Acceptability of an iTV promoting social link among older adults living at home and in geriatric institutions: A qualitative analysis

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Abstract

Background: When older adults (OAs) can no longer remain at home, they have a choice between several types of geriatric institutions: residential facility (RF) or nursing home (NH). For several years now, thanks to the development of interactive televisions (iTVs), social link functions have been accessible directly on a TV screen, a tool already integrated into the residents' room. Acceptance of technologies has been widely documented in the literature, specifically targeting older users, or iTVs by incorporating factors from the innovation resistance model.

Objective: The main aim of this research was to enrich existing models of innovations acceptance by OAs living in different settings.

Methods: User tests were carried out to identify the factors involved in the acceptance of an iTV by OAs living at home, in NH, and in RF. A total of 32 OAs were interviewed between November 2022 and June 2023. The acceptance model used for this study is an extended version of the Technology Acceptance Model (e-TAM) including the following factors: intention to use, perceived usefulness, perceived ease of use, user resistance, anxiety, facilitating conditions and user characteristics.

Results: The deductive qualitative analysis based on this extended version of the TAM helped to identify 33 concepts categorized according to the factors of the e-TAM.

Conclusions: This study has contributed to the literature on the acceptance of iTVs by OAs living at home and in geriatric institutions, in particular by enriching existing models and proposing new avenues for reflection.

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Original Manuscript

Original Paper

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Key words: interactive television (iTV); acceptance; older adults; nursing home; residential facility; technology acceptance model (TAM)

Introduction

Older adults (OAs) experience perceptual, physiological, and cognitive changes with ageing [1,2], that may affect their daily independence. When it is no longer possible for them to remain at home (e.g. presence of cognitive and/or functional problems, lack of daily support and assistance) [3], OAs may choose between different types of accommodation: residential facility (RF), or nursing home (NH). In France, RF represent a step between home and institutional care [4]. For several years now, and especially since the Covid-19 pandemic, NHs and RFs have been equipped with Information and Communication Technologies (ICTs) (e.g., tablets, computers, smartphones), to promote a feeling of connection between residents and their relatives [5,6]. In addition, with the development of Interactive Televisions (iTVs), social networking functions (e.g. social networks, video calls, messages) are now accessible directly on the television screen [7,8]. TV system has the advantage of being a tool already integrated into the daily lives of OAs and therefore familiar (i.e., the main source of information and entertainment) [8]. However, although iTVs seem to be able to facilitate access to social link functionalities within geriatric institutions, their long-term use depends on several other

factors: organizational (e.g., staff turnover, additional workload), human (e.g., health, self-efficacy, and technological and social habits), ethical (e.g. privacy, ageism), and technological factors (e.g. technical and ergonomic problems with iTV, non-existent or inadequate training) [9–11]. The literature on the acceptance of technologies by OAs is often stereotypical [12], considering the elderly user to be resistant to any form of innovation and lacking motivation to use a technology [13]. However, some authors [13] challenged these studies explaining that, while OAs value their independence, privacy and social interaction, products designed specifically for this population focus mainly on safety and assistance aspects. In the technology paradoxes framework [14], consumers face some paradoxes while using technology, creating negative emotions such as anxiety and stress. To combat these emotions, consumers tend to adopt various pre- or post-acquisition coping strategies to avoid or confront the technology. Applying this framework to older consumers, Wilson-Nash and Tinson [15] found that most of the strategies adopted by OAs are confrontational, showing that despite previous assumptions of lack of dynamism or willingness [16,17], OAs are keen to master the technology. There is a wealth of literature on the factors influencing the adoption of technological innovations, and several explanatory models have been developed. The two main ones are Davis's Technology Acceptance Model (TAM) [18], and Venkatesh's Unified Theory of Acceptability and Use of Technology (UTAUT) [19].

Models of technology acceptance

According to the TAM, the acceptance of a technology, i.e. the extent to which a product will be used or not, depends on two main factors: perceived usefulness and perceived ease of use [18]. Subsequently, other extended versions of the TAM emerged, culminating in the proposal of an integrative model named UTAUT [19]. Venkatesh et al. differentiate between the determining factors, i.e. factors influencing the intention to use or the use of technologies, and the moderating factors, i.e. factors influencing the determining factors. These include expected performance, expected effort, social influence, and the presence of facilitating conditions such as documentation. Although these models have been used in a variety of contexts, their original field of application is the workplace. Venkatesh et al. [20] then proposed a second version of the UTAUT (UTAUT 2), better adapted to the context of consumer use. Three other factors have been added to the existing determining factors: hedonic motivation, monetary value, and habit. Finally, these same authors proposed ways of developing the model, such as integrating contextual factors (e.g., organization, physical environment), as well as individual factors (e.g., user and technology characteristics) [21]. At the same time, Chen and Chan [22] have been looking at the acceptance of technologies by OAs and have developed the Senior Technology Assessment Model (STAM). This model incorporates factors from both TAM and UTAUT, such as perceived usefulness, perceived ease of use, attitude to use, facilitating conditions, self-efficacy and anxiety about gerontechnologies. The authors also added age-related factors such as perceived health, cognitive ability, attitude to ageing, satisfaction with life, social relationships and level of physical functioning. Age, gender, level of education and economic status were also considered as control variables.

Innovation resistance

The adoption of a technological innovation may also depend on the user’s degree of resistance to change, i.e. to the maintenance of the status against the pressure of change [23]. Any disruption to users' routines can alter their psychological equilibrium, which then needs to be adapted to reduce resistance [24,25]. An innovation can only be adopted once the initial resistance has been overcome by users [26]. Several authors have attempted to identify the factors influencing this resistance, such as the practice habit, and the perceived risk of the innovation [27], or the innovation, propagation mechanism and user characteristics [26]. According to Joseph, three types of factors seem to influence resistance: functional, psychological, and informational factors [28]. Finally, user

resistance seems to depend on several multidimensional factors.

The acceptance model used in the study

In their study on the acceptance of an iTV, Im et al. [29] proposed an integrative model combining the models of acceptance (TAM [18]) and resistance to innovation [26]. In doing so, they aimed to go beyond previous theoretical frameworks to better explain the dynamic nature of adoption [30]. According to these authors, the factors influencing iTV adoption are perceived ease of use, perceived usefulness, user characteristics (e.g. previous experience with innovations, self-efficacy), resistance to innovation, and intention to use. However, this model does not consider the characteristics of OAs (e.g. cognitive and/or physical disorders, lack of digital literacy, technological anxiety, low sense of self-efficacy, etc.) [2,31,32], and even less the specific characteristics of geriatric residents [33].
This paper presents a qualitative study investigating the factors that might influence the acceptance of iTV system by OAs living at home, in RF and in NH. The first step was then to create an acceptability questionnaire addressing both the specific features of the technology and those of the population studied. Thus, this study aimed to enrich existing models of acceptance by suggesting new lines of thought on the determinants of acceptance proposed in these models.

Methods and materials

Method

The method used was borrowed from User Centered Design (UCD), and from the qualitative and quantitative method of user testing [34]. The aim was to place participants in real-life conditions, based on pre-established iTV usage scenarios. By combining observation and interviews with the participant, the researcher was able to identify the difficulties encountered when using the technology. As part of this study, the participant could receive cues if they got stuck, asked for help or made a mistake.

Materials

The iTV

The iTV selected for the user tests is a system developed by Technosens (Grenoble, France) [35], and installed in geriatric institutions since 2011. A total of 53 NHs and RFs in France are equipped with the iTV, which is installed directly in residents' bedrooms. This iTV consists of a box connected to a TV screen and offering communication (e.g. messages, photos, video calls), entertainment (e.g. TV channels, radio) and information services (e.g. news from the institution) (Figure 1). All these functions can be accessed via a single remote control.

Figure 1. The e-lioTV system and the main menu interface: Box, camera, and remote control.

The questionnaires

To identify the different profiles of participants and to assess the acceptability of the iTV, we administered a total of 3 questionnaires: socio-demographic characteristics, technological habits (e.g. frequency of use of technologies), and acceptance of the device (extended Technology Acceptance Model (e-TAM), see Table 1). This questionnaire was constructed based on the literature on the acceptance of technologies [18,36,37], and in particular iTVs [29], among OAs [22]. A total of 7 dimensions were selected as having a direct or indirect influence on the use of iTV: 1. Intention to use (INT); 2. Perceived usefulness (PU); 3. Perceived ease of use (PEOU); 4. User resistance (UR); 5. anxiety (ANX); 6. Facilitating conditions (FC) (e.g. peer support, self-efficacy); and 7. User characteristics (UC) (e.g. previous experience and interest in technology, social influence, perceived health). Each dimension has two measurement items using a 5-point Likert scale (“1” indicating

"strongly disagree", "2" indicating "disagree", "3" indicating "neutral", "4" indicating "agree", and "5" indicating "strongly agree").

Table 1. e-TAM questionnaire.

Dimensions	Affirmations	References
PU	E-lioTV is practical for me.	[29]
	E-lioTV provides me with various useful functions and services.	
PEOU	It takes much time and effort to understand and use e-lioTV.	[18,29]
	I found e-lioTV easy to use.	
UR	Using e-lioTV is burdensome.	[29]
	E-lioTV is not for me.	
ANX	I'm afraid of using e-lioTV.	[36]
	I'm afraid that if I press the wrong button on the remote, I might break something on e-lioTV.	
INT	I want to have e-lioTV in my home.	[29]
	I would recommend others using e-lioTV.	
FC	In general, if I have a problem with a device, I ask my family or care staff for help.	[29,37]
	It is easy for me to understand and use new devices.	
UC	The people I care about push me to use messages and video calls.	[37,38]
	In general, I'm curious to learn how to use a new device.	

Participants and recruitment

Participants in the study lived in geriatric institutions (e.g., NH, RF) or at home, and were not e-lioTV users. The inclusion criteria were as follows: 1) To be over 60 years; 2) To be literate; 3) To be able to use a television remote control by themselves. Exclusion criteria included: 1) having an MMSE score of less than 16; 2) having visual, hearing or motor problems that prevented them from using a TV remote control, unless they could be compensated for by a technical aid. To this end, for NH and RF residents, professionals were asked to draw up a preliminary list of willing residents who met the above criteria.

In total, 38 participants were approached (RF: n=10; NH: n=12; Home: n=16) between November 2022 and June 2023. Among the participants, five dropped out before the end of the test, and one person was excluded because he was illiterate. A total of 32 participants were included, including 23 women and 9 men. The demographic characteristics of the three groups are presented in Table 2. These data seemed in line with the literature, with participants living in NH belonging almost entirely to the 80+ category [4]. In this study, it is interesting to note that almost all the participants living at home had a higher education degree (postgraduate degree) compared with the institutionalized participants.

