview texts, it can be found that older adults generally believe that smart devices have significant advantages in monitoring health indicators (e.g., heart rate, blood pressure), which makes these devices of high practical value to them. Interviewees generally agreed that some basic functions such as emergency locator, heart rate monitoring, and blood pressure measurement are not only easy to understand, but also closely related to their daily lives, making them easier to accept and use. For example, one interviewee mentioned,

"For me, the most commonly used function is the location function, my children can find me at any time. And it's easy to carry around.".

This portability and straightforward functionality add to the practical value of the device. However, older adults showed greater rejection of complex features in the devices, such as multiple levels of operation of apps or advanced settings. Some interviewees explicitly expressed discomfort with complex features and even considered them redundant for them, as one interviewee stated,

"There are some complex features that I can't learn and I don't need to use.".

Additionally, the learning threshold when first encountering a smart device is a major challenge for older adults. As they age, they find it more difficult to learn and memorize the operation of new technology. For example, one interviewee reported, "I often forget how to hang up the phone and my children hand me many times." This highlights the difficulties beginners face with new technologies. Despite the difficulty of the initial learning phase, subsequent continuous learning is particularly important. Most of the older interviewees said that only through continuous practice and patient help from their family members could they gradually master the skills and memorize the operation process. As one interviewee said,

"My child patiently teaches me every time, and I use it more myself or I will forget it.".

4.3.2 Perceived Usefulness (PU)

1)60-70
In relation to this category, the recurrently mentioned contents by the interviewees can be abstractly distilled into three themes: (1) Physiological Health-Related, (2) Psychological Health-Related, and (3) Aid in Daily Affairs. All interviewees repeatedly emphasized the health monitoring function of wearable smart devices. Such devices offer a means of conducting daily health monitoring at home, thereby reducing dependence on traditional medical services and resources.

“In the past, whenever I needed to measure my blood pressure or the like, I had to visit a clinic, which sometimes entailed waiting in long queues due to the crowds. Now, I no longer need to make such trips; I can monitor it myself at home, uninterrupted.”.

Furthermore, the interviewees also emphasized the paramount importance of the device's emergency call feature, whether they were at home alone or out and about, as it ensures their prompt assistance in case of emergencies. An intriguing revelation was that interviewees, especially those with chronic illnesses, when discussing the "utility" of wearable smart devices, apart from mentioning the benefits for their own physiological ailments and sudden emergencies, repeatedly highlighted the psychological well-being advantages, such as feeling "reassured," "at ease," and "content":

"I have a severe underlying condition. Previously, whenever I felt dizzy, I would become quite anxious, unsure if I might faint at any moment. Now, even if I occasionally feel unwell, as long as I check my blood pressure on the wristband and see that it hasn't exceeded the normal range too much, I no longer worry. I just go about my business, eating and drinking as needed...".

Simultaneously, the interviewees also mentioned the supportive role of such devices in their daily lives and routines, such as reminders for daily medication schedules and dosages. Particularly for elderly individuals experiencing a noticeable decline in memory, this feature significantly facilitates their lives. However, this feature is not exclusive to wearable smart devices; smartphones and other electronic devices can also provide it. When asked about the difference between smart wristbands and other devices, the interviewees all mentioned the compact and portable nature of wearable devices, ensuring they are not forgotten and can be carried around at all times. Although the interviewees all highlighted the "utility" of wearable devices for themselves, they also expressed that many functions in the wristband are not useful to them. One reason is that their health indicators directly associated with these functions are in good condition. For instance, one interviewee mentioned that the "sleep monitoring" function is not useful to them because their "sleep quality is excellent, and they rarely make a deliberate effort to track or pay attention to their sleep."

2)Over 70

This category summarizes what was repeatedly mentioned by the interviewees and is divided into two themes (1) Daily Life Aids (2) Importance of health monitoring. Older users particularly valued the blood pressure and heart rate monitoring functions in smart devices, with one interviewee stating, "He has detailed records of both blood pressure and heart rate. I feel this is particularly beneficial for monitoring the health of the elderly." This suggests that health monitoring features can help older adults better manage their health, and through real-time feedback from the device, they are able to receive the necessary health information and reminders in time to take appropriate health actions or adjustments. As one interviewee with a heart condition said,

"... And then anyway if the heart rate just changes in any way, like if there's an accelerated heart rate problem it'll alert you in time.".

