Factors for adoption of gerontechnology by community-dwelling older adults in the Western Cape

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Abstract

Background: Despite the growing older adult population in South Africa, the adoption of gerontechnology to support independent living remains under-researched.
Research aim: To explore the factors that can influence the acceptance and adoption of Gerontechnology amongst the community-dwelling older adults in the Western Cape and thus gain an understanding of the older adults' perceptions of using technology in aged environments to improve their quality of life.
Method: Semi-structured interviews based on the constructs of the Unified Theory of Acceptance and Use of Technology (UTAUT2) were conducted in lower and middle-socioeconomic areas of the Western Cape. All participants were over the age of 60, comprising both males and females.
Results: The investigation revealed a multitude of positive and negative perceptions identified within an older adult ageing environment. Many participants identified affordability, complexity of technology, and accessibility as negative perceptions, as well as the perceived need, support, enjoyment, health monitoring capabilities, and social inclusivity as positive perceptions that influence accepting and adopting gerontechnology. Safety was an identified ambivalent perception, which, although not a strong perception, remains relevant to accepting and adopting technology.
Conclusion: By investing in technology-based solutions and supporting older adults on the journey towards digital inclusion, society can empower them to live independently, engage with their communities, and age with dignity and success. Further research is needed to explore the long-term impacts of technology on the health and well-being of older adults, as well as to develop innovative interventions that can bridge the digital divide and promote equitable access to gerontechnology.

Keywords: acceptance; ageing; digital divide; unified theory of acceptance and use of technology (utaut2) model, technology adoption

INTRODUCTION

Gerontechnology, the application of technology to support ageing, has become increasingly vital in addressing the challenges faced by older adults. In South Africa, where the population is growing and healthcare resources are limited, gerontechnology presents promising solutions to significantly enhance the quality of life for older adults, offering hope for a better future.

South Africa, along with other African countries, will face a significant increase in its aged population by 2030, with statistics indicating an expected rise in older adults aged 60 and above (Knickman and Snell, 2002; Stats South Africa, 2017). This increase will place a considerable burden on South Africa's economy and resources, not only because of the volume of the aged but also due to the negative impact that the apartheid legacy

has had on the lack of economic wealth for previously disadvantaged older adults and eldercare facilities (Burman, 1996; Tanyi and Pelser, 2018). However, even older individuals who may possess the financial means to access technologies that can assist with ageing still face challenges in accepting these technologies and ensuring that they protect the identity of each older adult, their independence, and the professionalism of caregivers. Caregivers need to be proficient in their tasks and secure in their careers, while the technology must be user-friendly and effective in supporting activities of daily living (ADL). Acquiring quality healthcare in the 21st Century is not an inexpensive endeavour (Young, 2016, p.9), even for the working class. Maintaining long-term care in the healthcare sector for the aged is no exception. Across many countries, the quality of health among older adults in public or private

aged-care settings varies, making it imperative to focus on health maintenance so that older adults can be self-reliant, continue to participate in social activities, and remain independent (Peek et al., 2014).

Similar literature being reviewed assesses the Technology Acceptance Model and the extensions thereof. Aggelidis and Chatzoglou (2009) elucidate that with the modernisation of technology, questions will be raised as to whether people are willing to adopt these interventions. This research seeks to understand the perceived perceptions or factors that influence the acceptance and adoption of modern technologies, such as assistive, sensory, and wearable healthcare technology, among community-dwelling older adults (Rantz et al., 2013; Wang & Sun, 2016; Talukder et al., 2020; Wilkowska et al., 2020). A variation in research methods was employed across the different research studies in many different countries using both the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Davis, Bagozzi, and Warshaw (1989) and by Venkatesh et al. (2003), respectively.

Venkatesh et al., (2003) adapted the TAM model in a study that combined TAM with seven other models and theories to produce a unified model that integrates elements across the different acceptance models and then validates empirically. This model can explain up to 69% of the variance in behavioural intentions to use technology (Venkatesh et al., 2003)

For this study, the researcher makes use of the extended UTAUT theory, termed UTAUT2, which offers additional moderators such as Hedonic motivation, Price Value, and Habit, and explores Age, Gender, and Experience as key differentiators (Venkatesh et al., 2012). When evaluating the moderator differentiators, Venkatesh et al. (2012) argued that age, gender, and experience are vital in extending the generalizability of the UTAUT theory, particularly in the older adult environment.

The extended UTAUT2 theory provides better insights into the moderators that help understand key perceptions of older adults in South Africa. The need for research on gerontechnology acceptance in South Africa is significant, as it is under-researched and can provide valuable insights into the adoption factors of older adults. While studies conducted in Europe, the Middle East, Australia, Asia, and the USA have already assessed the challenges regarding the increased ageing population and lack of long-term caregiver resources, their perceptions of modern technologies, such as Wearable Health Technology

(WHT), can assist older adults in their daily activities (ADL) in their respective countries. However, gerontechnology acceptance studies in South Africa are under-researched, with only three studies. Du Preez and De la Harpe (2019) outline the design interaction and engaging factors that impact older adults using web-based services and technologies. Msweli (2020) explores the adoption rates of older adults using mobile banking applications, and Fotoyi and Cilliers (2023) understand the adoption factors of mobile health monitoring and care systems in remote settings. Access to modern assistive and sensor technology is not a priority for older adults. Yet, there are potentially significant medical insurance and financial cost savings to be gained.

