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ARTICLE

Smart technology and the meaning in life of older adults during the Covid-19 public health emergency period: a cross-cultural qualitative study

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ABSTRACT

The exponential increase of the older segment of the population is coinciding with the growing challenges of a digital society in different socio-cultural contexts. This exploratory study aims to analyze older adult perspectives of how smart technology influenced their meaning in life during the Covid-19 Public Health Emergency period, using qualitative research at a cross-national level. Three hundred and fifty-one community-dwelling older participants aged 65–87 years were included in the study. Participants were Italian, Mexican, Portuguese and Spanish. All the narratives went through a process of content analysis. Findings of content analysis produced six themes: Meaningful relations, rewarding activities, spirituality, health and safety-related support, self-growth, and physical activity. Smart technology was important in promoting significant relations for Mexican older adults (71.3%), rewarding activities for Portuguese older adults (57.1%), spirituality for Spanish older participants (71.6%), and physical activity for Italian older adults (29.5%). This study indicated that smart technology during the Health Emergency period was important for the meaning in life of older populations, mostly by facilitating meaningful relations, rewarding activities and spirituality. Future interventions with older adults during pandemic periods should consider the diversity of themes associated with increasing older adult well-being, from a cross-cultural perspective.

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Cross-cultural; meaning in life; older adults; positive psychology; smart technology

Introduction

The change from an industrial to a digital world will lead to radical changes in how we organize society. This development is converging with another trend: a global increase of the older population (Anderberg, 2020).

The 4th Revolution has affected our sense of privacy, ownership, skills, social connections, meaning in life and self-growth (World Health Organization, 2020). Older adults are increasingly using smart technology, however, they have not received enough attention in the literature (Anderberg, 2020). Research indicates that 67% of older adults in the United States and 49% in Europe use the Internet, on average, while 43% own smartphones (Anderberg, 2020). Wang et al. (2011) stressed that the cultural background of older adults is important for the design of smart technology. In fact, older adults use smart technological devices and solutions differently (e.g. personal computers, smart phones and tablets, software, Internet), on a daily basis, for communicating by e-mail, online video/phone calls, online chatting/instant messaging, using search engines, social networking sites, apps, word processing and online shopping (Finn, 2020). Moreover, higher levels of smart technology use seem to be significant predictors of reduced loneliness, higher levels of social support, fewer depressive symptoms, better self-rated health, fewer chronic illnesses, higher life satisfaction, purpose in life and well-being among older individuals (Finn, 2020). Additionally, artificial intelligence and algorithms have improved the diagnosis and treatment of older adults (Anderberg, 2020). Assistive technologies help older adults age in place longer, by allowing support from telecare, smart homes, proactive service systems, household robots, robot-assisted therapy and socially assistive robots (Anderberg, 2020).

In this context, gerontechnology has emerged as an answer with innovative and directed technological

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developments, which promote better living conditions and independent living for the older population (Anderberg, 2020). Smart gerontechnology has been used in assisted living of older adults by directly supporting independent living and social interaction (Martel et al., 2018). Home health technologies are mostly used for online shopping and to monitor daily living activities, mental health, physical exercise, cognitive decline and cardiovascular conditions among older adults (Martel et al., 2018). Gerontechnology has also facilitated social relations through the use of adapted communication devices (Anderberg, 2020). Furthermore, health care has benefitted from smart gerontechnology, by monitoring, providing preventive care and treating older adults, and by supporting function and maintaining a good life, especially for those living alone (Anderberg, 2020). Older adults have highlighted positive aspects of using smart technology (e.g. easy access to information, portability and communication, protection, user-friendliness) (Anderberg, 2020). Conversely, research suggests that older adults were unmotivated to use smart technology due to feelings of inadequacy and negative comparison with younger generations; insufficient interaction and social communication; excessively complex technology; lack of clear instructions and assistance; lack of privacy and security; and stigma (Vaportzis et al., 2017). Furthermore, research reiterates differences in use of smart technology stemming from the cultural background of older adults (Shirahada et al., 2019).