This suggests that the device not only monitors health in real time, but also provides warnings at critical moments to help older adults prevent possible health crises, especially for those individuals with chronic conditions or those who need close monitoring. At the same time, interviewees mentioned that smart devices not only improved their health management but also facilitated daily activities. For example, one interviewee mentioned that the device could remind him to pick up his grandchildren:

"I also often forget to do something, so picking up my youngest grandchildren from school reminds me.".

And another interviewee mentioned that the device's locator function allows family members to keep track of the older adult's location, adding a sense of security and peace of mind that the family is working. This feature is appropriate for older adults whose mobility may be limited and provides additional peace of mind for them and their families. In addition, smart devices reduce the frequency with which older people need to visit healthcare facilities in person, especially important for older people who live in remote locations or have limited mobility. One interviewee mentioned,

"If you want to measure your blood pressure or heart rate, you have to go to the community clinic. This is better and less cumbersome, and you don't have to go to the bracelet to see it directly.".

4.3.3 Facilitating Conditions (FC)

1)60-70
From the interview contents, we have derived the following three themes: (1) Convenience of Sales Points, (2) Accessibility of Repair Services, and (3) Economic Affordability. Regarding the purchase of wearable devices, the interviewees indicated that they are generally introduced and recommended by salespersons in offline stores or actively sought out based on recommendations from family and friends. The devices purchased by the interviewees are mostly from well-known brands, which have numerous stores near their residences. When the devices malfunctioned, the interviewees stated that they would first contact customer service or visit nearby repair centers for repairs. The repair costs are generally low, and the repair process is simple and convenient. Additionally, despite significant differences in the interviewees' incomes (ranging from 3,000 RMB/month to 10,000 RMB/month in retirement pensions), they are all willing to spend several hundred RMB (the current prices of wearable smart devices on the market range from 100 to 500 RMB) to purchase wearable devices. They explained :

"Compared to their health, the price of wearable devices is not expensive.".

2)Over 70
This dimension summarizes three interviewees over the age of 70 who can be divided into four themes. (1) Ways of solving difficulties (2) Purchase Route (3) Economic Factors (4) Availability of maintenance and services One interviewee shared her experience,

"When my daughter gets off work, I'll ask her to teach me how to use it.".

This suggests that despite the existence of a willingness to learn how to use the devices, the actual operation and problem solving often rely on the assistance of the younger generation. Most older users rely almost exclusively on the younger members of the family when using smart devices. These younger people not only provide technical support, but also help older people understand and adapt to the new technology. Interviews revealed that older adults often rely on the help of their children or make purchases through their children's recommendations when choosing and purchasing smart devices. They are usually not directly involved in online shopping or complex purchasing decisions, but rather go through the process through family members, especially the tech-savvy younger generation. One interviewee mentioned:

"I'm not very good with computers and the internet, so my children are the ones who help me order online. They know which brands are better for me.".

This suggests that while older adults may be less familiar with the specific functions and technical details of smart devices, they usually trust the judgment of their family members and trust their purchasing decisions to their more technologically savvy family members. Second, based on the interviews, price was found to be one of the significant factors influencing older adults' adoption of new technologies. Although some older people were price-sensitive, some interviewees felt that the cost was acceptable if the device would be of great help to them in managing their health. As one interviewee noted:

"It doesn't matter how much it costs when it helps your health." .

This reflects the prevalence of the notion of prioritizing health among older adults.