Table 2. Socio-demographic characteristics of participants.

	Gender		Age			Education	
	Female	Male	60-69	70-79	80+	Undergraduate	Postgraduate
NH n = 7	4	3	0	1	6	7	0

RF n = 9	7	2	3	1	5	8	1
Home n = 16	12	4	2	9	5	2	14
Total n = 32	23	9	5	11	16	17	15

To explore participants' technological expertise, we assessed the frequency of mobile phone use by functionality (e.g. calling, answering a call, sending a message, checking a message), as well as the overall frequency of computer and tablet use. We then categorized their expertise with the technology as follows: a person is considered *Expert* if they use the feature/technology "Several times a day" or "Every day or almost every day"; a person is considered *Non-Expert* if they do not use the feature/technology or if they use it "Every week" or "Every month". According to Table 3, most participants in the G_{RF} and the G_{NH} were not experts in the use of computers, unlike participants in the G_{Home}. In addition, some of the G_{RF} used their mobile phones more frequently (phone calls and messages) than the G_{NH}. It is interesting to note that among the smartphone users (NH: n = 0; RF: n = 6, Home: n = 15), those living in RF tended to restrict the use of their mobile phone to calling and messaging.

Table 3. Technological expertise of participants.

	Level of expertise	**Mobile phone**				**Computer**	**Tablet**
		Make a call	Answer a call	Send a message	Receive a message		
NH n = 7	Expert	1	2	0	0	1	0
	Non-expert	6	5	7	7	6	7
RF n = 9	Expert	5	8	4	5	0	1
	Non-expert	4	1	5	4	9	8
Home n = 16	Expert	14	15	15	15	16	5
	Non-expert	2	1	1	1	0	11
Total n = 32	Expert	20	25	19	20	17	6
	Non-expert	12	7	13	12	15	26

Procedure

The tests carried out as part of this study were individual. Consent was obtained on the day of the appointment, after the participant had been reminded of the objectives of the research. Before starting the scenarios on the iTV, the overall cognitive level (MMSE) of each participant was assessed. Then, they were asked to complete a socio-demographic questionnaire and to share their technology usage habits. After a brief presentation of the principle and overall functioning of the iTV (e.g. the different components of the tool such as the box, camera and remote control, and the main features), participants' first impressions were gathered. The iTV was used through three scenarios of increasing difficulty, each with more steps than the last (e.g., answering a video call, checking a message, and making a video call).The researcher then collected participants' opinions or recommendations on the iTV throughout the scenarios. Once the three scenarios had been completed, participants answered the e-TAM questionnaire. If necessary, the researcher asked participants to

develop some answers. Finally, and at the participants' request, the researcher could also provide an additional explanation of the iTV's marketing status and target audience, as well as the rest of its functionalities not used in this test (e.g. radio, news from the institution, games). Participants were then invited to react on their behalf, as well as on behalf of someone close to them.
Ethical approval for this study was obtained from the Research and Ethics Committee from Université Paris Cité in November 2021 (No. 00012021-91). Validation of the data management procedures and related compliance with the General Data Protection Regulation (GDRP) was obtained after the Data Protection Office and registered in the general register of Greater Paris University Hospitals (AP-HP) in February 2022 (No. 20220228123925).

Qualitative analysis

The qualitative analysis was based on the transcripts of the user tests, using a deductive analysis method. The aim was to identify the factors that could influence performance on the iTV, and therefore its acceptance, based on the e-TAM factors. To this end, we took inspiration from the Qualitative Analysis Guide of Leuven (QUAGOL) [39] following three preliminary steps before coding the interviews: 1. highlighting important elements and writing a mini report on the participant's characteristics; 2. designing conceptual schemes; 3. validity testing. Once the conceptual schemes had been tested and validated, we were able to draw up a list of concepts used to code the transcripts. These concepts were classified according to the e-TAM factors, allowing us to develop some of them further, or even to create new ones. An overall conceptual framework for our transcripts, in the form of a mind map, was thus created. Finally, each concept was described, including a short summary of the points raised in the interviews, as well as a few key verbatims.

Results

According to e-TAM, iTV acceptance depends on 7 factors: intention to use (INT), perceived usefulness (PU), perceived ease of use (PEOU), resistance to iTV (UR), anxiety when using iTV (ANX), facilitating conditions (FC), and user characteristics (UC). A summary of the 33 concepts found during the deductive qualitative analysis is presented in Figure 2.

Figure 2. Mind map of themes and sub-themes from the deductive qualitative analysis based on e-TAM.

Intention to use (INT)

Participants gave an average score of 6.7 out of 10 for their intention to use iTV. Although they seemed to perceive the interest of iTV in general, participants are equally divided between those who would like to have iTV at home and those who would not. However, a majority would still recommend iTV to their friends and family (Figure 3).

Figure 3. Intended use of iTV by OAs living at home, in RF, and in NH.

Existing technological environment (n=6)

Many participants already owned several technologies, some for several years, and had well-established communication and information habits. Some of them saw no point in using an iTV as a complement, for the following reasons:

- Technology perceived as a gadget, with no added value compared to existing technology (fewer functions or accessibility options such as voice): *"Me personally? No, no, I won't use it. [...] Because I have other things, things that react to my voice, things that are much more responsive" (H-2)*
- Multiplicity of everyday technologies: *"I have enough machines to do it" (H-13)*

It is interesting to note that this barrier only concerned OAs living at home, i.e. in this study, the participants with the most technology.

Technology for people with disabilities (n=7)

E-lioTV could be seen as a technology for people who are losing their independence, with temporary or permanent cognitive or mobility impairments. In fact, one of the advantages of the iTV identified was the centralization of functions on a technology that is already used on a daily basis, and located in a single room, often the most frequented, in the home. In the event of a call, this could reduce the risk of falling (getting up in a hurry if the phone rings): *"It's certain that if one day I'm a lot less mobile, and if I'm less able to flit from one thing to another, I'll use this device" (H-2)*. However, this comment was only made by OAs living at home, and if we take a look at the left side of Figure 3, no link can be made between living settings and intention to use.

Perceived usefulness (PU)

On average, participants rated the perceived usefulness of the iTV at 7.5 out of 10. The device seemed practical for most participants, with the services offered perceived as useful (Figure 4).

Figure 4. Perceived usefulness of iTV by OAs living at home, in RF, and in NH.

Simplifying or complicating the daily life (n=14)

Most participants had a very positive attitude towards iTV, satisfied with the principle of having a TV screen that brings together several functions. According to one participant, this principle is *"very clever" (H-3)* and avoids the multiplication of technologies in the home. Using a TV system also means that functionalities such as games can be accessed on a larger screen. It is also easier to position oneself in front of a camera on a TV screen than on a smartphone. However, some participants seemed to consider technological innovations as an unnecessary complication of everyday life. For example, even before the operation of the iTV was explained to them, some participants showed no interest in discovering this technology: *"I don't need it because I just want to keep watching the news and that's all [...] I'm starting to say: 'Whoa, let's just stay as we are, let's not complicate our lives'" (NH-6)*. The value of technology can also be linked to a person's lifestyle and job. One former farmer, who had always lived in a rural environment, had never understood the usefulness of a computer: *"And then, in the countryside, it's not really that useful. The main thing is to have the essentials" (NH-14)*.

Supporting certain values (n=12)

According to some participants, the iTV's features were relevant because they supported values that were important to them:

- *Connection with the outside world.* The iTV could facilitate the interaction with loved ones, as well as giving people the opportunity to take part in moments of life through photos and video calls: *"Oh yes, indeed, you can travel that way" (NH-7)*
- *Autonomy and health.* Other participants appreciated the reflection involved when using the iTV, as well as the games: *"That way, he can do cognitive remediation on his own" (H-3)*. Video calls could also help to reassure family and friends.

Perceived ease of use (PEOU)

On average, participants gave the iTV a score of 7.7 out of 10 for perceived ease of use. Although the majority of participants found the iTV easy to use, a few participants reported that they needed a little more time to learn how to use it (Figure 5).

Figure 5. Perceived ease of use of iTV by OAs living at home, in RF, and in NH.

Ease of use (n=14)

The iTV seemed easy to use for the majority of participants, even for those with no computer skills or with mild cognitive impairment. Several participants found that the remote control had few new buttons, making it easy to identify the most important ones. The icons also seemed logical and easy to understand. The information insert on the TV screen served as a memory aid: instead of spending time looking for the solution, they felt the system was doing the work for them by pointing out the right buttons: *"Well yes, everything has been spoon-fed, you know" (H-1)*, something that is all the more relevant for OAs: *"It's visual, but maybe you need that more when you're older too" (H-14)*.
This guidance greatly reduced the amount of information to be memorized, facilitating familiarization with the system and success during the first moments of interaction, an important phase in forming a good first impression. Finally, the participants had the feeling that they were being supported: *"It's pretty simple, isn't it, because you're really being taken by the hand from the beginning to the end" (H-1)*. Finally, one participant was used to a certain complexity on a daily basis (two remote controls) and seemed pleasantly surprised to be able to do so many things with just one remote control.

Need for time and effort (n=17)

Although the iTV was considered rather easy to use, some participants said they needed time to get used to it. This time was needed to develop automatisms/reflexes, but also to become familiar with the buttons and the iTV's operating principle, i.e. looking at the screen to find the right button: *" It requires some adaptation, and adaptation takes a little longer now" (H-11)*. However, although learning and problem-solving take longer with age, participants were not bothered, also because they have more time to spend on this than young adults: *"It took me a little while to find it, but does it need to be immediate? I'm not sure" (H-8)*.
Regarding the need for effort, several participants emphasized the cognitive resources required to handle the iTV. Using this tool seems to have a cost in terms of attention and mental flexibility to make the link between the guidance on the screen and the buttons on the remote control, to select the relevant information on the screen, and to remember the actions of certain buttons: *"I was doing gymnastics between looking at the screen, looking at the remote control" (NH-6)*.