Despite the growing importance of gerontechnology in South Africa, several research gaps remain in existing literature and are explained as follows:

• Long-term impact
Having conducted a thorough research investigation, it was found that limited research exists on the long-term impact of gerontechnology on the health, well-being, and quality of life of older adults in South Africa (Du Preez & De la Harpe, 2019; Fotoyi & Cilliers, 2023).

• Cultural and social factors
Studies exploring how cultural factors, social norms, and economic disparities influence the acceptance and adoption of gerontechnology among older adults in South Africa are limited (Du Preez & De la Harpe, 2019; Msweli, 2020).

• Accessibility and affordability
Research on accessibility and affordability of gerontechnology for older adults with different socio-economic backgrounds is vital to ensure equitable access (Msweli, 2020).

• Integration with healthcare systems
Studies investigating the integration of gerontechnology into existing healthcare systems and its effectiveness in improving healthcare delivery for older adults (Du Preez & De la Harpe, 2019). By addressing the above research gaps, this research study can contribute significantly to the understanding and implementation of gerontechnology in South Africa, ultimately improving the lives of older adults.

This research aims to explore the factors influencing gerontechnology adoption among community-dwelling older adults in the Western Cape. By exploring these factors, the study reveals what older adults perceive as influential factors in adopting technology. These factors

either promote or hinder the acceptance and adoption of gerontechnology.

The research objectives are:
• Research objective 1: To identify the key determinants influencing the acceptance of gerontechnology among community-dwelling older adults.

• Research objective 2: To determine the role of key moderators in facilitating or hindering the adoption of gerontechnology.

The secondary research questions below focus on understanding the barriers, enablers, and overall perceptions related to gerontechnology.

• Secondary research question 1: What are the key determinants influencing the adoption of gerontechnology by community-dwelling older adults in the Western Cape?

• Secondary research question 2: How do key moderators, such as performance expectancy, facilitation conditions, social influence, and price value, influence the adoption of gerontechnology?

By providing answers to the above questions, conclusions around the main question (MRQ) of this research will be provided:

• Main research question: How can the key acceptance and adoption perceptions of older adults influence how technology is accepted within older adults environments in the Western Cape?

METHODS
By understanding the philosophical underpinnings, selecting appropriate research methods, and carefully designing the data collection and analysis processes, this study aims to contribute to the growing body of knowledge on gerontechnology adoption, particularly in the context of the Western Cape.

Research design and strategy
This research evaluated global research involved in understanding the adoption of technology within aged-care environments. A qualitative approach offered reasonable inductive reasoning using the theories within the literature review and the collected data through semi-structured interviews conducted with the community-dwelling older adults.

This research employs a qualitative case study design and aims to contribute to a deeper understanding of the complex factors that shape gerontechnology adoption among older adults in the Western Cape.

The case study design is used to understand the real-life relationship between technology and older adults' acceptance and adoption of it. Furthermore, the researcher derived a systematic cross-co-occurrence case analysis around the analysed positive or negative factors that have the potential to reveal "similarities and differences" between participants. This will impact the ultimate findings (Ridder, 2017, p.282).

Sampling
The study focused on using the judgmental sample strategy. The participants were selected from a pre-identified group of people in the Western Cape: older adults, 60 years and older. Information was collected from participants who may offer different perspectives on the research interview questions. This is achieved by collecting information from middle to lower socio-economic groups across both male and female genders.

Research participants
The recruitment of participants and the online recruitment form were open to responses from January 2024 to October 2024. The researcher created a generic message that was posted on the community WhatsApp™ group, seeking potential participants to participate in the study. The group's admin gave permission to request participants.

The following recruitment responses were received and summarised in *Table 1* below.

In a study conducted by Gentles et al. (2015), it was noted that researchers are not clear in their explanations relevant to sample size and data saturation across different research studies that included qualitative case studies, grounded theory, and phenomenology. Young and Casey (2018:2-3) examined three studies entitled "The Men Against Violence (MAV)", "The Social Workers in Criminal Justice (SWCJ)", and The Adolescent Bystander Behaviour (ABB). Findings of the research showed that for interview-related studies, MAV and SWCJ, near-completed (97% and 96%, respectively) codes were achieved at the 8th and 9th interviews. In the focus group-related study, ABB achieved 97% in 6 groups, and adding a 7th group only added 1% to the total codes.

The researcher for this study approached the sample population with the mindset of 25 interviews and proceeded to recruit. From January to March 2024, only 14 older adults responded to the recruitment drive. Despite the recruitment form being open until October 2024, no new older adults wanted to take part in the interviews. Three older adults cancelled the interviews, citing that they no longer wanted to continue. In

Table 1. Research participants

Participant ID	Age range	Gender	Socio-economic community
F_S01	60+	Male	Middle
K_S02	60+	Female	Middle
M_M03	60+	Female	Middle
F_M04	60+	Male	Middle
AN_S05	60+	Female	Lower
D_D06	60+	Male	Lower
J_G07	60+	Male	Lower
C_J08	60+	Male	Lower
P_M09	60+	Male	Lower
C_S10	60+	Female	Lower
A_V11	60+	Female	Lower

line with the proposed ethical considerations, no further data for these participants have been included in this study.