Meaning in life is the individual perception allowing one to understand the beliefs about one's life and activities, and the value and importance attached to them. It is related to terms such as order, justice, coherence, values, faith and belonging. It includes involvement or commitment to goals or a life structure and the subsequent sense of accomplishment and satisfaction or lack thereof (Moore et al., 2006).

Meaning in life among older people generally depends on whether they have different positive meanings of their present and past life experiences. Older adults build meaning and portray a sense of self-evolution that contributes to their living and adopted life. This evolutionary sense of self is reflected in how they lived their lives, faced challenges and extreme situations, took risks and strove to maintain an attitude that promoted their sense of engagement and purpose in life. Meaning in life is a significant component of quality of life, contributing to health and well-being in old age (Moore et al., 2006). Indeed, for older adults, meaning in life is related to a good life, well-being, health and quality of life (Hupkens et al., 2018), and differs culturally (Moore et al., 2006). Indeed, research reiterates that meaning in life depends on the type of meaning, age and culture (Hupkens et al., 2018).

In 2019, a new coronavirus (SARS-Cov-2) began to cause respiratory illness, and older adults have a much higher risk of mortality (about 15%) than younger people, especially if they have comorbidities like diabetes, hypertension, obesity, heart and respiratory diseases, cancer, lupus, renal insufficiency, and other chronic conditions (Wilson et al., 2020). Health recommendations suggest that older adults, in particular those with comorbidities, should be protected with social distance or if necessary social isolation (Wilson et al., 2020).

As of 30 June 2020, more than 95% of deaths due to Covid-19 were people aged 65 years and older, and more than half of deaths were people over 80. In addition, worldwide, 8 out of 10 deaths occurred in individuals with at least one underlying comorbidity, in particular those with cardiovascular diseases, hypertension and diabetes. In Europe, about 30,000 people died with COVID-19, where 90% of the deaths were in Italy, Spain and France (European Centre for Disease Prevention and Control, 2020).

Italy presented a total of 233,836 assessed cases and 33,601 deaths from Covid-19, and 85.1% deaths were people aged 70 or older (Ministero Della Salute, 2020). In Mexico, approximately 29,592 older adults (13.6% from total) were infected. The number of deaths related to Covid-19 in Mexico has still been growing and, by June 30, there were 26,648 reported deaths, of which 41.7% (11,132) corresponded to older adults (Gobierno de México, 2020). By end of June 2020, there were 39,392 cases of Covid-19 in Portugal, and about 30.6% of the infected people were individuals over the age of 65. This country's death toll has been low compared to many other countries, however, approximately 67.2% of cases are older adults aged 80 years and older (Direção Geral de Saúde, 2020). Furthermore, Spain had 246,272 cases and 28,323 deaths for Covid-19, of which 86.5% were people aged 70 years or older (European Centre for Disease Prevention and Control, 2020).

Isolation and loneliness may lead to depression, cognitive dysfunction, disability, cardiovascular disease and increased mortality among older adults (Morley & Vellas, 2020). Trzebiński et al. (2020) indicated that meaning in life, satisfaction with life and basic hope are elements that influence thoughts and emotions in case of mortal danger. Hence, higher

levels of meaning in life, satisfaction with life, and sense of hope correlate with less state anxiety and stress during COVID-19 pandemic (Trzebiński et al., 2020).

The literature suggests that the experience of meaning in life among older people is higher when they have access to family and friends, more interpersonal intimacy, mutual aid in daily life, practice self-disclosure, higher levels of education, emotional support, better self-perceived health status, and are open to communication (Lewnard & Lo, 2020). In this context, smart technology has been relevant to explore meaning in life, personal meaning, self-growth, sense of agency and self-management, as well as other person-centered developments in old age (Martel et al., 2018).