Perceived and experienced complexity (n=9)

Some participants experienced difficulties in learning how to use the iTV, such as recognizing the icons on the remote control, pressing the buttons gently, or identifying the actions to be performed on the TV screen. One participant stressed the need to simplify the technology as much as possible to avoid discouraging users: *"It can be very discouraging for someone who doesn't understand it very well, and maybe not curious enough to insist either" (H-14)*. Indeed, when faced with several failures, one participant was tempted to give up: *"Pfff. What am I going to do? I can't do anything. I'm stuck" (RF-15)*. Beyond the experienced complexity, the perceived complexity could influence the way the iTV was approached. Indeed, even before using the device for the first time, participants had already formed an initial impression based on their personal experience with their TV. Some participants perceived the remote control as complex (using a remote control with fewer buttons on a daily basis), while others imagined that the iTV would be simple to use, like an ordinary TV. But this first impression could be misleading, particularly because of the difficulty of applying knowledge of other technologies to this device: *"It looks very simple, but in the end, you have to find out what it means on the remote control" (H-14)*; *" I don't know why […] I end up thinking about how to use a remote control " (H-14)*.

Need for support (n=14)

A number of participants said they needed extra support, or even guidance, to be able to use the iTV. The fact that there were no instructions and that they had to manage on their own from the start seemed to disconcert some of them: *"We're letting people get started without giving them a user manual?"(H-2)*. One participant stressed the need for the OAs to put everything in writing. A summary note of the remote control with the actions associated with each button might be enough, particularly in the early stages of the interaction. However, one participant was reluctant to have a user manual, considering them too complicated in general. Other participants preferred to have support from someone, in particular to reassure them during the first moments of interaction: *"Well, at least ...., I don't know, one or two days to fully understand the buttons" (RF-15)*.

User resistance towards the iTV (UR)

On average, participants rated their resistance to iTV at 3.9 out of 10. Although its use did not seem to be perceived as tiresome by the participants, several of them did not consider the iTV adapted to their needs and uses (Figure 6).

Figure 6. User resistance towards the iTV by OAs living at home, in RF, and in NH.

Technology not adapted to OAs (n=7)

Some of the participants immediately thought that the iTV was not suited to them or their NH neighbors because of:

- Health conditions: *"We're all a bit lost, I don't think it's really suited to our home" (NH-6)*
- Poor knowledge of technology use
- Age

This last point can be seen as self-ageism. One participant seemed outraged by this stereotype: *"[This television is not for me] Why? Because I'm stupid? And I'm old? [Laughs]" (NH-7)*. Finally, although participants found the functionalities rather useful, they almost systematically considered that the iTV was made for someone else, seeing no point in changing their habits.

Costly changes (n=4)

A number of participants had a negative attitude towards application updates, or the switch to SmartTVs, showing annoyance or even stress when using them. OAs may find it difficult to adapt to change, with each new feature requiring an effort to understand and learn, which become even more demanding with age (e.g. slowness, need for repetition): *"That's what's annoying, it's the constant updates that turn everything upside down. So, you make an effort to keep up with it, you start to assimilate it more or less and that's it, off you go again" (H-12)*. So, even though the TV remote control is used on a daily basis, most of the participants were not used to using other buttons apart from the TV channels, to keep control of the situation. Using an iTV therefore necessarily requires a learning curve. Another explanation for this annoyance could be the imbalance between the cost and benefit of the change, as it is not necessarily perceived as an improvement, especially if it makes other functions less accessible. In the case of iTVs, one participant showed particular resistance, mainly because it made it harder for her to access TV channels.

Negative image of TV (n=5)

A few participants said they disliked TV in general, preferring to use another technology (e.g., computer), or do another activity. The TV system is generally perceived as a technology that isolates people and encourages immobility. In addition, some participants found the programs they watched uninteresting. In this case, the TV system is confused with the functionality of the TV channels, affecting the overall iTV experience: *"But I'll tell you, honestly... logically I don't like TV" (RF-15)*.

Resistance towards video calls (n=8)

A few participants didn't like making video calls because they were either uncomfortable with seeing themselves on a screen (n=7), or they perceived video calls as an intrusion into people's privacy (n=1).

Financial resources (n=6)

Several participants quickly raised the issue of the iTV's price. Aside from the usefulness of the system, this aspect was quickly considered by the participants when they were planning to use the system: *"What bothers me is the money, to change television" (NH-14)*. Moreover, as soon as the question of a subscription was raised, the participants seemed reluctant.

Perceived risks (n=10)

The participants showed a certain reluctance towards technology in general, or towards the iTV in particular, because of risks such as:
Addiction and social barriers (n=6). Several participants felt that the use of technology represented a social barrier, intruding between people and making communication difficult: *"But it's frightening how many people have their smartphones and don't look at the person next to them. It's crazy" (H-1)*. Then, some participants showed contempt or annoyance towards people who spend a lot of time on their phones. One participant feared becoming an addict and refused to learn how to use a digital tool: *"There are dangers there, I have to be careful" (NH-8)*. Finally, one participant feared that iTV would be used as an excuse to reduce the number of carers, or to reduce the number of family visits.
Excessive solicitation (n=4). Some participants showed a certain resistance to ICTs (e.g., social networks, iTV) because of over-solicitation. According to one participant, receiving messages every day was inconceivable. Indeed, this form of remote communication is relatively recent: *"No, no, no, once in a while! If people send me messages every day, it's going to explode" (RF-1)*. Over-solicitation could then lead to annoyance, or even refusal to use the technology: *"I don't want that"*; *"But that's the flaw, it's the instantaneity of today's world" (H-12)*. However, one participant mentioned the possibility of an evolution in this resistance with the evolution in the importance of certain values with age, i.e. favoring social contact over entertainment: *"Human contact is even more important at that age than seeing a documentary on which she falls asleep, eh" (H-12)*.
Lack of control over data (n=4). Two participants mentioned the dangers of the internet and the importance of data protection. One of them was very reluctant to go online because someone she knew had been ripped off. Generally speaking, the lack of control over technology seemed to bother the participants: *"And can we deactivate this action? That's the problem" (H-12)*.

Anxiety towards iTV use (ANX)

Participants rated their level of anxiety when using the iTV at 3.8 out of 10. The majority reported no apprehension about using, or even making mistakes on the iTV (Figure 7). It is important to note that some responses may have been influenced by the test format, i.e., by the aids provided by the researcher.

Figure 7. Anxiety while using iTV by OAs living at home, in RF, and in NH.

Anxiety-provoking technology (n=14)

Several participants reported feeling anxious when using their device: fear of making irreparable mistakes and getting stuck, having lost their bearings: *"I'm not going to look too hard when it's set, because I'm always afraid of going wrong anyway" (H-14).* Some people felt this apprehension every time they used their technology, while others were especially stressed during the learning phase: *"Computers really put me off because I can't get the hand of it [...] Oh yes, I screw up... I lose*

things... Pfff" (H-11). This apprehension was not the same depending on the technology: some participants felt more comfortable with their computer than with their smartphone, with which they were less used to interacting, while others apprehended using the TV system: *"I hope there's no remote control" (H-3)*. The remote control seemed to generate stress because of their diversity (i.e., each brand of TV has a different remote control: *“Look, I don’t really like remote controls, but because they change all the time” (H-5)*), because of the large number of buttons, or because of the presence of generic buttons (e.g. colored buttons with no symbols on it, arrows). During the test, one participant did not feel confident because of the workload required by the iTV functioning (i.e., linking the information on the screen with that on the remote control). These anxious OAs did not necessarily show resistance, but they saw the iTV as inevitably more complicated to use, making it difficult to apply their digital literacy: *"I do it all the time. I was looking for something more complicated" (RF-11)*.

To cope with this technological anxiety, some participants adopted coping strategies such as neglect: one participant preferred having someone operate her TV for her; or avoidance: ignoring certain buttons/functions on their TV and remote control: *"Oh no, no, I just do the channel and that's it. No, I haven't explored it, and I don't even know what these are [arrow buttons]" (NH-7)*.

Anxiety-provoking context (n=2)

One participant mentioned the influence of the context in which the technology was used on the stress felt at the time of use: *"for train tickets for example, I don't know... there's something about it, there's the urgency and the stakes" (H-5)*. According to her, what was most stressful was the stakes behind the successful use of the technology, as well as the potential consequences if it failed (e.g. ATM, train tickets). In the case of the iTV, the ringtone used to notify the user of a call could also be stressful, with the user rushing to find the button to pick up the call.

Progressive familiarization and search strategy (n=11)

Some participants were not afraid of pressing the wrong button and dared to explore. This confidence may have come from their own experience of computers, or from their confidence in their ability to solve problems: they were aware that it was always possible to go back, or to ask for help: *"Well, sometimes the experience consists of going back" (H-2)*; *"You can go wrong at first, but you can go back, you can fix it" (RF-10)*.

The participants' level of apprehension could then influence their strategies for finding solutions. If they found themselves stuck, some opted for testing unknown or unused buttons, while others preferred to test randomly, seeing the mistake as an opportunity to learn something else. It is interesting to note that this confidence was acquired gradually, as OAs learned how the technologies worked and overcame their initial reluctance: *"Now it's easy, because I've learned, but before, no, it was a real barrier” (H-5)*.

Facilitating conditions (FC)

The majority of participants considered having support from their families or care staff (for participants living in NH or in RF). However, when it came to their ability to learn how to use a new device, participants were more divided and undecided (Figure 8).

Figure 8. Facilitating conditions for the use of iTV by OAs living at home, in RF, and in NH.

Feeling of self-efficacy (n=25)

As shown on the right of Figure 8, participants' feelings of self-efficacy varied considerably. Some participants were confident in their ability to use and solve problems on the iTV, as three of them pointed out the role of expert they assumed among their friends and family. Autonomy in finding

solutions (e.g. consulting YouTube tutorials, online forums) could therefore be an indicator of a feeling of personal efficacy. It is interesting to note that, as with anxiety, this feeling depended on the technology and remained variable over time. For example, a participant felt confident using the iTV, but doubted their ability to use a tablet. Even before they started the test, other participants were skeptical about their ability to use the iTV independently: *"I'll need help with this" (RF-2)* and seemed to consider its use as very difficult or impossible: *"I was looking for something more complicated" (RF-11)*. One participant even questioned their place in this test: *"I'm wasting your time, aren't I?" (NH-7)*. This lack of confidence in their abilities could have influenced their first experience with the iTV in several ways. As participants used the iTV, mistakes could be more prominent than successes (*"Well, that's a good start!" (RF-9)*), and participants tended to blame themselves (e.g., slowness, lack of thinking, impatience and haste) for the slightest problem they encountered, never questioning the design or functioning of the technology (*"Well, maybe it's because I'm not paying enough attention" (H-6)*). The tests revealed the difference between participants who were actively looking for a solution and those who gave up at the first sign of difficulty and preferred to rely on the researcher's help. Finally, a bias identified among some participants was the supposed comparison with other people, younger or the same age, making the situation even more frustrating: *"I'm sure someone younger would have understood straight away" (H-14)*.