Credibility, validity, reliability, and transferability of research

Credibility refers to the notion of how trustworthy and believable the findings are. Nowell et al. (2017) claim that this can be achieved by spending sufficient time with older adults to build rapport and gain insight into their experiences. In addition, the researcher must be able to share interpretations with participants to check if the findings corroborate their experiences. Furthermore, sessions were held by the researcher with colleagues through mock sessions and peer presentations to discuss emerging themes, intending to identify potential biases and alternative perspectives. Noble and Smith (2015) argue that the above criterion can be used to measure the credibility of the research.

Validity is sought through the participation of semi-structured interviews. This study seeks reliability by being "free of bias" and reveals the true significance of older adults' experience with technology. The interviews intend to naturally flow with robust discussions with the aim of gathering responses (Collingridge et al., 2019, p.390). The qualitative data generated were subjected to thematic analysis using ATLAS.ti™. Lincoln and Guba (1985) assert that to enhance the trustworthiness and dependability of the findings, a comprehensive audit trail will be maintained, including all research artefacts (Nowell et al. 2017).

Furthermore, according to Stalmeijer et al (2024), transferability needs to be achieved. This describes three facets. Firstly, applicability means the ability of the reader to find the relevance of the findings of this study and align them to other contexts. Secondly, for the researcher to create a resonance that spurs familiarity, and thirdly, for the researcher to articulate the problem and the use of the UTAUT2 theory to explain the older adult phenomenon, in this case, by way of theoretical engagement (Stalmeijer et al.,2024). Transferability is considered, as the research is set in the Western Cape, providing thick descriptions of context, participants, and data collection procedures so that the research can potentially be applied in other provinces in South Africa across low and middle-socio-economic environments.

Research process and procedures

Initially, the researcher created a generic message that was posted on the community WhatsApp™ group, seeking potential participants to participate in the study. The group's admin gave permission to request participants.

The semi-structured interviews took place as face-to-face sessions in a location and time convenient for the participant. The participants had the option of including their informal caregiver. However, on the one occasion that a caregiver attended the interview, there was no response to any of the questions asked, and the researcher observed this as support for the participant.

After greetings and salutations, and before the interview proceeded, the participant was requested to complete the consent form. The researcher would then proceed with initiating the recording using a smartphone device. During the interview, the researcher guided the interview with the prepared questions and invited robust responses from the participants. The researcher designed the questionnaire template with the knowledge and understanding of the constructs from the UTAUT theory. The design of the questionnaire involved five main questions, several probing questions, and a technology demonstration.

The researcher demonstrated wearable and sensor technology examples and discussed potential assistive technologies from the reviewed literature.

Upon completion of the interview, each participant was thanked for their time and detailed responses, and the recording stopped. The researcher acknowledged to the participants that feedback would be given upon completion and submission of the research.

Data analysis is the systematic process of examining, preparing, and interpreting the collected data. In this study, the researcher employed a coding technique, applying codes to transcribed interviews to produce insights relevant to a qualitative study (Håkansson, 2013, p.7).

Ethics

Ethics approval was obtained from the Faculty of Informatics and Design, as well as the Faculty of Health and Wellness at the Cape Peninsula University of Technology, given that this study spans both technology and health disciplines. To ensure ethical conduct:

• Informed consent: Older adult participants received a consent form outlining the study's purpose, procedures, risks, duration, and emergency contact details.

• Confidentiality: Pseudonyms protected participant identities; all data were securely stored and accessed only by the researcher.

• Participant welfare: Interviews were held in comfortable, participant-chosen locations. Any signs of distress were addressed immediately.

• Ethics approval: Institutional review boards approved the study, ensuring compliance with ethical standards.

• Data protection: Personal information was handled per POPIA to uphold privacy and data security.

These measures ensured the study was conducted responsibly, with full regard for participants' dignity and safety.

RESULTS
Participant attributes
This study used the judgmental sample strategy, as the participants were selected from a pre-identified group of people, older adults, 60 years and older, in the Western Cape. Information was collected from participants who may offer different perspectives on the research interview questions. This is achieved by collecting information from middle to lower socio-economic groups across both male and female genders

The Western Cape is home to a diverse South African older adult population. The researcher has chosen to collect data across two low—to middle-income areas of the Western Cape. The first area is the Northern Suburbs of the City of Cape Town, which represents the middle socio-economic area for research data collection. Given the travel budget constraints, the researcher recruited participants from the Tygervalley and Durbanville areas.

The second area is the highlighted Drakenstein area of the Cape, which represents the lower socio-economic area where the research data were collected. The researcher recruited participants from the Wellington and Paarl East suburbs. Socio-economic standards are accepted combinations of an individual's economic prosperity and social status within an area or community. These standards can vary across regions and are influenced by different factors, i.e., education, occupation, income, etc. (Baker, 2014). According to the Urban-Econ Development Economists

(2023:16), the Municipal Economic Review and Outlook report shows that the GDPR per capita is a measurement that evaluates the economic well-being of individuals, but also the living standards across the population. The Western Cape average is R107k, with the broader Cape Metro representing many affluent suburbs showing above the average, and the Winelands district showing a below-average GDPR per capita. Recruitment for potential participants took place from January 2024 to October 2024. The participants were subjected to semi-structured interviews involving five main questions

Presentation of findings
The following *Table 2* represents the full code list with its associated theme. However, to focus on the perceptions that were more prevalent during the interview sample population, those perceptions with fewer than 3 instances were not included in the analysis. By restricting the analysis to the most prevalent perceptions, it was possible to identify patterns and trends within the data more effectively.