Smart technology has been important for confined older adults during the Covid-19 pandemic, but we still lack knowledge about how Covid-19 affects meaning in life among older adults from different cultures and how technology is related to their meaning in life during the COVID-19 pandemic (Trzebiński et al., 2020). In this context, this study aims to analyze older adult perspectives of how smart technology influenced their notion of meaning in life during the Covid-19 Public Health Emergency period (Covid-19 PHEP) in different cultures.

Methods

Four hundred people were contacted and 378 agreed to participate in this exploratory study. In total, 351 were included in the final sample. The rest were excluded due to lack of availability or incomplete data, yielding an unweighted response rate of 87.8% and a weighted response rate of 94.3%. Among the participants, 63.0% were women, 66.7% were married or in a relationship, 39.0% lived alone and 43.9% attended primary school (see Table 1). Participants were recruited in Italy, Mexico, Portugal and Spain. Recruiting methods varied widely, including senior universities, message boards, community centre list-serves, social networks ads and personal emails. The objectives of the study were described, participants were informed that the information they provided was to be employed for this research only and their names were kept anonymous. Participants gave their informed consent to provide a telephone or online contact and answer an online questionnaire (e.g. Skype, Survey Monkey, Zoom and Whatsapp).

Participants had to fulfil a series of inclusion criteria, namely (a) age equal to or over 65 years; (b) clearly understanding of the decision to participate in the study; (c) no history of psychiatric or neurological illness, or history of drug or alcohol abuse, which might compromise cognitive function and (d) use of smart technology (e.g. computer, tablet, Apps, artificial intelligence) during the Covid-19 PHEP.

Qualitative data were collected between 1 May and 30 June 2020. Interviews lasted approximately 15 min and were conducted in the participant's mother language, namely Italian, Spanish or Portuguese. The questionnaire and interview guide were translated in three steps (forward translation, back translation and reconciliation). All procedures were approved by the

Table 1. Sample socio-demographic and health characteristics.

Characteristics	Italian 78 (22.2)	Mexican 94 (26.8)	Portuguese 98 (27.9)	Spanish 81 (23.1)	Total 351 (100.0)
Age, mean ± SD	67.4 ± 3.1	69.7 ± 2.6	76.2 ± 4.1	75.2 ± 6.4	73.4 ± 3.4
Gender, *n* (%)					
Women	42 (53.8.0)	65 (69.1)	64 (65.3)	50 (61.7)	221 (63.0)
Men	36 (46.2)	29 (30.9)	34 (34.7)	31 (38.3)	130 (37.0)
Living status, *n* (%)					
Alone	34 (43.6)	45 (47.9)	23 (23.5)	35 (43.2)	137 (39.1)
With children	3 (3.8)	2 (2.1)	6 (10.2)	0 (0.0)	11 (3.1)
With a partner	41 (52.6)	47 (50.0)	65 (66.3)	50 (61.7)	203 (57.8)
Education, *n* (%)					
Primary school	39 (50.0)	41 (43.6)	33 (33.7)	41 (50.6)	154 (43.8)
Middle school	20 (25.6)	22 (23.4)	24 (24.5)	1 (1.2)	62 (17.7)
≥ High school	36 (24.4)	31 (33.0)	41 (41.8)	27 (33.3)	135 (38.5)
Marital status, *n* (%)					
Married or in a relationship	65 (83.3)	61 (64.9)	54 (55.1)	54 (66.7)	234 (66.7)
Not married or in relationship	13 (16.7)	33 (35.1)	44 (44.9)	27 (33.3)	117 (33.3)
Professional status, *n* (%)					
Active	18 (23.1)	16 (17.0)	21 (21.4)	18 (22.2)	73 (20.8)
Inactive	60 (76.9)	78 (83.0)	77 (78.6)	63 (77.8)	278 (79.2)
Family annual income, *n* (%)					
≤ 25,000 €	67 (85.9)	72 (76.6)	76 (77.6)	52 (64.2)	267 (76.1)
> 25,000 €	11 (14.1)	22 (23.4)	22 (22.4)	29 (35.8)	84 (23.9)
Perceived health, *n* (%)					
Good	68 (87.2)	73 (77.7)	87 (88.8)	61 (75.3)	289 (82.3)
Poor	10 (12.8)	21 (22.3)	11 (11.2)	20 (24.7)	62 (17.7)