Occasional or regular help from peers (n=20)

In most cases, peers provided occasional assistance in particular to help them out in the event of a problem, to support them as they familiarize with a new technology or feature, or to explore other functionalities: *"my son told me 'there's a yellow line there'. He says you have to press really hard" (NH-14)*. Training people in a new technology/function sometimes meant reassuring them during the first moments of interaction. On a few occasions, participants' relatives were able to act as advisors, pointing out additional features that could meet their needs:

- Difficulty writing text messages: audio message.
- Difficulty understanding a TV program: subtitle option.
- Urinary problems: pause function on TV.

Finally, other participants could also benefit from regular help with administrative formalities. In this case, the relatives provided more than just help, as they were doing things directly for the participants. Help often came from younger family members, and occasionally from friends or digital advisors via local councils. For participants living in institutions, the care staff were able to absorb some of the family's support role, especially when the family was not nearby. This feeling of trust between the resident and the professionals could facilitate the adoption of a new tool.

Peer attitudes (n=4)

Some participants complained about the annoyance and impatience of their relatives: *"My nephew often reproaches me: 'You're not watching! It's indicated!'" (RF-16).* Moreover, peers may not be available to help if problems arise: *"My family... they'll tell me 'I don't have the time!'" (H-15)*, or they may have lost interest when faced with the participant's resistance. However, as one participant pointed out, the trainer's attitude can be passed on to the learner, and therefore influence their attitude towards the technology.

Peer dependence (n=10)

Several participants depended entirely on their relatives for certain tasks (e.g., video calls, tax declarations), which could accentuate the gap between their current skills and modern technological requirements: *"For example, I have taxes, but my son does them, so I don't even know how to do them myself" (H-11)*. Depending on several people can constitute a barrier and complicate the day-to-day use of technology. For example, one participant was very frustrated and angry at having "lost"

her computer when she moved into an institution, and another reported his dependence on his wife for the tablet they share. This dependence could be induced by peers, or desired by the participants themselves. In the first case, peers might think they were helping by sparing them the difficulties associated with the technology. This could be frustrating for one participant, who felt she was capable of managing her own accounts: *"because he's afraid I don't know how to manage my account, so he checks! […] No, because I don't need him, I do it myself" (RF-16)*. In the second case, some participants tending to wait to be contacted, or for someone to do it for them : although they had taken part in the test and shown their ability to use a remote control, some participants living in NH preferred to delegate its use to care staff, mainly because of the anxiety-provoking technology: *"When they come, if the TV is on or off, they put it on for me or turn it off. I mean, I know how to turn it off, but still... I don't feel safe using it" (NH-14)*.

User characteristics (UC)

The participants from the three settings appeared to be divided into two groups in terms of the perceived social pressure and their curiosity about technology (Figure 9).

Figure 9. Participants' characteristics.

Influence of an exceptional situation (n=11)

In response to exceptional situations (e.g., a relative moving abroad, covid-19 pandemic), peers may have adopted different behaviors in an attempt to maintain cohesion within the group of friends or family. For example, during the covid-19 pandemic, several participants mentioned using video calls to stay in touch with their loved ones, and to take part in activities (e.g. a multimedia café organized by a laboratory). As a result of these exceptional situations, certain functionalities such as video calls or messages may have become the norm in terms of communication within the family, a group of friends, or even in the professional environment (e.g., association). This iTV could then have more added value since the covid-19 pandemic and confinements, with the more widespread use of video calls: *"If she'd had that [iTV with video calls], it would have made our lives a lot easier because we could have seen her. And it would have been nice for her, you know" (H-5)*.

Social pressure (n=16)

Both private and professional peers could have a direct influence on the use of a feature/technology by encouraging the use of particular applications (e.g. Google Maps to find your way home, Skype for remote meetings). Relatives could also offer participants a technology (e.g. a tablet, smartphone, connected watch), first perceiving it as a gadget and then, after a period of familiarization, discovering its usefulness in everyday life: *"No, no, it [connected watch] was offered to me because... I said it was a gadget, but when I saw the applications…" (H-2)*. Some participants also felt forced to use several applications depending on the habits of the person they were talking to (e.g. Messenger, WhatsApp, Signal etc.): *"I receive messages from people who each have the good idea of having a different application" (H-2)* or felt over-solicited by their peers: depending on the generation, it is not usual to receive messages every day or several times a day. However, this influence did not necessarily enable participants to become more skilled at using the features. In the case of video calls, some participants simply received the calls, without really understanding how they worked: *"He calls my sister, the kids, and we all see each other on the mobile. But I'm not the one doing it, I don't know how" (H-11)*. Finally, two participants pointed out their own influence on their mode of communication: *"it would be the other way round [...] It's easier for me to read than to listen. So, I prefer to have messages..." (H-3)*, or on the frequency of exchanges with their loved ones: *"And then I solicit them too, to get news" (NH-7)*.

Consequences of non-compliance (n=5)

Whether or not participants are resistant to ICTs (e.g., video calls, messages), they sometimes represent the only way for them to keep in touch with their loved ones living abroad: *"I have children who live in Japan, so I only see them that way" (H-8)*. For them, resisting these innovations would mean isolation and rejection by their peers. One participant felt excluded from his family following his refusal to use several technologies, and another felt ashamed of being out of step with her RF neighbors: *"I told them I'm hopeless, I'm old-fashioned! So, they laughed because it can seem completely absurd nowadays" (RF-9)*. Finally, some participants saw no alternative but to submit to the group norms: *"Well, it's not that they [the peers] push me, it's mandatory" (H-5)*.

Temporary group compliance and reactance (n=7)

The adoption of certain modes of communication (e.g. video calls) may have been only temporary, the time needed to overcome the exceptional situation that had prompted relatives to adopt them in the first place (e.g. covid-19, relatives abroad). Thus, the social pressure present at a given moment is not necessarily effective over time, especially if the participants were initially resistant to change or video calls: *"Well, I'm the one who doesn't want to. [...] We used to do it during the covid with the young persons who couldn't come and see us. Otherwise, I don't like it, I don't like being seen, I don't think it's ... for me anymore" (RF-11)*. Although one participant communicated a lot via messages, she seemed annoyed by the regular solicitations from her peers, thus provoking psychological reactance: *"[People who are important to me push me to use messages and video calls] Yes, that's true, but I don't reply [Laughs]" (NH-7)*.

Computer experience (n=18)

Most participants saw their previous experience with technology (e.g. smartphone, computer or tablet) as facilitating, if not essential for using iTV. This technology seemed to partially use knowledge already acquired through other technologies (e.g., icons, navigation), making it easier for people who already had certain reflexes and rudimentary knowledge to learn: *"Yes, there are lots of gestures now that are new, that have been learned and that correspond" (H-9)*. Certain symbols that used to be incomprehensible (e.g. menu, contact) have come to mean something thanks to the use of technology in everyday life, and therefore familiarity with the technical vocabulary and overall operation: *"But finally, I think it's an icon [contact] that has become universal now, for everyone who uses a smartphone" (H-9)*. However, some participants stressed that it was not necessary to have highly developed digital literacy to use iTV: *"It's quite accessible to people who don't have any skills, well, who don't have a ... how should I say ... a culture" (H-16)*. Sometimes, certain prior knowledge could even hinder the use of iTV, as in the case of one participant who had learned to press hard on the remote-control buttons, thus causing several actions on the iTV instead of one.

Some participants pointed out the late access to the Internet their generation had. Indeed, several participants had acquired more or less advanced computer skills, or even automatic skills with the arrival of computers in the workplace. However, the training received and the use of digital technology (whether at work or not) often dated back several decades. So, with the rapid development of technology, one participant said she felt out of date: *"let's just say it's changed so much since then, it's evolved so much that I'm sure I'm ... [out of date]" (RF-16)*. However, two participants thought that the digital literacy of OAs would evolve rapidly in the future: *"But I think that use will increase because, in NH, you are dealing with an age group that is of my generation and I belong to a generation that has had very little access to the Internet" (H-8)*.

Technological routine (n=11)

In many cases, using the computer, tablet or television was part of a well-established routine: *"I've had this habit for a very, very, very long time" (H-4)*. This routinised use could then lead to the

following events:

- The installation of habits that are difficult to disrupt. In addition, this routine was all the more difficult to change it was hard to establish with peers.
- The development of automatisms making it harder to transfer knowledge to other technologies: *"I'm so used to [typing] 3, that's it. But that's to find the right button [on the remote control]" (NH-6)*.
- Neglect of buttons not used on a daily basis : *"As I only ever use the same buttons, there may be things I have that I don't even look at" (H-14)*.

Interest in technological innovations (n=14)

Participants seemed curious to discover the iTV functionalities and found it fun to try and figure out how the iTV worked, perceiving mistakes as challenges to be overcome.
Some participants were rather curious about new technologies in general (e.g. robots, computers), being interested in them since the early days of computing. The time and effort invested at the time would have made it easier for them to learn how to use a new technology: *"So I bought some books, I didn't understand anything... And I read and reread the same thing over and over again, and then that was it, I was able to design programs. That may also explain why, perhaps more quickly than others, I quickly understand how to use the software" (H-2)*.
Two participants emphasized the importance of initial motivation in the learning process, imagining the potential benefits of a technology can stimulate its exploration: *"It can be exciting, in the sense that it's great, I'm going to have something better and everything" (H-4)*. Although curiosity seems crucial when learning to use the iTV, it may not be enough due to the apprehension of making irreparable mistakes, or the lack of perceived usefulness: *"But I don't see what it's for, what it can lead to. Yes, I see it as a game" (RF-10)*.

Sensory disorders (n=9)

With advancing age, sensory problems (e.g. visual, auditory, motor) could appear and develop over time, limiting the use of certain technologies such as smartphones (e.g. difficulty typing on a small keyboard) and TV (e.g. visual fatigue). Participants who wore glasses to improve near vision generally did not wear them to watch TV. In the case of iTV, these people then had difficulty recognizing certain symbols on the screen as well as on the remote control: *"Oh maybe with glasses I'd see better" (H-10)*. In terms of hearing, one participant with hearing aids felt the sound of the iTV was not loud enough : on a daily basis, he used headphones plugged directly into his TV. With regard to motor problems, some participants found it difficult to press certain buttons correctly (e.g., arrows, back buttons) because of their design (i.e., size, shape of the button) or their location (i.e., in the middle of two buttons). One participant was convinced she pressed the right button, when in fact she pressed the wrong one: *"That's what I've pressed now, isn't it? [Researcher] You pressed just below it" (NH-14)*.