The first column of *Table 2* lists the five emergent themes synthesised after the data analysis process, which used qualitative data analysis capabilities offered by ATLAS.ti™. Column two sets out 83 categorised codes gleaned from participant feedback.

Generating themes
The research explores the key determinants and moderators influencing gerontechnology adoption among older adults, as proposed by the UTAUT2 model. As the groups were formed and colour-coded, the researcher began formulating themes. The following themes were created to either expand on or corroborate with the literature relevant to older adults perceptions of technology use, identified in Chapter 2. The five identified themes are explained below.

Theme 1: Experience with Technology - This theme identifies that technology exposure can be linked to experience. Exposure refers to the amount of time a person is exposed to a particular technology, either by using it themselves or observing someone else using it. Awareness refers to a person's knowledge and understanding of the technology (Venkatesh et al., 2012).

Theme 2: Influencing Types of Technologies - This theme describes the types of technology exposed to older adults. There is a strong indication of ICT exposure and wearables, but little to no exposure to sensors or assistive technology.

Table 2. Full list of emergent themes and associated codes

Themes	Codes
Theme 1: Experience with technology (four codes)	AI awareness
	Regular usage
	Technology awareness
	Technology exposure
Theme 2: Influencing types of technology (five codes)	Assistive technology
	ICT
	Robotics
	Sensor technology
	Wearable technology
Theme 3: Within the aged environment (two codes)	Gerontology
	Support
Theme 4: Negative perceptions towards technology (25 codes)	Affordability
	Basic experience
	Cause of frustration
	Economic hardships
	Expensive healthcare
	Exposure to certain ethnicity
	Hesitation
	Impatient support
	Lack of accessibility
	Lack of availability
	Lack of formal training
	Lack of funding
	Lack of government support
	Lack of Interest
	Lack of ownership
	Lack of support
	Lack of understanding
	Level of difficulty
	Low experience
	Low exposure
	Low usage
	No enjoyment
	No exposure
	Perceived exploitation
	Technophobia
Theme	**Code**
Theme 5: Positive perceptions towards technology (47 codes)	Attractive
	Benefit
	Covid19
	Defined purpose
	Ease of use
	Enjoyment
	Facilitating environments
	Fascination
	Forced usage
	Gain knowledge
	Goal setting
	Healthcare importance
	Healthcare monitoring capabilities
	Health care value
	Health tech exposure
	Improving the way of life
	Individual influence
	Influence
	Intention to use regularly
	Interesting
	Need for efficiency
	Need for mind stimulation
	Need for support
	Need to adapt
	Need to be notified
	Need to improve health
	Patient to doctor familiarity
	Perceived importance
	Perceived need
	Perceived safety
	Perceived use
	Positive attitude
	Positive attitude
	Price-value
	Providing support
	Quality of life
	Social inclusion
	Social influence
	Sustainable benefit
	Technology improvements
	Tracking health
	Usability
	Usefulness
	User-friendly
	Varying options
	Willingness to learn
	Willingness to trial

Theme 3: Within the aged environment—This theme examines the ageing issues and support structures prevalent in the participants' ageing environment.

Theme 4: Negative perceptions towards technology - The negative key determinants theme highlights factors that act as barriers to older adults' acceptance and adoption of technology.

Theme 5: Positive perceptions towards technology— The positive key determinants theme emphasises factors that encourage the acceptance and adoption of technology.

Technology experience of older adults

Venkatesh et al. (2012) discussed that an individual's experience reflects the intention to start using technology over time. Based on the interview findings, ICT, such as smartphones, computers, and the Internet, is more widely used among older adults. *Figure 1* represents the findings that reveal more awareness and exposure to Wearable Health Technologies (WHT) and sensor technology, and low awareness of Assistive Technologies (AT).

Findings within the ageing environment

Significant findings from the interviews revealed that eight of the eleven participants openly recognised the gerontological issues of ageing within their environment. These were related to mild cognitive impairment, blood pressure and diabetes. Furthermore, findings revealed that only three of the eleven participants are technologically supported within their community-dwelling aged environments.
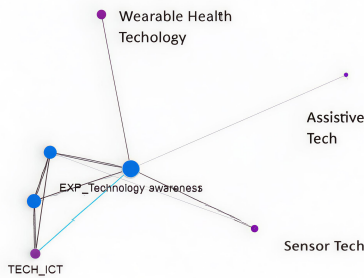
Figure 1. Older adults' technology experience

Moderator differentiators to older adults' technology adoption

Venkatesh et al., (2012) argued that age, gender, and experience are vital in extending the generalizability of the UTAUT theory, particularly in the older adults environment, and are relevant to the findings of this study.

DISCUSSION

Older adults experience with technology (themes 1 and 2)

Older adults' experience is highly subjective and often based on historical experiences. There are many instances where the participant's experience has derived from their previous work environments, family members or social circles, which creates awareness or ideally exposes them to different technologies.

"That is correct. Like I said, I was a project manager in my work time. So, IT project manager." (9:7 ¶ 11 – 12 in J_G07_part1_Transcript)

"I had to use it when I had Covid. Correct. And I'm a nurse, so I need to know what it is." (3:9 ¶ 26 in C_S10_Transcript)

"We use phones, we use the computers and things. Computers came way back. You know, we were not born in the time of computers. Right. So, when I first had to get my degree, all of a sudden, everything I needed to do was on the computer. Right. So, my younger sister helped me with a crash course in technology and all of that. " (3:1 ¶ 6 in C_S10_Transcript)

"I got a lady friend that have such one, and she normally shows me, see my blood pressure, you know, that, this is a total of steps that I do for the day up to now." (13:14 ¶ 39 in P_M09_Transcript)

The findings have revealed that ICT devices remain the technology of choice; however, some older adults people have been exposed to smartwatches, either directly or indirectly.