4.3.4 Compatibility (COM)

1)60-70
Within this category, no consistently recurring themes were identified. However, the interviewees did not mention any aversion between wearable devices and their daily lives. On the contrary, some interviewees drew a comparison between the use of wearable wristbands and smartphones, stating:

"When I first started using a smartphone, I wasn't very accustomed to it. But as I gradually got used to it, I couldn't live without it. Now, the smartphone has become a part of my life. Although I haven't been using the smart wristband for long, I feel that it will also become a habit, just like the smartphone. Perhaps in the future, not using it will feel uncomfortable...".

2)Over 70
Addressing this category and summarizing what was found was not mentioned repeatedly by the interviewees. Interviewees typically want smart devices to fit seamlessly into their daily lives. This means that the device must be compatible with their existing habits, for example, the device should operate in a simple and intuitive way to accommodate their possible cognitive and physical limitations. For example, one interviewee stated,

"People my age don't want to spend too much time learning how to use a new device; I want these devices to fit naturally into my daily life.".

4.3.5 Social Influence (SI)

1)60-70
Within this category, we have identified two themes: (1) Recommendations from the Younger Generation and (2) Information Exchange among Peers. The interviewees commonly experienced positive attitudes and recommendations regarding wearable smart devices from their family and friends. These recommendations often emphasized the device's health monitoring functions and its potential contribution to improving quality of life. The interviewees expressed that positive recommendations and evaluations regarding health aspects often served as the primary motivation for their initial purchase and use of the device. Furthermore, the usage experiences and stories shared among peers reduced their psychological barriers to adopting the device, enhancing their confidence in trying out this "novel gadget they hadn't heard of before," believing that "if their peers could learn to use it, they could too." Additionally, discussions among peers about the device were not limited to its advantages; some negative evaluations were also exchanged. However, interestingly, while "positive evaluations" were often mentioned by the interviewees as the primary reason for "trying out" the device, negative evaluations from peers did not hinder the interviewees' adoption of the device. Particularly after they had experienced using the device themselves, negative evaluations did not lead them to stop using it.

2)Over 70
For this category, we got two themes (1) Recommendations from professionals and family members (2) Influence of peers. One of the interviewees mentioned,

"My doctor recommended that I use this device to track my heart health, and he said it would be helpful in controlling my blood pressure.".

The advice of a doctor or other health-care professional is also a powerful social influence. Older people are often receptive to the advice of their doctors, especially when it comes to health management. When healthcare professionals recommend the use of certain smart devices to monitor health conditions, older adults may be more inclined to adopt these technologies as a result. In addition, some interviewees indicated that they started using smart devices on the advice and support of their children. An interviewee mentioned that

"My children were using these devices and they told me it could help me manage my health better, so I started trying them out.".

Furthermore, the acceptance and use of a particular technology by peers can greatly influence older people's acceptance of that technology. Interviewees reported that seeing a friend or peer using a smart device and benefiting from it would increase the possibility that they would try the technology. This "peer effect" is particularly effective among older adults, as they are likely to be involved in specific social circles and groups, and the sharing of experiences within these circles can be a significant guide to individual decision-making. As one interviewee noted,

"My friends in my fitness class have started using this bracelet and they say it's really handy for monitoring heart rate and steps, so I bought one too.".

4.3.6 Perceived Social Risk (PSR) and Performance Risk (PR)

1)60-70
Regarding perceived social risk, no expressions were identified from the interviewees regarding wearing smart health devices causing social pressure or negative evaluations from others. On the contrary, some interviewees mentioned that many people in their social circles are using smart wearable devices. Similarly, opinions varied among the interviewees regarding performance risk. Concerning the risk of privacy breaches, some interviewees expressed concerns, while others stated that although they were aware that smart wearable devices collect personal information and data, they did not believe that the collected data would reveal too much of their privacy. Furthermore, the interviewees believed that the performance of smart wearable devices is reliable. Although there are occasional discrepancies between the measurements taken by the device and those taken at medical institutions, the interviewees considered these discrepancies to be within an acceptable range.

2)Over 70
We found no recurring themes in one category. However, some interviewees felt that technology is advancing rapidly and that wearable devices are highly capable and intelligent. For example, the accuracy of location is also very high. They showed that they still have trust

in technology and that they go to the hospital for medical checkups based on the results and opinions of the devices' monitoring.