Cognitive disorders (n=15)

With age, certain cognitive disorders can affect memory, information processing speed and mental flexibility. During the test, some participants could not remember and/or frequently asked for the function of buttons they had already used (e.g. camera button). Performing the action once seemed insufficient for the information to be retained, which underlines the importance of reminding people on the screen of the buttons to use. Several participants complained they were slow to think, learn or even adapt to a new way of functioning: *"You have to adapt, and it takes a bit longer to adapt now [...] You're not as fast and your brain doesn't work as quickly as it did a few years ago" (H-11)*.
Another manifestation of cognitive impairments was the false recognition of certain actions and buttons. Some participants tried to remember a button they had supposedly already used, instead of scanning the remote control again to identify the right button. Because of the difficulties mentioned

above, one participant living at home could not imagine the iTV being used by people with cognitive impairments. Two others living in NHs felt they had been in decline for some time, partly due to various events (e.g., retirement, covid-19, heatwave) also affecting the residents around them. Thus, one participant no longer considered herself *“adapted” (NH-6)* to new technologies such as iTV, while another complained her life had *“shrunk” (NH-7)*, giving her the feeling she *“no longer had time to do anything” (NH-7)*. Finally, participants conscious of their cognitive decline and the impact on their performance questioned and blamed themselves more often for the difficulties encountered during the test: *"Yes, but maybe if our brains were a bit more developed, we wouldn't do anything stupid either" (RF-16)*.

Fatigability (n=8)

As people age, they may become more fatigued, impacting the time spent on certain activities. Because of the effort required to discover the iTV (e.g., gymnastics between the screen and the remote control, searching for information, number of steps in the scenario), some participants apparently reached cognitive saturation, with increasing difficulty in maintaining their attention, refocusing after a distraction, or even blocking on a task: *"The trick is to pay attention, you can't do random things. You have to try and think, which isn't always easy at our age" (RF-10)*. The fatigue accumulated throughout the test may have hampered the use of the iTV and led to frustration if the participant got stuck on a task already completed: *"My brain doesn't want to work anymore" (RF-4)*. For example, one participant gradually lost sight of the test objective, constantly wanting to return to the TV channels instead of following the instructions. By making repeated mistakes, two participants admitted confusing good and bad learning.

Attitude towards ageing (n=4)

Among the participants living at home, some seemed to perceive the onset of cognitive problems as imminent and inevitable. Beyond the participants' current state of health, the image they had of ageing and their perception of the time they had left in good health, or even to live, could influence their commitment to iTV, as well as its acceptability. One participant seemed impatient, declaring that he had no more time to lose with technologies that were complex to learn, or that didn't meet his needs: *"This thing is a tool, so it has to provide me with the services I need quickly and immediately. I've got no time to lose in my life, I've got 89 anyway [laughs]" (H-9)*. Others didn't see the point of learning to use the iTV, believing they didn't have much time left to enjoy it: *"I'm in my 91s this year. So maybe I won't get much out of it" (NH-14)*.

Discussion

The main aim of this research was to contribute to the enrichment of existing models of acceptance of innovations by OAs. This study focused on the acceptability of an iTV system by 32 people living in different settings (e.g. home, NH, and RF). A deductive qualitative analysis based on e-TAM identified 33 concepts, each related to the following themes: intention to use, perceived usefulness, perceived ease of use, user resistance, anxiety about the iTV, facilitating conditions, and user characteristics.

Advantages of the methodology used

This qualitative research complements a previous study, currently being submitted, aimed at assessing the perceived usability and ability of OAs to use the iTV. The data extracted from these tests were self-reported and subject to certain biases. For example, some authors have shown the influence of stereotypes on the perceived ability to innovate [40], while others have discovered that OAs who reported using smartphones were in fact only using the basic functions of the phone (i.e., making calls, sending text messages) [41]. Using only a quantitative study therefore does not allow

us to understand the acceptance of technological innovations and its mechanisms in their entirety.
The deductive qualitative analysis used in this study is based on the QUAGOL method [39]. One of the advantages of this analysis method is the combination of approaches used. The transcripts were first analyzed separately, using a case-oriented narrative approach. This approach ensured that the interaction between the ideas from each transcript and the specific characteristics of the participants was not overlooked, particularly with the help of conceptual diagrams. Then, by cross-referencing all these ideas, more global concepts were developed. It was only at this point in the analysis that all the data was interpreted, allowing themes to be developed by drawing on the richness of the data and doing justice to the complexity of the experiences of the participants [42].

The technology paradoxes

This qualitative analysis has highlighted the different behaviors of OAs when they are confronted with the use of a technological innovation. Participants were both very curious about the functioning of iTV and anxious about having to use a TV remote control. Some said they were already beyond the stage of being apprehensive about using a technology, with one participant mocking these anxious people: *"You'd think we were going to bring out the atomic bomb! "No, no, no, I don't want to touch it! It's going to be dangerous! (H-4)*. These results are in line with the literature on the use of technology by OAs [43–45], and highlight the nuances of older users' experience when confronted with technological innovations.
In addition to current models of technology acceptance (e.g., TAM, UTAUT), authors have proposed a framework of technology paradoxes [14,15]. This model states that users, when using a technology, are subject to a certain number of paradoxes that create strong emotions such as anxiety and stress. Wilson-Nash and Tinson [15] identified three types of paradox: functional, social and psychological.
Among the functional paradoxes, the paradox of chaos/control can be at the origin of several situations reported by participants and classified in the category of resistance. In the case of the participant complaining about the addition of functions on her TV, she experienced the transition from a situation of control (i.e., watching TV channels) to a chaotic situation (i.e., YouTube starting at the same time as the TV), resulting in frustration and the stress of losing one's bearings.
In order to deal with the emotions generated by paradoxes, users may adopt various coping strategies before or after acquiring a technology, in order to avoid it or confront it. Wilson-Nash and Tinson [15] have identified five coping strategies used by OAs: neglect, partnership, control, adjustment and acceptance. The partnership strategy seems to have been used by some participants in this study (n = 3), via a mechanism of humanization of the technology. The participants tended to consider the indications displayed on the left of the TV screen as instructions to follow, or even tips given by the iTV. The participants spoke of the 'inter-relationship' and mutual assistance that existed between them, as users interacting with a remote control, and the TV screen: *"View the photos, I press OK? Because they tell me to" (H-11)*. The personification of the iTV observed by the researcher could therefore prove to be a strategy for confronting the technology, enabling participants to overcome their anxiety when using the iTV. It would be interesting to investigate the humanization of technology further, and to test whether reinforcing this feeling (e.g., the presence of a virtual agent on the iTV) could influence the perceived usability and acceptability of the iTV.
Technologies are often perceived as isolating people from others, as evidenced by the risks perceived by the participants in this study. However, almost all participants also admitted to calling on certain members of their family, or friends, to resolve problems encountered with their technology. Thus, mastering the technology, which is another adaptation strategy, also includes a social dimension.
The acceptance strategy put forward by Wilson-Nash and Tinson [15] states that OAs, because of their life experience and time perspective, have a greater tolerance of technology faults. In this study, the difficulties encountered, and the time required to understand how the iTV worked, did not seem to have a major influence on its perceived usability. Error tolerance may therefore be a differentiating factor between generations, as may apprehension when learning how to use an iTV.

Sense of self-efficacy and performance

The feeling of self-efficacy refers to the evaluation of one's personal abilities, not one's personal worth [32]. Belief in one's abilities can influence the level of effort put into using and learning the technology, as well as thoughts and emotional reactions when using the technology [46]. Thus, the fact of not believing in one's abilities, or even failing several times, does not normally influence one's self-esteem, but on the contrary can greatly harm motivation and performance. In this study, by blaming themselves for the difficulties they encountered, the participants tended to feel ashamed of not succeeding, and even to devalue themselves: *"So turning it off, I don't know where it is. That's what I told you, eh, I'm ashamed but ... [laughs]" (RF-9)*. In this case, the perceived inability to use an iTV seemed to influence self-esteem. Arning and Ziefle [47] also stated that when a device presents technical difficulties, OAs suffer a loss of technical confidence and begin to question their own value. These elements refer to Wilson-Nash and Tinson's paradox of competence/incompetence [15], where users can feel both a sense of accomplishment when using a technology successfully, and a sense of self-doubt when encountering difficulties.

Authors have also found that OAs who consider themselves targeted by a stereotype tend to reduce their capacity for innovation (i.e. their ability to mobilize their resources) to avoid appearing incompetent [40]. Ageist stereotypes may therefore indirectly influence older users' feeling of efficacy.

Another factor that can influence OAs' sense of self-efficacy is institutionalization, which is often associated with an increase in the degree of dependency of OAs. An institutionalization syndrome is characterized by apathy, indifference, reduced cognitive ability, difficulty in expressing feelings, and loss of autonomy [48]. The lives of residents in geriatric institutions are routinised to facilitate the organization of care, implying that residents may lose control over their activities. However, residents who are given control over their daily lives are more socially active, more involved in activities, happier, healthier and live longer than those who are kept staff-dependent [49,50].

However, beyond the possibility of exercising control, the desire for personal control tends to diminish with age, as does self-esteem and the belief in efficacy [32]. One participant in this study, living in a NH, relied heavily on the care staff to use her TV. Although she took part in the test and showed that she was capable of using a TV, she preferred to delegate its use on a daily basis, in particular because it made her anxious. Other levers exist, such as the presence of a role model (i.e., a person with whom we can identify (age, sex), and who is able to manage), or resorting to social persuasion (i.e., support and encouragement from carers, care staff) [32].

The influence of motivation on the acceptability of ICTs

Several participants stressed the influence of motivation in the acceptance of a technology or feature. According to the literature, there is an essential distinction between voluntary behavior and behavior resulting from external pressure or control [51]. Intrinsically motivated behaviors are performed because of interest and to satisfy innate psychological needs for competence and autonomy, whereas extrinsically motivated behaviors are often carried out for external and instrumental reasons.

In the literature, enjoyment has often been used to represent this notion of intrinsic motivation [52]. Thus, the enjoyment experienced when using a technology could reduce the perception of the effort made during its use [53], and thus be a predictor of the intention to use it [52]. In this study, some participants expressed curiosity about the iTV and emphasized the playful nature of its handling, taking a certain enjoyment in discovering its functioning. What was categorized as an interest in technological innovations could therefore represent a source of intrinsic motivation for the participants. This study therefore seems to be in line with the literature, although some participants raised limits to this notion of enjoyment. Indeed, while the use of the iTV could be enjoyable, some participants saw no point in using it on a daily basis. Perceived usefulness therefore remains an essential factor in the long-term acceptance of a technology.