"Uh, I, uh, we're exposed to all levels and different types of technologies. Uh, the first obviously is computers. Cell phones, mainly. And, uh, things around, mainly around computers and uh, cell phones. Uh, I, uh, definitely do not probe into all the different types of technologies. I use what I need. (7:1 ¶ 8 in F_S01_Transcript)

"Cell phones. Cell phones. Okay. Digital watches are also... Ah, smartwatches. Smartwatches. That's nice. And, um, what's it? Internet.

Internet is good, yeah." (2:2 ¶ 11 – 12 in AN_S05_Transcript)

Sensor technology exposure has enabled some older adults to monitor their ailments, especially during visits to the hospital. However, assistive technology remains elusive to older adults, and the potential benefits of these technologies are not being realised within their own homes and communities (Peterson, 2014; Gutman et al., 2021; Sanchez et al., 2024).

Aged environments of the community-dwelling older adults (theme 3)

The Oxford meaning for "environment" is the surroundings or conditions in which a person, animal, or plant lives, and the "external conditions in general affecting the life" (Oxford English Dictionary, 2023). The aged environment is not restricted to just the buildings (Kort, 2017) in which older adults inhabit, but also the gerontological conditions (Ozsungur, 2019) they are subjected to as they age, the type of care and technical support relevant to their conditions, and the devices they operate with.

Although this study did not focus on exposing the specific types of gerontological issues that each older adult participant was subjected to, older adult participants were open to discussing their existing ailments. However, as the researcher deems this information personal and private, it must only be highlighted that this exists within their ageing environments.

Perceptions Towards Technology (themes 4 and 5)

The results uncovered from the data represent both positive and negative key determinants that influence accepting and adopting gerontechnology. The following sections are key to addressing the first sub-question in the research. The negative influences will be discussed first.

Negative perceptions

The negative key determinants that predominantly emanate from the findings revealed strong factors for discussion.

This study recognises affordability as a key influence in older adults acquiring technology for health improvement needs. This is confirmed by the study by Peek et al., (2014).

"It's a question of affordability. Do you think you could afford it? At the moment, I don't think so. Okay. I don't think so. The, uh, whole medical side, medical stuff has become so expensive now. And I don't understand why." (7:22 ¶ 73 – 75 in F_S01_Transcript)

This is indicative of the economic hardships experienced by the lower socio-economic communities because of the legacy of apartheid (Tanyi & Pelser, 2019). The current state of expensive healthcare experienced by older adults in middle socio-economic communities of South Africa has also had an impact (Young, 2016; Ballot, 2021).

Older adults struggle with the difficulties experienced with some technology. This supports findings from several studies (Liu & Joines, 2020; Pal et al., 2018; Jo & Hwang, 2021).

"Experience with any Technology today for me, it's a little bit hard. It's a little bit of a struggle, I'm struggling with it, but I'm open to learning. " (6:1 ¶ 8 in D_D06_Transcript)

Hesitation to use certain features of the technology was also acknowledged as a negative key determinant (Osman et al., 2020).

The lack of accessibility of technologies corroborates the findings of O'Connell et al. (2018), especially for older adults in remote, lower socio-economic communities, which negatively influences adoption.

"If it was sponsored or funded? Because it was more accessible, and I am knowledgeable of it " (3:18 ¶ 69 in C_S10_Transcript)

Major strides evident in the literature review show that Gerontechnology efforts by government and private institutions are a high focus. However, South Africa struggles to stay within the range of global innovations, and this impacts older adults. The findings reviewed show that older adults are willing to try gerontechnology interventions. The lack of interest in more modern gerontechnology, i.e., assistive technologies, is potentially a direct result of the lack of accessibility, availability, and exposure.

Positive perceptions
The data reveals many positive influences. Many older adults have a perceived need for technology (Peek et al., 2014)

Older adults will adopt technology that addresses their needs. One predominant need, as an extension to the Peek et al. (2014) study, is centred around the need to improve their health, with the recent pandemic COVID-19 being a strong motivator.

"Yes, but if I'm sick, I must use it every day. I can't, uh, ignore that thing. It's important for me, for my health. Okay" (2:16 ¶ 63 in AN_S05_Transcript)

"Nobody showed me that before? And I would love to learn about that because I can hear that's going to be good for me, for my health" (6:8 ¶ 39 – 40 in D_D06_Transcript)

Older adults will adopt technology if it can be supported. Support can be provided by informal caregivers who may have an aptitude for technology and are willing to undergo training from the institutions that provide gerontechnology. This is preferred to older adults, as these persons have a direct relationship with and provide care to older adults. The institutions are also responsible for providing or establishing facilitating conditions for technical training.

"So, when we ask people to help us with things, they laugh at us. And they don't answer. Patience. Patience. Okay. And then we must go to someone who can sit and then help us. And if we do that thing (referring to the use of the technology), you ask, it's very nice (1:2 ¶ 6 in A_V11_Transcript)

The technology that older adults use must provide efficiency in their daily routine.