4.3.7 Self-reported Health Conditions

1)60-70
Within this category, we did not identify recurring themes directly related to the health status of the elderly. However, all interviewees, despite their current health conditions varying, repeatedly mentioned their identification and concern for potential health risks:

"My health is quite robust, and I don't need to go to the hospital, but as one grows older, there's always some concern about one's health...".

"My blood pressure and heart aren't good; I have to take medication every day. Whenever there's any change in these health indicators, I still feel very worried...".

Simultaneously, all interviewees expressed their emphasis on health, believing that good health not only improves their own lives but also reduces their family's worries about them.

2)Over 70
During the interviews, interviewees expressed interest in smart devices that continuously monitor health conditions (e.g., heart rate, blood pressure), especially for those with chronic conditions such as heart disease or high blood pressure. One interviewee mentioned that he relies on the device to monitor his heart condition, which helps him keep abreast of health issues and adjust his daily activities accordingly . Other interviewees emphasized that as they age, their reduced mobility and ability to take care of themselves on a day-to-day basis makes them more dependent on devices with emergency call functions. For example, some older people use devices to ensure that they can get help quickly in the event of an emergency such as a fall.

4.4 Additional Categories

4.4.1 Spousal Influence

1)60-70
Within this category, we have identified the following themes: (1) Shared Responsibility for Health Management and (2) Involvement of Spouses. The interviewees mentioned that they and their spouses mutually care for and monitor each other's health in daily life, including reminding each other to take medication on time, supervising and encouraging moderate exercise, and accompanying each other for medical check-ups. Moreover, spouses generally hold positive attitudes toward the purchase and use of wearable smart devices by the interviewees, and they actively participate in learning how to use such smart devices together with the interviewees. Some interviewees mentioned that their spouse's interest in and trust in the device made them pay more attention to it. For example:

"Sometimes I feel dizzy and suspect that my blood pressure might be high again. My spouse said that the wristband didn't sound an alarm, so I just took some medicine and rested, without worrying too much...".

2)Over 70
Within this dimension, we summarize two themes: (1) Managing health together (2) Spousal support. Managing health together is particularly important to the interviewee, especially if one or both partners have a chronic condition. Smart devices such as health trackers and heart rate monitors can provide couples with real-time data on the health status of both partners, helping them to better manage medication plans, medical appointments, and daily activities. However, one interviewee mentioned the importance of the spouse in the decision to use a smart device. This interviewee's spouse started using a smartwatch first to manage their health, and after seeing the obvious benefits, encouraged the interviewee to start using one as well. This interviewee stated that the positive experience and encouragement of their spouse was a significant motivator for them to try new technology . And from the interview it was found that when spouses are open to a technology, this attitude motivates the interviewee to be less fearful of the new technology and increase the likelihood of trying it.

4.4.2 Elderly Knowledge of Smart Wearable Devices

1)60-70
Within this category, we have identified the following themes: (1) Recognition of Basic Functions and (2) Differences in Understanding of Functions.

The respondents unanimously indicated their awareness of what smart wearable devices are, attributing their knowledge to peers, children, and promotional efforts by sales personnel in stores. When discussing their overall impressions and evaluations of these devices, the respondents were able to varying extents to describe the basic functions of the devices. However, they also exhibited different levels of understanding regarding the various functions of the products. For instance, they mentioned:

"I know this gadget can measure blood pressure, but I'm unsure about the rest…" ,

"*There are many functions I don't understand.*"

"*I haven't looked into the vitality measurement in detail; it seems irrelevant to me.*".

Furthermore, when encountering unfamiliar functions, some respondents stated they would search online for relevant information to understand the functionality before deciding whether to use it. Others mentioned relying on their previous experience with electronic products to roughly judge the function's purpose, reasoning that:

"*There are similarities between electronic products; even if I don't know exactly what a function does, I can usually make a pretty good guess based on similar features I've seen before.*".

2) Over 70
Within this category, we identified themes of (1) awareness of basic functionality and (2)

differences in understanding of functionality.