Another aspect raised by this study is the extrinsic motivation to use a new technology. Some participants mentioned a certain pressure to learn how to use a computer, for example with the digitization of administrative services (e.g., train e-tickets, tax). Indeed, one participant said that under normal circumstances, she would never have explored a new technology on her own. However, although this digitalization is pushing OAs to acquire digital knowledge, this learning process remains costly. The obligation combined with the difficulty of increasing skills and knowledge seemed to irritate some participants. Indeed, in order to avoid constantly disturbing her family and friends, one participant put a certain amount of pressure on herself to solve her problems on her own: *" They seem to say that we all have to learn and manage. But it's not... it's not easy, is it?" (H-11)*.

Limitations

This research was inspired by the user-testing method, itself derived from User Centered Design. This method enabled us to observe the behavior of OAs as they familiarized with the iTV, and to identify the factors influencing its use. However, this evaluation was punctual, and did not allow us to monitor and understand changes in acceptance over time. A future study could focus on the longer-term use of iTV, in particular by verifying the influence of the factors identified when the iTV was first used.

Another limitation of the study was the experimenter bias, which could either harm or positively influence acceptance of the iTV. Throughout the scenarios, the researcher was able to provide clues on how to use the iTV if the participant asked for them, if they were blocked, or if they made a mistake. The presence of the researcher in this supportive role could then help the participants to overcome the problems encountered more easily, thereby reducing the perceived difficulty of use and anxiety: *"[I felt confident when I used e-lioTV] Yes, but because you were there, sweetheart! […] Otherwise, it would have gone out of the window" (RF-4)*. However, the presence of the researcher could also increase anxiety, placing the participants in a situation of evaluation: *"It's the setting in a way. It's an exercise, I have to pass, so there's stress" (H-9)*; *"And I don't know... You're destabilizing me [laughs]" (NH-7)*.

Conclusion

This study aimed to described in detail the factors influencing the iTV acceptance among OAs living in different settings (home, NH, RF), using the example of e-lioTV. A total of 32 OAs used the communication functionalities of the iTV system (i.e., messaging and video calling), and shared their opinions about the learning process, the daily use, and the iTV adoption. Based on the e-TAM built on the technological acceptance literature, 33 concepts were identified among the 7 determinants to iTV use (intention to use, perceived ease of use, perceived usefulness, user resistance, anxiety towards iTV use, facilitating conditions, and user characteristics). No new determinant was found during the qualitative analysis, even though some factors (e.g., facilitating conditions and user characteristics) were completed and extended to consider all the nuances of OAs' experience when interacting with an iTV system.

To conclude, the iTV acceptation seemed to be context-, techno-, and characteristics-dependent. The participants seemed to agree with recommending the iTV to others, they also found using the iTV relatively easy and pleasant, and thus they felt confident when using it. Almost all participants considered having support from their family and friends to learn or use a new technology. However, the participants had a divided opinion of the intention to use the iTV, the feeling of self-efficacy and social pressure.

It is also interesting to point out the dimensions that generated the most disagreement between the institutionalized participants and those living at home. While participants living at home seemed to be quite consistent on some dimensions, the institutionalized participants shared more nuanced

opinions about the usefulness of the iTV, the effort required to learn how to use it, the resistance to iTV, and the apprehension about pressing the wrong button. Finally, persons living at home were more curious and interested in technological innovations than other participants.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study, in data collection, analyses, or interpretation, in the writing of the manuscript, or in the decision to publish the results.

Abbreviations

e-TAM: extended-technology acceptance model
iTV: interactive television
NH: nursing home
OA: older adult
RF: residential facility
TAM: technology acceptance model
TV: television

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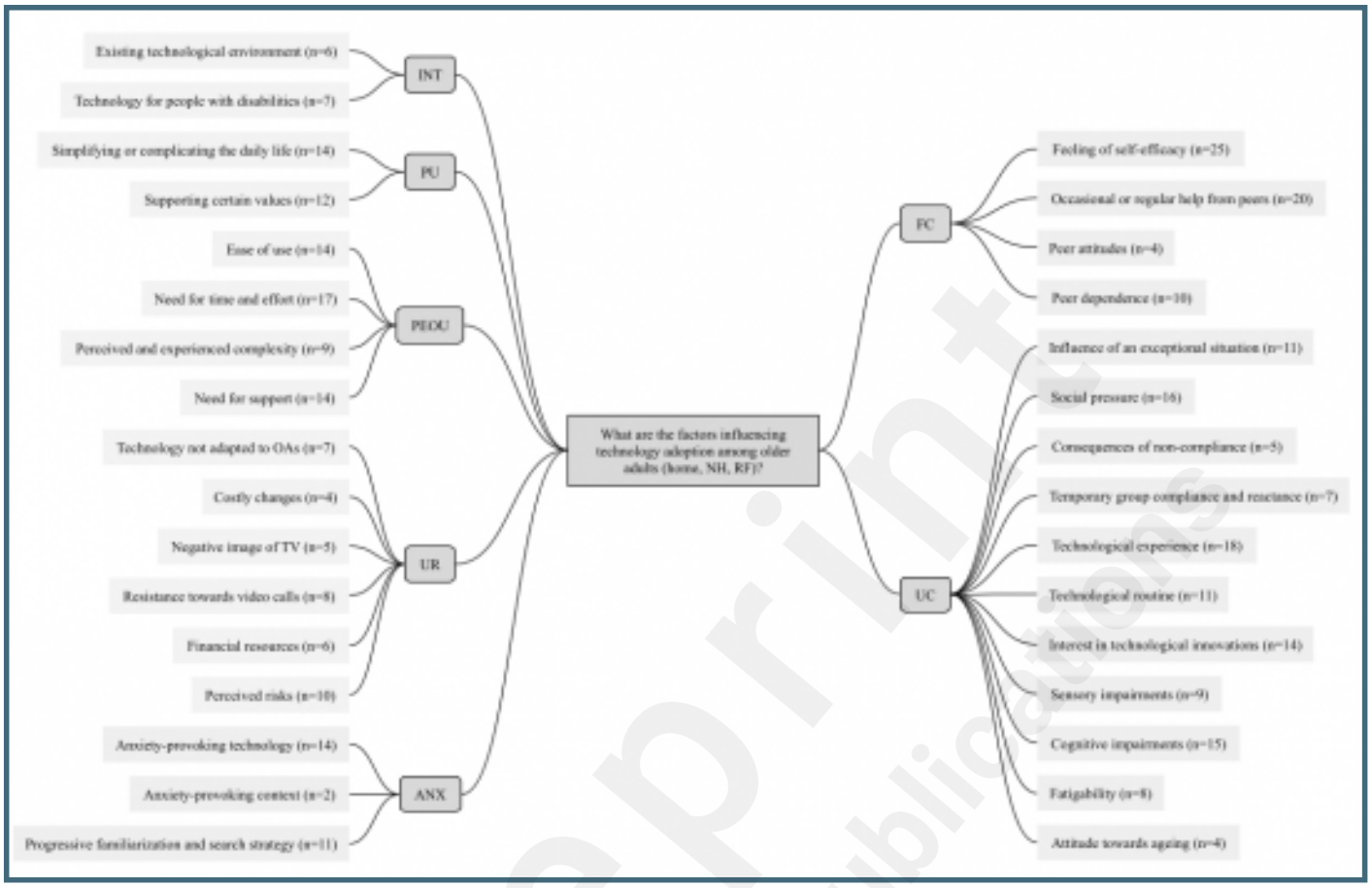
Supplementary Files

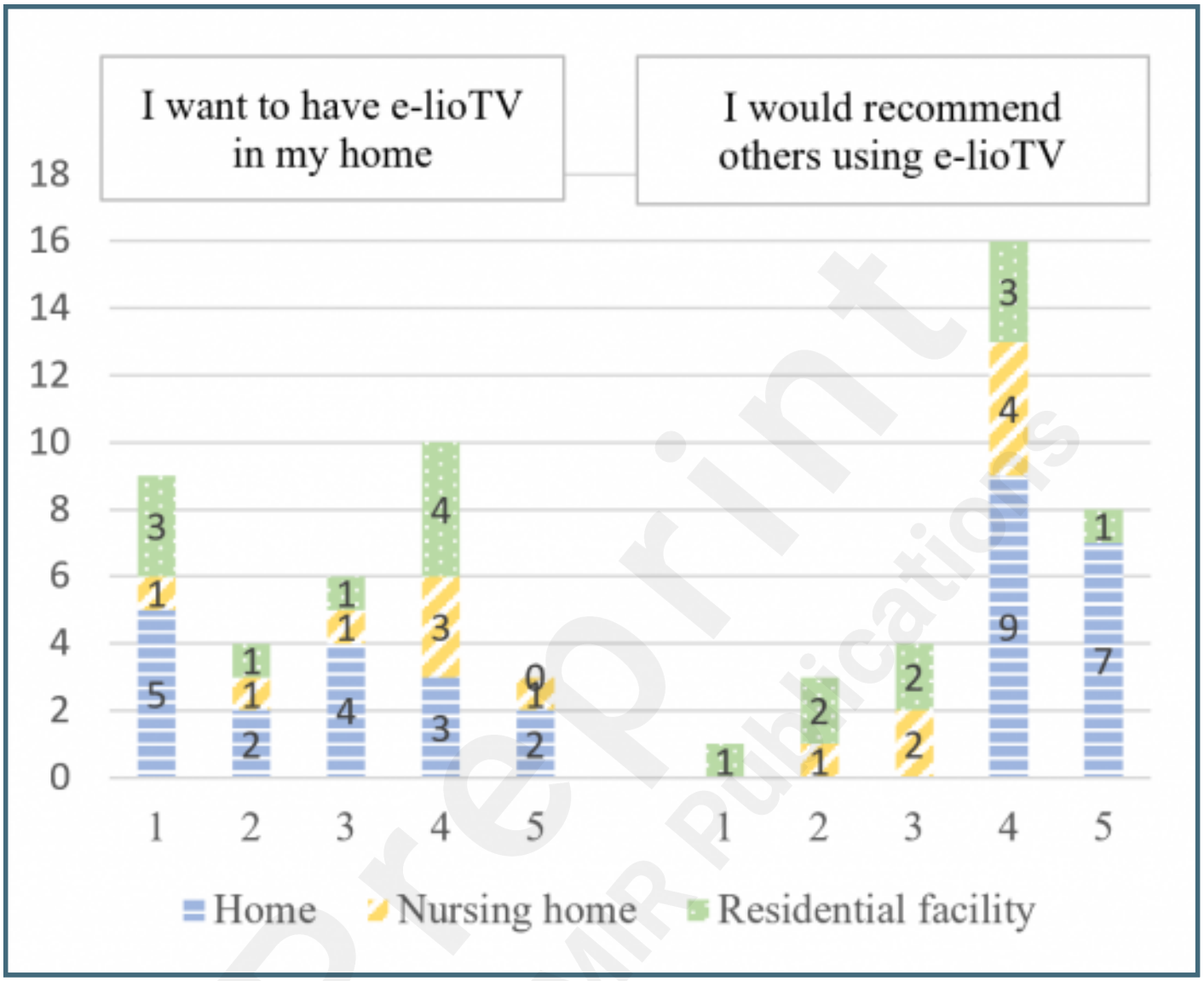
Figures

The e-lioTV system and the main menu interface Box, camera, and remote control.