"Oh, yes. It's so much easier than, um, trying to catch it on the radio. If you've missed that particular time slot, your phone is amazing in that regard" (11:5 ¶ 14 in K_S02_Transcript)

Another predominant need is support during the use of gerontechnology to maintain social interaction, and healthcare needs corroborate with the Willkowska et al. (2020) study. Support is a key influence and is indicative of the facilitating conditions that must be established to allow older adults to trial health technologies.

"If I need something, something goes wrong, I take it to my son. And if he can't help me, I had a problem with the phone the other day, I go to Vodacom and fix it." (7:5 ¶ 13 in F_S01_Transcript)

These environments will support older adults in gaining knowledge about gerontechnology solutions and further sharing their experiences within their social environments.

Being able to enjoy the technology is a key determinant in adopting gerontechnology.

"I am enjoying it. I am using it. To good value here in the community where I am at the Newtown Service Centre for older adults. I'm their treasurer, and I'm helping them, and I'm assisting them with keeping their books up and running to applications, to the lotto, stuff like that, you know" (9:10 ¶ 18 in J_G07_part1_Transcript)

"For sure. It just, I think it, helps you to realise you need that because it makes you aware of things that you were never aware of. How many steps do you do during the day? You know, I think it's awesome. It's absolutely awesome. Wonderful." (12:7 ¶ 33–34 in M_M03_Transcript)

Older adults are more likely to adopt gerontechnology if they find it enjoyable and easy to use, especially when it can be used within the familiar setting of their own homes. This study confirms that the hedonic motivating attributes discovered are centred on a variety of functionalities that technologies provide (Peek et al., 2014). This study confirms that older adults accept technology with health monitoring features, such as tracking health and the ability to set goals, as identified in a Mejia et al. (2020) study.

"Definitely. It gives me an indication of where I am at that particular point with my so-called fitness and what I can do maybe to help and to take it further." (10:6 ¶ 37 in J_G07_part2_Transcript)

If I didn't have that machine this morning, I wouldn't know if my blood pressure was right or not get the headache and then you realise… and it turned out that I forgot to take my pills this morning" (11:10 ¶ 46 in K_S02_Transcript)

Should health monitoring features be available in a device, older adults will adopt and use gerontechnology regularly.

This study confirms that a pivotal factor for older adults to remain independent is to continue being social. Being social eliminates loneliness and provides older adults with a sense of well-being and inclusivity (Wang and Sun, 2016). Older adults potentially use technology to gain knowledge and share experiences collectively.

"Yes, I will share it with them. I will share it with them. Okay. And talk about this, the new technology of the watch" (2:13 ¶ 51–52 in AN_S05_Transcript)

Having gained knowledge and experience in using technology that can potentially improve their quality of life, older adults want to remain socially inclusive by sharing their experiences.

Ambivalent perceptions towards technology
Although this study does not uncover a strong determinant, it confirms that this factor remains relevant to the adoption of technology. The factor of safety is evident as a positive and a negative factor in accepting and adopting technology.

"it's more, um, safe. Okay. For the people to go to the bank. We can do anything on the phone. And so, and that is a good thing" (2:6 ¶ 21 in AN_S05_Transcript)

"But sometimes it and people, what do they do? They hack into your phones. It happened to me. So, I'm very, you know, cautious. Cautious about doing specifically the bank things on my phone. Because they hacked into my account, and I lost some money. So yeah. Okay. That is the scary part of technology" (3:7 ¶ 20–21 in C_S10_Transcript)

These findings corroborate the factor of geronsafety, whereby safety considerations are imperative to the overall development of technologies and the application of these technologies to social services. (Pinto et al., 2000; Le Deist & Latouille, 2016; Ozsungur, 2019)

Theoretical implications
Exposing the key determinants guides the researcher in understanding the key moderators influencing technology adoption among South African older adults. This section is key to addressing the second sub-question of this research.

In addressing the differentiators, this study's findings revealed that age and gender, indeed, do have a joint impact on this specific population cohort. Venkatesh et al. (2012) reported that there will be a significant differentiation across the genders as older people become. This study challenges the findings of Venkatesh et al. (2012) and corroborates the findings of Wilkowska et al. (2020) that age and gender were weak linear relationships in elder studies. The study revealed that age and gender work in tandem with experience, corroborating Venkatesh et al. (2012) when they are associated with the main moderators for behavioural intentions to use technology.

In addressing the UTAUT2 theory, the older moderators will be assessed first based on the literature of Venkatesh et al. (2003; 2012), reviewed in earlier chapters of this study.
Performance Expectancy evaluates an older adult's belief that the system will help achieve

health improvement. A positive key factor result is the usefulness of the exposed systems to older adults. Peek et al. (2014, p.237) report that PU and PEU are strong predictors of technology adoption, and older adults adopt technologies that allow them to accomplish tasks that improve their daily living activities. However, the lack of availability, accessibility, and exposure prevents South African older adults from realising that there are advances in technology that can improve their health performance. Therefore, performance expectancy is key to understanding the adoption of gerontechnology.

Effort expectation evaluates the ease with which older adults use a technology device. This key moderator is evident in the responses, particularly with the ease with which older adults have adopted using banking applications within the comforts and confines of their homes. However, systems possess complexity and safety factors that may hinder older adults from adopting technologies. Older adults worry that they will break the device and experience fear in learning new technologies, as acknowledged by Jo & Hwang (2021), and practical implementations need to be considered to eradicate the uneasiness for older adults to adopt gerontechnology.