Interviewees reported that they were aware of what smart wearables were, and that their knowledge came primarily from young people in their families, especially their own children. When talking about their initial impressions and evaluations of these devices, the interviewees were able to describe the basic functions of the devices to varying degrees. Several interviewees mentioned:

"I know that this device can monitor blood pressure and heart rate, and I think it's still the simple functions that work best."

"The most used feature for me is the location feature, the kids can all find me at any time. And it's easy to carry around."

"These new functions are too complicated for me to use."

When they encountered unfamiliar functions, the interviewees said they would seek help from the young people in their families.

5 Discussion

5.1 SWAM and the Acceptance of Smart Wearables for Elderly People

In this section, we discuss in detail the conclusions drawn based on our findings and the SWAM model used, and compare these conclusions with the predictions of the SWAM model.

5.1.1 Perceived Ease of Use (PEOU)

In our study, interviewees categorized the features offered by wearable devices into two parts: the core basic features that are easy to understand and useful, and the other features that are complex and difficult to understand but not used much. The simple and easy-to-understand core basic functions contributed to the adoption of the interviewee, while the difficult functions did not have a negative effect. The findings support the predictions of the SWAM model on the PEOU dimension, showing that older adults perceive these devices as easy to use in terms of basic functionality. This is consistent with Chen and Chan's (2014) study, who noted that older adults' perceived ease of use of technology is a key determinant of their acceptance

5.1.2 Perceived Usefulness (PU)

From the results of the study, the interviewees highlighted the significance of smart wearable devices for health monitoring, especially for heart rate and blood pressure, which can help them to monitor their daily health at home and decrease their dependence on traditional healthcare services. Additionally, interviewees mentioned that the emergency call function provided by these devices in case of emergency also positively impacted their mental health, providing them with peace of mind and satisfaction. It is also worth noting that one interviewee said that his memory was gradually deteriorating and that the smart wearables were able to provide timely reminders of when it was time to take his medication and when it was time to pick up his grandchildren from school. These findings are aligned with the 'PU' dimension of the SWAM model and support the model's view that smart wearables can significantly improve the quality of life of older adults. A study by Lazaro et al., (2020) found similar results when they found that perceived usefulness was the main driver for older adults' adoption of health-monitoring devices.

5.1.3 Facilitating Conditions (FC)

It is observed from the findings of the study that many of the interviewees mentioned that they purchased devices of familiar brands from nearby malls or e-shops, which made it easy for them to access the devices when they needed them. In regards to device repairs, a portion of the interviewees indicated that if they had a problem with their device, it was easy to find a repair store to have it repaired, while another part of the interviewees said that they needed the help of their family members in order to take their device in to be repaired. Regardless of the

differences in access to repair services, this factor remains an important condition that influences older people's acceptance of smart wearable devices. Even though the income levels of the interviewees varied, they all agreed that smart wearables were relatively affordable, especially given the potential benefits of these devices for health management.The SWAM model emphasizes the role of functionality factors in technology acceptance. Our finding that convenient purchasing and repair conditions and affordability are important factors for older adults to consider is consistent with SWAM's predictions and suggests that these conveniences do affect older people's attitudes about smart wearable devices.

5.1.4 Compatibility (COM)

Compatibility was mentioned in SWAM's projections as influencing older adults' use of smart wearables, with interviewees stating that the portability and ease of use of these devices make smart wearables a part of everyday life. However, some interviewees mentioned that they were put off by the complexity of the device's features, considering them unnecessary and inconvenient to use. The results of the study showed that compatibility did not significantly affect older adults' attitudes towards these devices. Instead, older adults were more concerned with the simplicity of using the devices and the intuitiveness of the basic functions. Even if a device is well integrated into daily life, if it is complex to use, older adults will still tend to avoid these features.Barnard et al., (2013) in their previous study, noted that older adults are more concerned with the intuitiveness and ease of use of technology than with its compatibility with other devices or with daily life. They found that complex user interfaces and high learning costs were the main reasons why older adults were reluctant to adopt new technologies, rather than device compatibility issues.