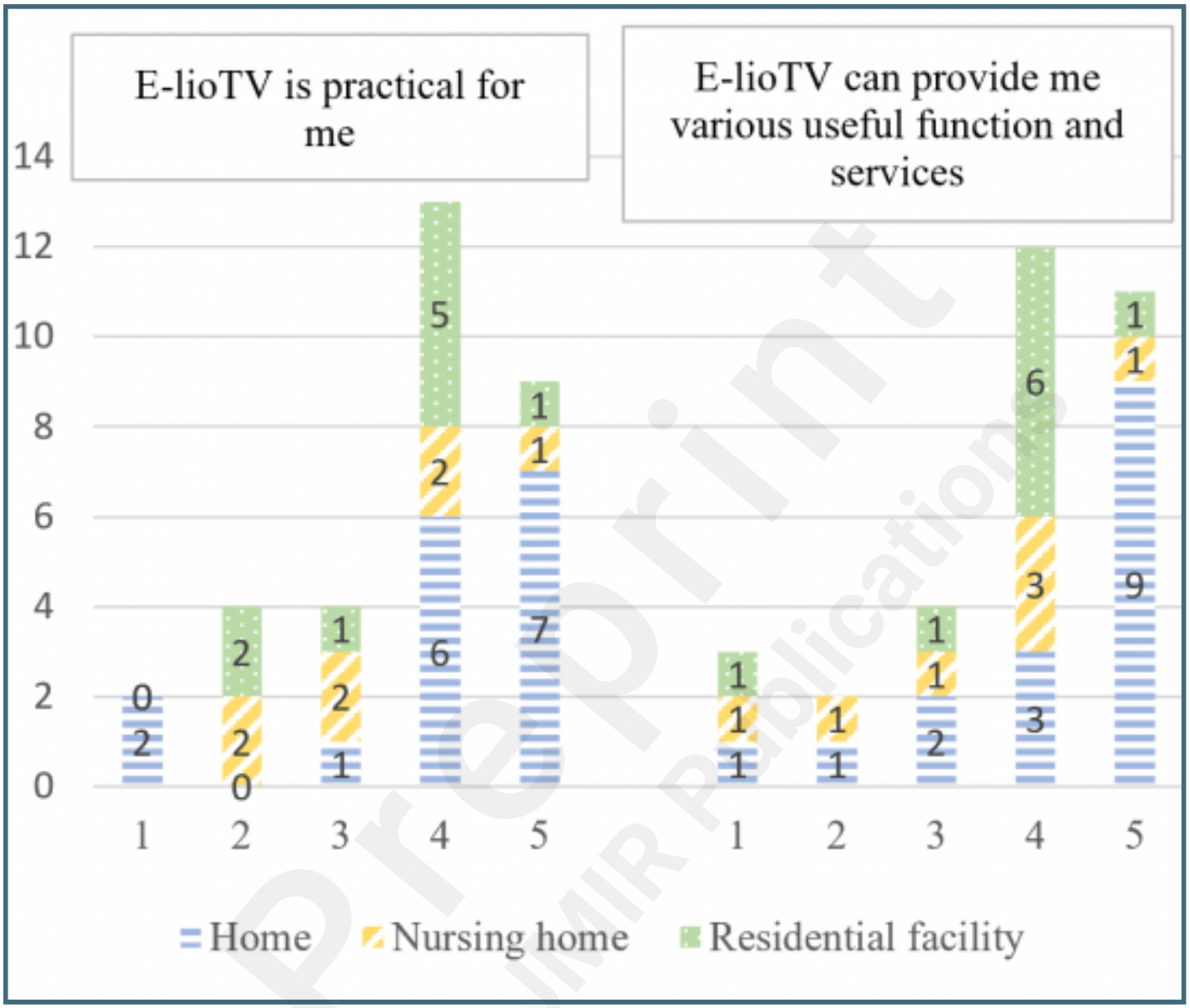
Mind map of themes and sub-themes from the deductive qualitative analysis based on e-TAM.



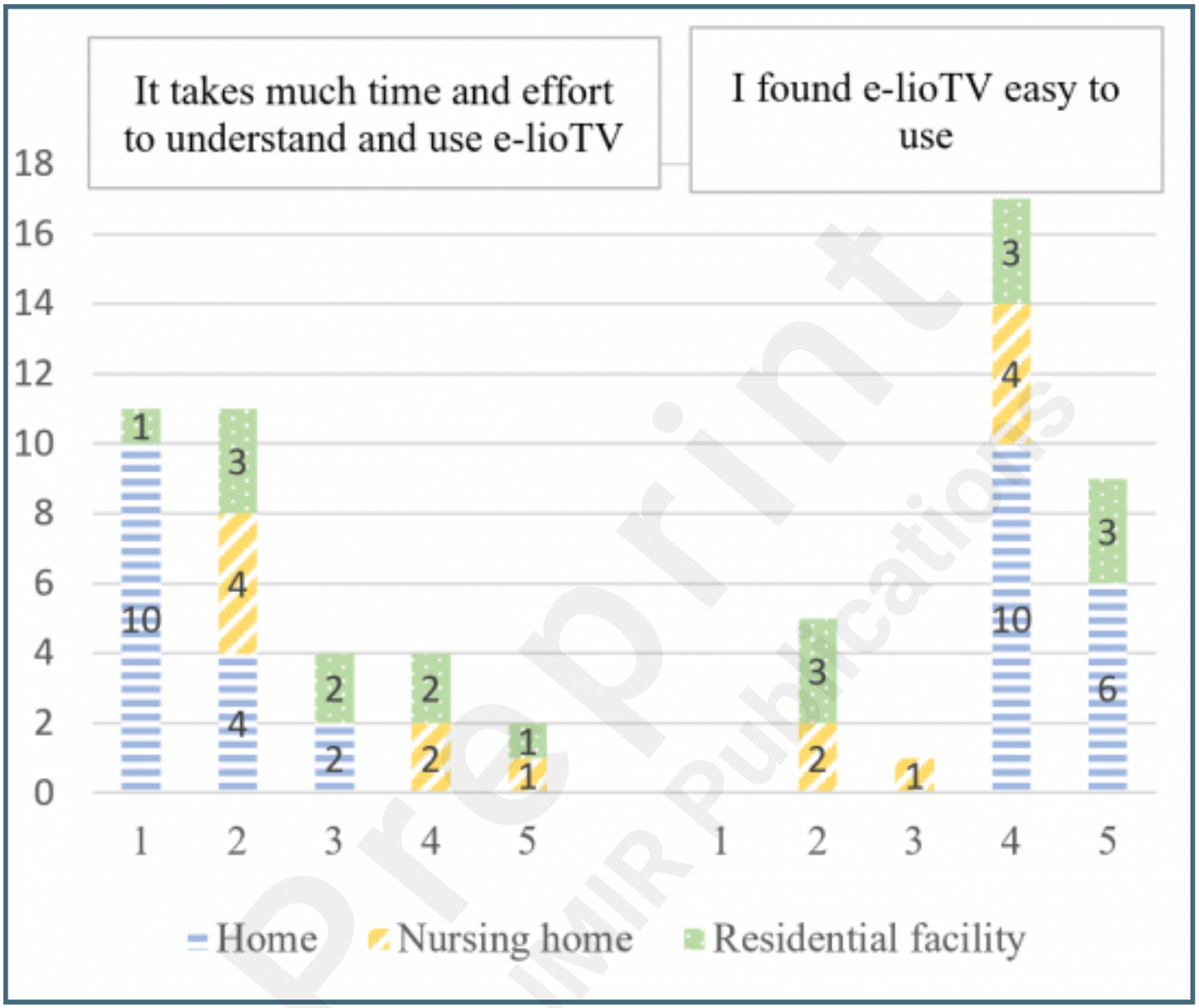
Intended use of iTV by OAs living at home, in RF, and in NH (1: strongly disagree; 5: strongly agree).