William James Centre for Research Ethics Committee, ISPA – Instituto Universitário, and were in accordance with the ethical standards of the 1964 Helsinki Declaration and its subsequent amendments or comparable ethical standards. Support for participants was available by phone or online, and participants were invited to give their feedback.

Data analysis

The interviews were recorded and transcribed verbatim. After this phase, an in-depth reading was carried out, with the aim of collecting material for content analysis. After reading the interviews, the data were distributed with the aim of generating units of meaning; then codes for the units of meaning were created; and finally categories were created from the existing codes. In this process, the contents were named with succinct and intuitive names and several codes were collected that referred to the same category. The designation of each category was defined at the end of the process (Erlingsson & Brysiewicz, 2017).

To guarantee the replicability and reliability of the analysis, the content organization process followed specific rules, such as the existence of exclusive codes and the homogeneity of those codes. Finally, when the information collected stopped providing knowledge and important information for the analysis, the process was interrupted due to its theoretical saturation (Erlingsson & Brysiewicz, 2017).

Throughout the study, qualitative (theoretical and empirical) and quantitative (descriptive statistics) analyses were performed to elaborate an interpretative structure of the findings, of a descriptive nature (Erlingsson & Brysiewicz, 2017). All names used in the content analysis are pseudonyms.

Categories were subjected to an external review and critical feedback was obtained. To guarantee the reliability of the study, Cohen's Kappa was used. The scores showed a high level of agreement ($.87 < k < .96$, $p < .01$).

Results

We examined six non-mutually exclusive themes that represented the cultural diversity of narratives reported by older participants from four nationalities (Italian, Mexican Portuguese and Spanish) when exploring their meaning in life through smart technology during the Covid-19 PHEP. Although participants did not always plainly use the expression 'meaning in life', their narratives pointed towards contexts clearly related with their perspectives of meaning in life. The evidence of meaning in life emerged in six major themes: meaningful relations, rewarding activities, spirituality, health and safety-related support, self-growth, and physical activity. The information shared by each participant could have added to different themes (see Table 2).

Theme 1: Meaningful relations

A large number of participants ($n = 134$) indicated that technology helped them connect with family, colleagues and friends. This theme was reported mainly by Mexican participants ($nMex = 67$; $nPort = 32$; $nSpan = 24$; $nItal = 11$). Maria explained that smart technology 'is an open door to social interrelationships, at the international, national and regional level in my city, with family and friends' (Maria; female, 79 years-old). Some participants reported the feeling of being rewarded by being able to communicate with their significant relations. Carlos explained that 'being able to communicate with many members of my family who are in different countries, by videoconference and WhatsApp, and with my groups of friends on a daily basis is very rewarding' (Carlos; male, 81 years-old). Moreover, smart technologies also served as a

Table 2. Main themes found and descriptive examples.