5.1.5 Social Influence (SI)

According to the findings of the study it was stated that all the interviewees were recommended by their family members especially their children, peers and doctors, the interviewee mentioned that "My son and I said that this bracelet is very useful for my body to monitor blood pressure and heart rate." This played a significant role in their use of smart wearables. The SWAM model states that SI is an important factor influencing technology acceptance among older adults. Our findings are consistent with the SWAM model and suggest that social influence especially for the advice of close family and friends has a significant impact on the acceptance of older adults. As mentioned in Anderson and Perrin's (2017) study, support from family members plays an important role in technology adoption among older adults.

5.1.6 Perceived Social Risk (PSR) and Performance Risk (PR)

According to Fraile et al.,(2010), they found that older adults have lower perceived social risk and performance risk of technology. And in our findings the interviewee did not show significant concern about the social risk and performance risk of smart wearable devices. The majority of interviewees felt that these devices performed reliably, although in some cases the measurements may differ slightly from those of healthcare providers, for example, one interviewee mentioned that ".... The value measured by this bracelet is a little bit wrong with the one I took at the clinic, but the error is not big enough to affect my use". In the SWAM

model, PSR and PR were seen as factors that could influence the acceptance of the technology. However, our findings suggest that older adults are not sensitive to these risks, which is different from the predictions of the SWAM model. Although the SWAM model suggests that PSR and PR may influence acceptance, our study found that these risks had less of an impact on older adults' attitudes.

5.1.7 Self-reported Health Conditions

From the results of the study, it can be seen that the interviewees commonly agreed that smart wearable devices are quite useful in health management, especially for the elderly who suffer from chronic diseases or need to keep a close watch on their health conditions. Interviewees mentioned that with smart wearable devices, they could manage their health better by monitoring their health indicators such as heart rate and blood pressure in real time. These devices for health monitoring and emergencies enable older adults to be more proactive in dealing with health issues, improving their sense of security and quality of life. The SWAM model predicts that self-reported health status is an important factor influencing older adults' need and willingness to use smart wearable devices. Our findings show that health status does have a significant impact on older adults' need and willingness to use these devices. For example, some interviewees noted that they suffered from chronic diseases and that smart wearable devices helped them to perform daily health monitoring at home and reduced the frequency of hospital visits. This showed that smart wearables are more appealing and acceptable to older people who have poorer health or need close monitoring. The findings indicate that older people do perceive these devices as important for managing their health conditions, which is consistent with the predictions of the SWAM model. This is also confirmed by the study by Paolillo et al., (2022), which states that older people with weaker health conditions are more likely to adopt smart health monitoring devices.The results of this study show that older people are more likely to adopt smart health monitoring devices than those with poor health conditions. The results of the study show that older people are more likely to adopt smart health monitoring devices than those with poorer health conditions.

5.2 Other Factors Influencing the Acceptance of Smart Wearable Devices Among the Elderly

The original structure of SWAM is insufficient to fully explain the attitudes and adoption of smart wearable devices among the elderly. Therefore, it is necessary to investigate other potentially significant factors beyond SWAM to better accommodate the target group. Currently, in the research field of technology adoption and usage among the elderly, two additional categories are the influence of spouses and the knowledge of the elderly (Stibe, Krüger, and Behne, 2022; Marler and Hargittai, 2022).

5.2.1 Influence of Spouses

As seen from the research results presented in Chapter 4, respondents' answers all involve the influence of spouses on the adoption and use of smart wearable devices. Firstly, for the elderly, the health status of their spouse and daily health management activities are their shared responsibilities. The elderly rely on their spouses for health management, such as being reminded to take medication or to monitor and check various physiological data

regularly. This dependence is particularly evident in the interviews with older respondents or those with poorer health conditions. The high level of concern for each other's health is also reflected in respondents mentioning that their spouses encourage them to purchase smart wearable devices, stating, "My spouse believes that using this device will alleviate their worries about my health." Additionally, the interviews reveal that the spouses of the elderly also participate to some extent in using smart wearable devices, such as learning how to use smart wristbands together. The recognition and positive attitude of spouses towards wearable devices bolster the elderly's confidence in overcoming usage difficulties. Previous studies have identified the health status and involvement of spouses as significant factors influencing the adoption or use of technology by the elderly (Cortellessa et al., 2008; Sorri and Leinonen, 2008; Ma, Cui, and Zhang, 2023). Our research findings support this view, indicating that this perspective also applies to the acceptance and use of smart wearable devices.