Social Influence evaluates the perception that an older adult needs to involve others in using the technology. In this study, it was evident that a family member's involvement was crucial in sharing experiences and providing support to older adults. It is also apparent in the interviews of this research that, as older adults encounter technology that benefits their daily lives, it is vital to assist other older adults who may need the knowledge to operate the device. This is a strong key moderator in sharing newly discovered technology with friends, family, and the broader community that shapes older adults' adoption decisions.

Facilitating conditions evaluate that an older adult has the belief that there is a technical support structure available when adopting a piece of technology. This is a strong key factor, coupled with the need for support from their immediate surroundings, that reassures older adults that help is available. Failure to establish adequate facilitating conditions in place for older adults to resolve instances of technology system failure corroborates with Osman et al. (2020), which results in hesitancy to use the technology. Therefore, by incorporating affordability considerations, establishing the right infrastructure and accessible means to use the technology, the correct facilitating conditions may provide a platform for older adults to adopt

technology and be able to use it regularly, making facilitating conditions key to understanding the adoption of gerontechnology.

The newer moderators are assessed below in addressing the additions to the UTAUT2 theory. Hedonic Motivation evaluates the belief of an older adult in finding pleasure or enjoyment from using technology. Older adults have a positive emotional experience through enjoyment and pleasure when using technology, and these variables have a high correlation with both usage and behavioural intention (Wu & Lu, 2013). Enjoyment, as a finding in this study, is a strong key factor in the adoption of technology by older adult participants, making this a key moderator in understanding the adoption of gerontechnology.

Price-value evaluates the extent to which older adults derive value from the technology they acquire and operate. Older adults demonstrate a keen interest in paying for the technology, provided it meets their need to improve their health and that the benefits are sustainable. However, the pressures of economic hardships, expensive healthcare, and high-value-priced products (Jo & Hwang 2021:6) currently hinder the adoption of technology, as older adults struggle to acquire the most needed devices. Therefore, older adults are not given the opportunity to assess their perceived value (Özsungur, 2019). This moderator is key to understanding the adoption of gerontechnology.

Habit evaluates the extent to which older adults constantly target and use technology over time. This moderator does need to consider the fear perception of breaking older adults' daily routine, as identified in the study conducted by Randriambelonoro et al. (2017). This remains a challenge, and further studies are needed to expose this. This study's findings suggest that, given that the technology is tested and approved and there are no side effects to using it, it makes this an acceptable moderator for older adults in South Africa to adopt and use gerontechnology regularly and intentionally.

Having identified the key determinants and understanding their alignment to the theoretical key moderators, this research reveals the considerations of key acceptance and adoption perceptions of older adults and how they influence the adoption of gerontechnology within older adults environments in the Western Cape.

Practical implications
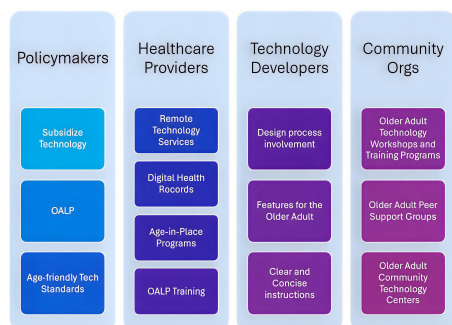*Figure 2* illustrates the findings of this study, offering practical implications for gerontech-

Figure 2. Practical implications for gerontechnology adoption

nology adoption:

Subsidise technology: Policymakers can develop policies that promote digital literacy and accessibility for older adults. This can be achieved by implementing subsidies for older adults to purchase assistive technology. In addition, tax breaks can be extended to pre-retirees to acquire sensor technology to prepare for a quality life beyond retirement.

Older Adults' Digital Literacy Programs (OADLP): Policymakers can fund digital literacy programs that are aligned with older adults' needs, covering topics like ongoing smartphone usage, wearable technology clinics, and online banking.

Age-friendly technology standards: Policymakers can develop and enforce standards for gerontechnology that prioritise usability, accessibility and safety for all older adults.

Healthcare providers: Incorporate technology into healthcare services to improve patient outcomes and reduce the burden on the healthcare system. The following can be considered to achieve this:

- Remote technology services: Healthcare providers can expand their services to include mobile monitoring and care systems for remote consultations and monitoring, reducing the need for in-person consultations.

- Digital health records: Healthcare providers can implement an Older Adults Electronic Health Records database to improve older adults' patient care and facilitate communications between older adult patients and the healthcare provider.

- Age-in-place: Medical Aid schemes can introduce age-in-place programs that require little to no human intervention in community-dwelling older adults' environments. These programs provide financial savings and positive attitudes from older adults towards gerontechnology implementations (Rantz et al., 2013).

- OADLP training: Provide training to healthcare professionals on effectively communicating with older adults about gerontechnology.

Technology developers: Design user-friendly and affordable technologies tailored to the needs of older adults. The following can be considered to achieve this:

- Older adults can be involved in the design process to ensure that gerontechnology is intuitive and easy to use.

- Developers can incorporate accessibility features such as large fonts, voice commands, and high-contrast displays.

- Furthermore, it guides older adults by providing clear and concise instructions, both in written and verbal forms.

Community organisations: Organise workshops and training programs to equip older adults with technology skills. This can be achieved by considering the following.

- Older adults technology workshops: Organise regular workshops to teach older adults basic computer skills, smartphone usage and online safety.

- Older adults peer support groups: Facilitate peer support groups where older adults can share their experiences and help each other with technology.