Themes	Descriptive examples
Theme 1: Meaningful relations ($n = 134$)	"Is an open door to social interrelationships, at the international, national and regional level in my city, family and friends" (Maria; female, 79 years-old)
Theme 2: Rewarding activities ($n = 121$)	"Internet allowed me to continue my work, volunteer with groups spread over the national territory, participate in national and international webinars, visit museums around the world, strengthen communication methodologies, truly a source of intellectual nourishment." (Karim; male, 66 years-old)
Theme 3: Spirituality ($n = 110$)	"I may be in quarantine, in total isolation, but I will always have God by my side. I believe that we will go through this and in the end, we will be stronger" (Alice; female, 76 years old)
Theme 4: Health and safety-related support ($n = 102$)	"It helped me better understand the instructions to protect myself from contracting the covid-19 infection and that made me feel safer and stronger, more aware of myself and my limitations. I think I reached a new level of self-concept and I know what life means to me" (Diana; female, 75 years old)
Theme 5: Self-growth ($n = 87$)	"Technology made it possible to broaden the expression of my possibilities and to accompany and stimulate the imagination. They favoured concentration as well" (Sophia; female, 79 years old)
Theme 6: Physical activity ($n = 54$)	"I do Yoga through an App and it works very well for me, sometimes new situations are food to break up myth. I thought I couldn't do it bit it was easy to use this App." (Ava; female, 75 years old)

way of companionship. Miriam reported that 'it is important because it is a distraction tool and it's another way to have company when we feel so much what it is to be alone. I can see my loved ones and share my day with them' (Miriam, female, 83 years-old). Smart technology also permitted new relations to be formed. As Diego verbalized: 'Covid-19 was not bad to me. I met Irina online and fell in love with her, now we are in a relationship and I reconnected with people with whom I had not been in contact for a long time. I can't complain' (Diego, male, 68 years-old).

Theme 2: Rewarding activities

Some participants ($n = 121$) indicated that smart technology was also seen as an important instrument for carrying out their activities. This theme was mostly reported by Portuguese participants ($nPort = 56$; $nSpan = 34$; $nMex = 18$; $nItal = 13$). Smart technology enabled older adults to have access to relevant information and activities, which were important for their learning, self-fulfilment and accomplishment. Thus, Nicole explained: 'Since I am in the first year of my degree, it was thanks to intelligent technology that the information and materials were transmitted. Probably, without this technology, our classes would have been paused' (Nicole; female, 65 years-old). Karim added that the 'internet allowed me to continue my work, volunteer with groups spread over the national territory, participate in national and international webinars, visit museums around the world, strengthen communication methodologies, truly a source of intellectual nourishment'. (Karim; male, 66 years-old).

Smart technology was a means to fight monotony by allowing a large range of activities. Hugo claimed that 'It takes away my boredom, it amuses me with podcasts" and "technology allowed the learning of languages' (Hugo; male, 77 years-old). Filipa verbalized that 'there are also applications where I can be distracted, to knit, listen to music, learn gardening techniques, write down my thoughts, meditate, think about myself, listen to tips for a better life and recipes' (Filipa; female, 69 years-old). In addition, participants reported that the attitude towards to use of technology changed during the pandemic: 'Covid-19 gave me the opportunity to experience technology more calmly; previously I used technology for specific purposes and now this is how I research anything I feel like. The emergency period accelerated online processes and it generated other challenges and situations to solve'. (Oscar; male, 70 years-old)

Theme 3: Spirituality

Some participants ($n = 110$) indicated that new technologies helped develop a sense of spirituality. This theme was mostly reported by Spanish participants ($nSpan = 58$; $nMex = 23$; $nItal = 20$; $nPort = 9$). Lucilia explained that 'I wake up with the Guruji and make guided meditation daily. It has been wonderful to follow his Podcast'. (Lucilia; female, 79 years old). Carla added that 'technology is innovative and important to develop physically, emotionally and spiritually'. (Carla; female, 68 years old).

Spirituality was important for meaning in life and for enduring this difficult phase in the lives of these participants. Elena reported that 'It helped me to be a better person, to live with more tranquillity and to be grateful to God for what I have' (Elena; female, 81 years old). Erica added that 'we have to believe in ourselves, to have faith. It is just a phase, a test to our spirituality'. (Erica; female, 84 years old).

Some participants reported that smart technology helped them attend religious ceremonies and keep their faith alive: Mia verbalized, 'I continue to attend masses, but now on the internet' (Mia; female, 84 years old). Alice added that 'I may be in quarantine, in total isolation, but I will always have God by my side. I believe that we will go through this and in the end, we will be stronger' (Alice; female, 76 years old).