5.2.2 Knowledge of the Elderly

Stibe and colleagues found that the knowledge and understanding of a technological product among the elderly is a strong predictor of whether they will adopt and use the technology (Stibe, Krüger, and Behne, 2022). The interview results in Chapter 4 reveal that all respondents have a basic understanding of smart wearable devices, knowing that these devices can monitor various physiological data in real-time around the clock and recognizing the direct benefits, such as "I don't need to queue at hospitals or clinics to measure my blood pressure anymore." However, it is noteworthy that the vast majority of respondents' knowledge and understanding of these devices are relatively limited, confined to the most basic functions. For the rich array of features offered by these devices, most elderly respondents show a lack of understanding or interest. Compared to functions they clearly know and understand, those they have not explored are almost never used. Thus, from an overall product perspective, although the elderly have a general understanding of smart wearable devices and their functions, their knowledge at a more granular level shows varied understanding and corresponding usage intentions.

5.3 Acceptance of Wearable Devices Among Elderly of Different Age Groups

Firstly, although both groups of respondents believe that smart wearable devices are beneficial and helpful to their health, the descriptions of their health status and how these devices aid their health differ by age group. Based on self-reported health status and descriptions of daily activities, there are noticeable differences between the health conditions of the two age groups. While some respondents aged 60-70 report chronic conditions such as hypertension and heart disease, these conditions are relatively mild, allowing them to engage in general household chores and moderate physical activities. In contrast, respondents over 70 generally have poorer health and engage in lower-intensity activities such as walking. Although both groups find smart wearable devices useful, the specifics of their usefulness vary. Respondents aged 60-70 focus on long-term potential health risks, particularly using these devices for continuous monitoring of blood glucose and heart rate to preclude and warn of risks, and to help them maintain regular lifestyle habits. For those over 70, aside from regular health monitoring functions, frequently mentioned useful features include emergency alert systems. Previous research suggests that the health needs of the elderly vary with age (Chen and Li,

2022), and that the elderly should not be viewed as a homogeneous group (Niehaves and Plattfaut, 2014). Our findings support these views.

Secondly, despite both groups relying on external support during the adoption and use of smart wearable devices, the types of social support they depend on vary by age. Respondents aged 60-70 rely on various social connections, such as peer recommendations, sales personnel's advice, and contacting repair shops for device issues. This aligns with Van Tilburg's (1998) findings, which indicate that the social networks of the elderly are relatively extensive at younger old age stages, providing diverse social support. In contrast, respondents over 70 rely predominantly on their children for information, purchasing decisions, and usage guidance, especially for handling device malfunctions. This reflects the trend of a shrinking social support network with age (Pilisuk & Minkler, 1980; Hajek et al., 2022). Our findings also support Ungar et al.'s (1997) conclusion that with aging, the elderly have fewer social interaction opportunities and increasingly rely on family support, influencing their adoption and use of smart wearable devices.

6 Conclusion

This study explored the acceptance of smart wearables among older adults, using the Smart Wearables Acceptance Model (SWAM) as a theoretical framework. Through qualitative research methods, we identified key factors that influence acceptance, including perceived ease of use, perceived usefulness, facilitating conditions, social influences and self-reported health status, and the spouses influence. In both PU and SI, there were significant differences in performance between the age groups 60-70 years and over 70 years. These factors are interrelated and influence the acceptance and use of wearable devices by older adults.