- Older adults community technology centres: Establish community technology centres with trained staff to assist older adults with technology-related issues.

Figure 3 culminates the study. It provides a framework of concretised concepts that inform stakeholders considering implementations, policymakers, healthcare providers, technology developers, and community organisations who can work together to promote the adoption of gerontechnology and improve the quality of life for older adults in the Western Cape.

Limitations
The study's limitations included a relatively small sample size and a focus on a specific geographic region. Additionally, the self-reported nature of the data may introduce biases.
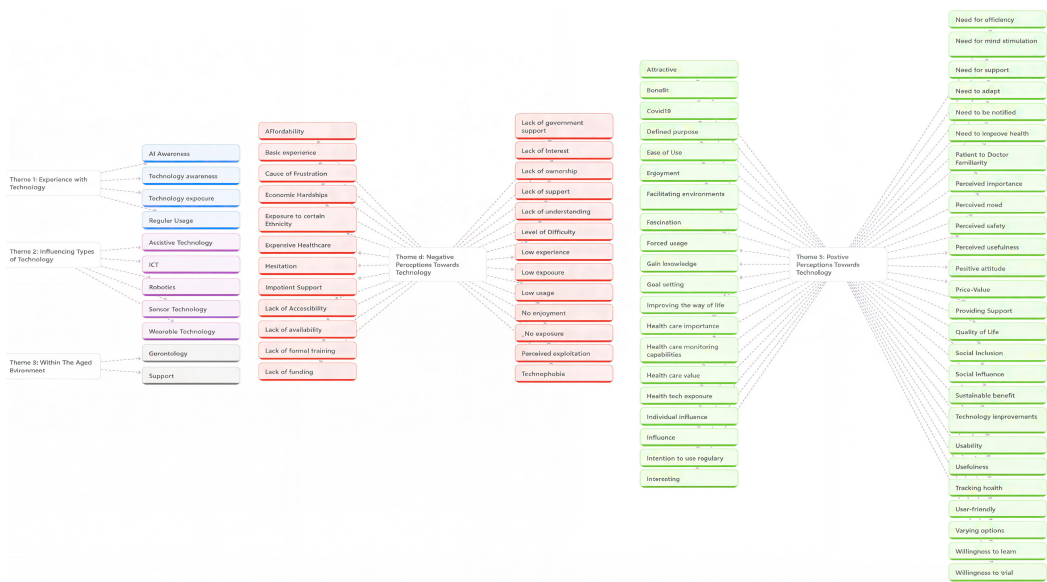
Figure 3. Framework of factors for the adoption of gerontechnology by community-dwelling older adults

The relatively small sample size limits the generalizability of the findings to a broader population of older adults. A larger sample may have provided a more comprehensive understanding of older adults' diverse experiences and perspectives.

This study's focus on the Western Cape region may not fully represent the experiences of all older adults in other areas of South Africa, particularly those with different socio-economic and cultural contexts.

The study's reliance on self-reported data through the interviews may introduce biases, as participants may not accurately recall or report their experiences.

This study's cross-sectional design limits the ability to draw causal inferences and track changes in technology adoption over time. Therefore, a longitudinal study can provide more insights into the dynamics of technology adoption among older adults.

By acknowledging these limitations, the study's findings should be interpreted cautiously, and further research is needed to validate and extend these results.

Recommendations for future research
Future research could explore the following areas:

Longitudinal studies: To track changes in technology adoption over time.

Comparative studies: To compare the experiences of older adults in a different cultural and socio-economic context.

Qualitative studies: To delve deeper into the individual experiences and perceptions of older adults.

Mixed-methods studies: To combine qualitative and quantitative methods to gain a more comprehensive understanding of technology adoption.

CONCLUSION
This study explored the factors influencing the acceptance and adoption of gerontechnology among community-dwelling older adults in the Western Cape. Key findings identify the key determinants explored and offer insight into the theoretical key moderators. The role of the key moderators is clearly understood in terms of how older adults can adopt gerontechnology in the Western Cape. The key findings include:

• Negative perceptions: Affordability, complexity, and accessibility were identified as significant barriers to gerontechnology adoption.

• Positive perceptions: Older adults demonstrated a positive attitude towards technology, particularly when it can improve their health and well-being.

• Role of social influence: Social Influence, particularly from family and friends, played a crucial role in encouraging technology adoption.

• Importance of support and training: Adequate training and support were essential for older adults to use technology effectively.

This study advances gerontechnology adoption research by extending the UTAUT2 model to incorporate factors specific to older adults, offering a refined theoretical lens. Methodologically, it employs a robust qualitative approach to capture older adult users' lived experiences and perceptions. Practically, the findings equip policymakers, healthcare professionals, technology developers, and community organisations with actionable insights to foster digital inclusion among older adults in the Western Cape and broader South Africa.

This research underscores the crucial importance of addressing the digital divide among older adults in the Western Cape. By identifying key factors influencing technology adoption, this study provides valuable insights for policymakers, healthcare providers, technology developers, and community organisations. It is important to implement strategies that address affordability, accessibility, and digital literacy to improve the quality of life for older adults. By investing in technology-based solutions and supporting older adults in the journey towards digital inclusion, society can empower them to live independently, engage with their communities, and age with dignity and success. Further research is needed to explore the long-term impacts of technology on the health and well-being of older adults and develop innovative interventions that can bridge the digital divide and promote equitable access to gerontechnology.

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