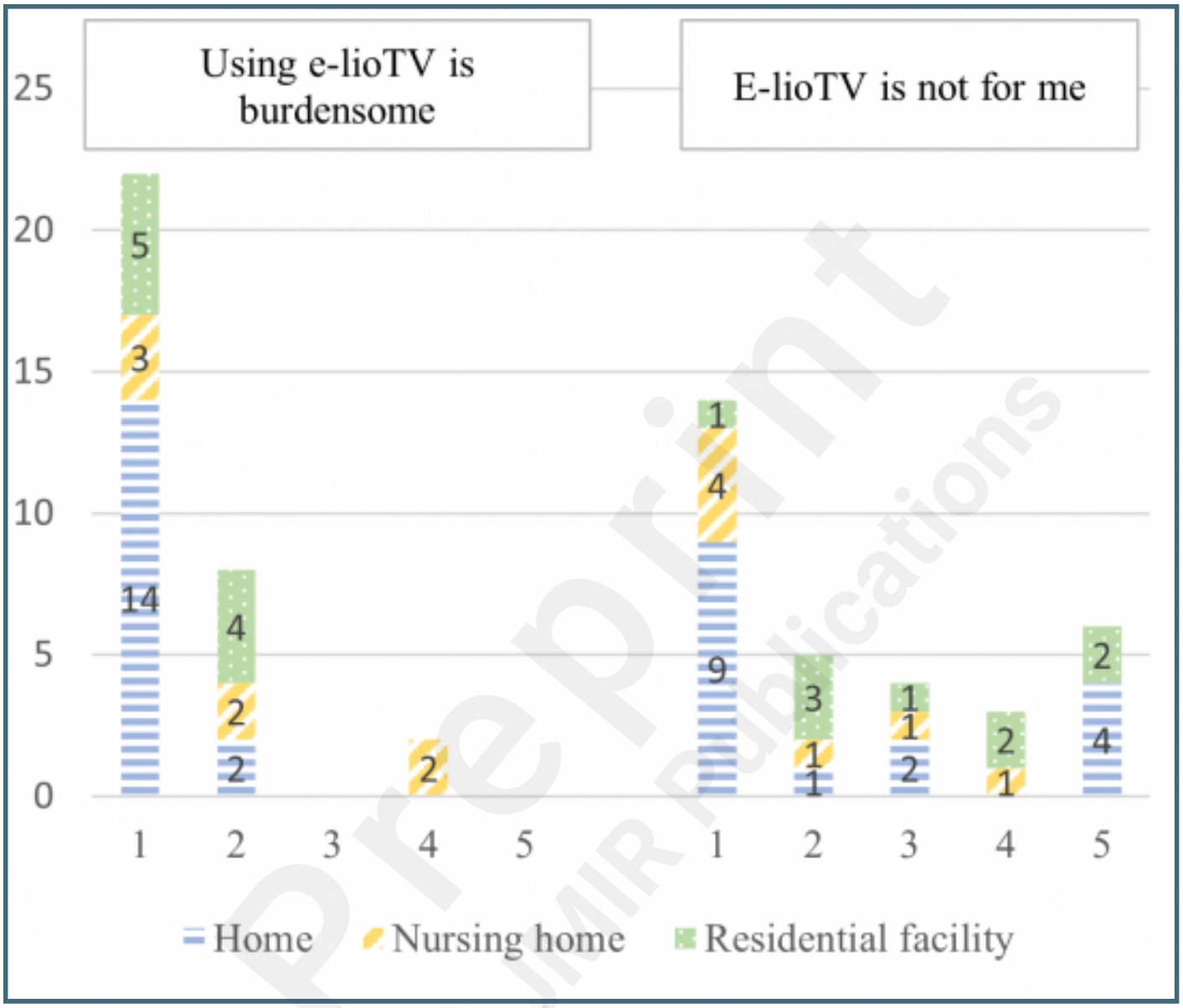
Perceived usefulness of iTV by OAs living at home, in RF, and in NH (1: strongly disagree; 5: strongly agree).



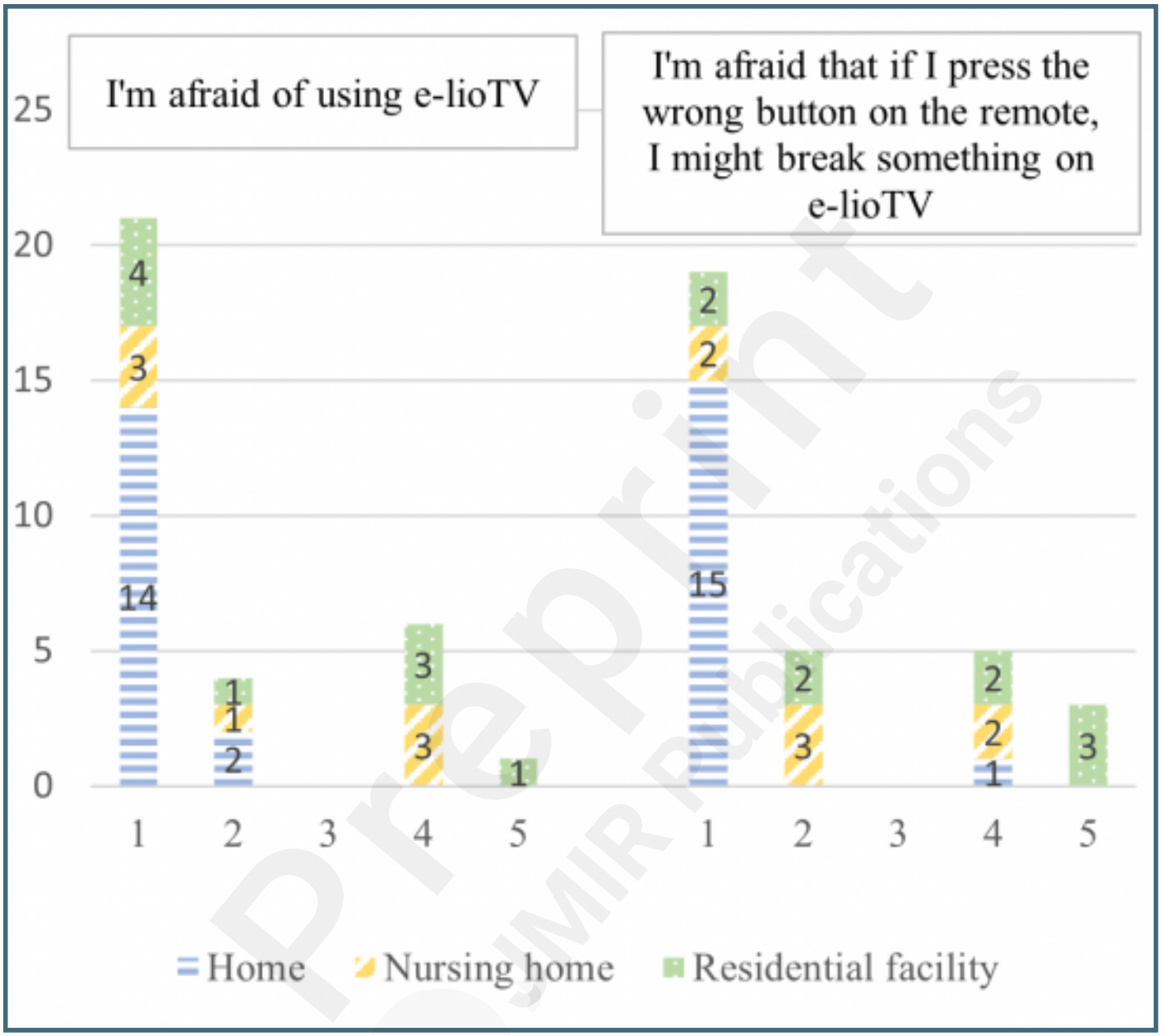
Perceived ease of use of iTV by OAs living at home, in RF, and in NH (1: strongly disagree; 5: strongly agree).



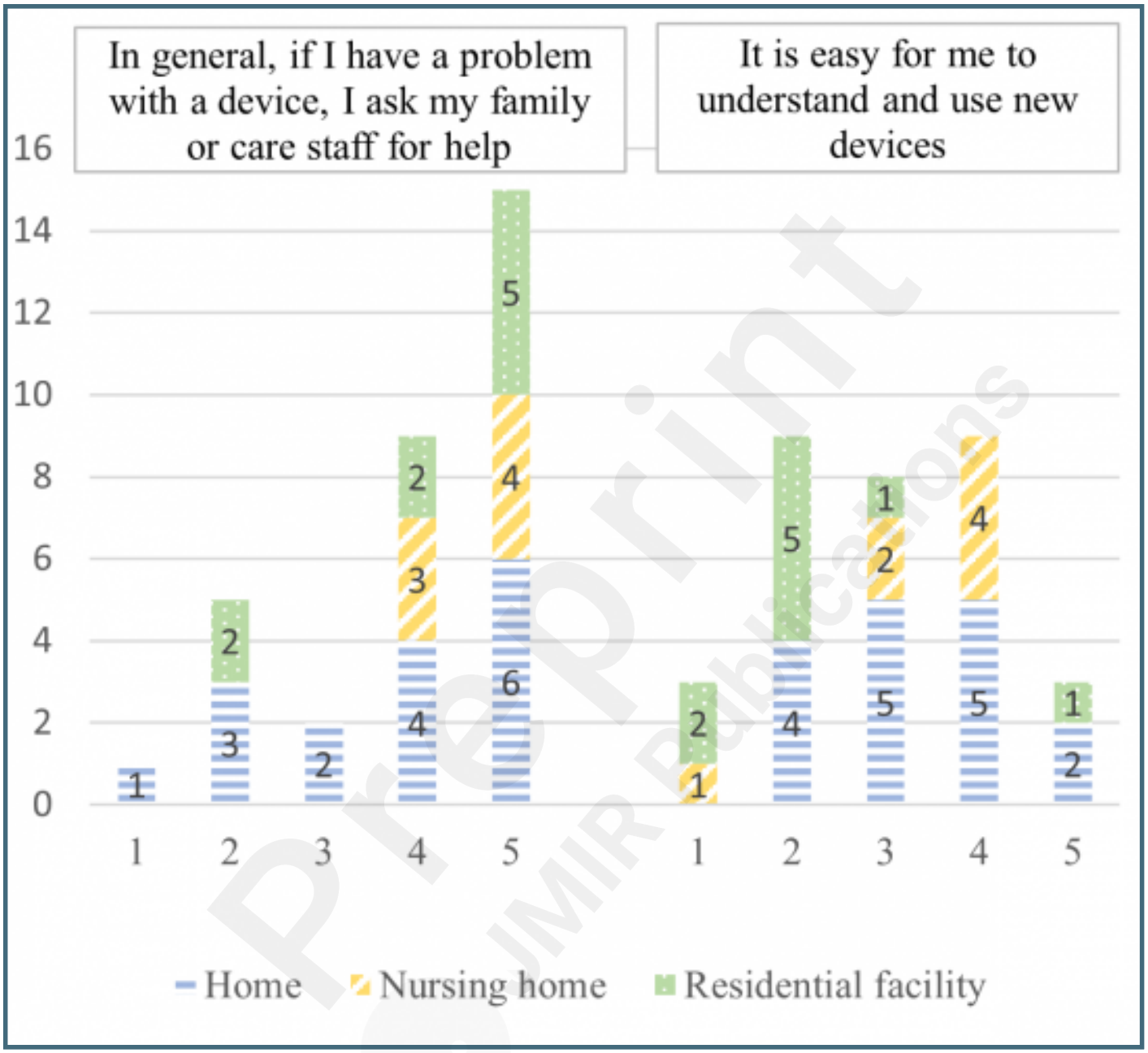
User resistance towards the iTV by OAs living at home, in RF, and in NH (1: strongly disagree; 5: strongly agree).



Anxiety while using iTV by OAs living at home, in RF, and in NH (1: strongly disagree; 5: strongly agree).



Facilitating conditions for the use of iTV by OAs living at home, in RF, and in NH (1: strongly disagree; 5: strongly agree).



Participants' characteristics (1: strongly disagree; 5: strongly agree).