Perceived ease of use: The study found that older adults find wearable devices with basic core functionality (e.g., heart rate and blood pressure monitoring) easy to use. However, they tend to avoid complex features that are difficult to understand and use .

Perceived usefulness: Wearables are valued for their health-monitoring capabilities, which help older users manage chronic conditions and provide peace of mind through emergency alert features. This perception significantly drives their acceptance of wearable technology. 60-70 years: in relatively good health, mainly engaged in household chores and moderate exercise, use smart wearables to monitor blood glucose and heart rate to prevent potential health risks and maintain regular lifestyle habits. Over 70 years: in poorer health, mainly engaged in low-intensity activities such as walking, for whom the device's emergency alert system feature is particularly important. The device's emergency alert system feature is especially important for them.

Facilitating conditions: Accessibility to purchase and repair services for wearable devices, as well as the affordability of the devices, are key to their acceptance. Older users benefit from easy access to devices and services, which supports their continued use .

Social influences: Recommendations from family, friends and healthcare professionals play an important role in encouraging older adults to use wearable devices. In particular, children's support was crucial in the acceptance process .60-70 year old group: relied on a wide social network, including peer recommendations, salesperson advice and repair store services, with a variety of sources of social support .70+ year old group: relied primarily on their children for information, purchasing decisions, and guidance on use, reflecting a narrowing of the social support network and a greater reliance on family support.

Self-reported health conditions: The elderly people with chronic conditions or requiring regular health monitoring are more likely to embrace wearable technology. These devices offer practical solutions for managing health conditions, reducing hospital visits and increasing users' sense of security .

Spouses influence: Spouses play an important role in the adoption and use of wearable devices by older adults. Findings suggest that spouses' health status and daily health management activities are the joint responsibility of older adults. Mutual support between spouses helps older adults to overcome difficulties in use and increases confidence in the device .

6.1 Limitation

Although this study provided valuable findings, there are some limitations that need to be addressed in future studies:

Geographic and demographic scope: This study interviewed older people in the communities for the elderly in Guandu District, Kunming, which limits the generalizability of the findings to other regions and populations.

Sample size and selection: The sample size of this study was relatively small, with participants from specific age groups (60-70 years old and over 70 years old). A larger and more diverse sample would have provided a more comprehensive factor analysis of the factors that influence older adults' acceptance of wearable technology.

Other variables: Other potential factors influencing technology acceptance, such as education level and experience with technology, were not considered in this study.

6.2 Future Work

To further improve the current study, the following recommendations should be considered for future research: expanding the scope of the study to include participants from different regions and different demographic backgrounds would increase the generalizability of the findings. Broadening the sample size to include a wider age range and different socioeconomic backgrounds would provide a more comprehensive understanding of the acceptance of wearable technology among older adults. Future studies should incorporate variables such as education level, economic status, and technological experience to explore their impact on the acceptance and use of wearable devices. Future research could examine the use of mixed methods combining qualitative and quantitative data, through questionnaires and data analysis, to count the frequency and duration of use of smart wearable devices by older adults of different ages, and to identify their main functions and usage patterns. Quantify the health status and needs of older adults of different age groups and clarify their different needs for smart wearable devices. Through in-depth interviews, understand the specific contexts and personal experiences of older adults in using the devices, and explore their reasons for choosing specific features as well as the specific difficulties and feelings they encountered during use. To gain a deeper understanding of the motivations and emotions behind these factors and to explore the specific impact of various factors on the decision-making process of older people.

In addressing these limitations and recommendations, future research could provide a deeper understanding of older adults' perceptions and use of wearable technology, and eventually help support the design and implementation of more effective and user-friendly devices by identifying and addressing the barriers that older people face in the use of smart wearable devices.

AI contribution statement (mandatory)

During the preliminary preparation phase of the thesis, ChatGPT was used to assist in brainstorming and exploring topics of interest. This helped in gaining an initial understanding of the subtopics under these areas, thereby aiding in the initial screening of keywords for the literature search. And Grammarly was used to check the syntax. After using the tool/service, the content was reviewed and edited as necessary and we take full responsibility for the content of the publication.

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