Theme 4: Health and safety-related support

Older participants ($n = 102$) indicated that health and safety assistance were possible to maintain due to smart technology. This theme was mostly reported by Spanish participants ($nSpan = 67$; $nPort = 17$; $nSpan = 14$; $nItal = 4$).

A large number of older individuals considered information essential for their safety and health protocols, and those of their families, by adding to the definition of their self-concept and meaning in life. Diana reported that 'It helped me better understand the instructions to protect myself from contracting the covid-19 infection and that made me feel safer and stronger, more aware of myself and my limitations. I think I reached a new level of self-concept and I know what life means to me'. (Diana; female, 75 years old). Daniel reported that 'Yes, health instructions are important, to protect us and our families relationships and friendships. After all, we are part of a risk group. That made me think about how vulnerable I became. I think about what life will

mean to me in the future and what the future will bring me' (Daniel; male, 90 years old).

Health care was reported as being facilitated by smart technologies, since they make it easier for people to take care of themselves. Samuel verbalzsed: 'Actually … It has been a great help, all the health support and healthy lifestyle activities that have been sent to us by City Hall's Safety and Health department' (Samuel; male, 69 years old).

Some respondents shared their gratitude for efforts from health professionals. Anabela indicated that 'I thank in advance all the team that has supported us (myself and my husband), in these difficult times'. (Anabela; female, 79 years old).

Some participants indicated that they enlarged their perspective of life and its meaning, by staying connected with the outside world, and, therefore, staying updated with the news and opinions from the exterior. These participants also shared their concern with fake news: 'Knowing the reality in which we live is essential, in order to learn. It has been very good since it has given me a broader knowledge of the reality that I am living, namely the evolution of Covid-19. We just have to be careful with fake news' (Oswald, male, 81 years old).

Theme 5: Self-growth

Some participants ($n = 87$) indicated that smart technologies allowed for self-growth and reflection about how to achieve self-growth during the Covid-19 PHEP. This theme was mostly reported by Portuguese participants ($nPort = 48$; $nItal = 21$; $nSpan = 12$; $nMex = 6$).

Difficult experiences were reported as occasions for self-growth for these older participants and the pandemic gave them the opportunity to reflect about and experience new perspectives of meaning in life. Isabel revealed, 'I feel calmer now because the world has stopped stressing me. I do not have to hurry up for everything anymore. For me, Covid-19 has been good. I grew up and learned a lot. I feel more at peace. It has been a vacation all around. I have explored the topics that interest me on Youtube, I listen to podcasts, I have time to explore important apps. Technology has served my interests. I can taste food, look at a flower, and do nothing but feel. What can I ask for more?' (Isabel; female, 69 years old). Additionally, some participants focussed on how technology allowed them to explore possibilities and to stimulate imagination: 'Technology made it possible to broaden the expression of my possibilities and to accompany and stimulate the imagination. It favored concentration as well' (Sophia; female, 79 years old).

In addition to experiences, some participants reported that this phase also provided important life lessons. David explained, 'I have been able to understand the magnitude of the problem and how to survive. It has also taught me a great lesson: that we have nothing safe in life and must be prepared psychologically with a balanced and responsible attitude in life and towards others' (David, male, 65 years old).

Some participants indicated that they valued little things and the time they had. By living some part of their lives online, they did not waste time in non-satisfactory activities and focussed upon the free time they had. Laura explained that 'I discovered that I owe much more importance than I thought to small things. I notice more of them. The laughter of a child, a flower blossoming, a cat that comes to my garden every day'. (Laura; female, 76 years old). Sara added some environmental concerns: 'I learned to be alone and to value my life on this planet, Covid is helping us to save the planet. The human race had to stop and give the planet a break'. (Sara; female, 86 years old).

Some participants reported self-growth by learning with new technologies that were available online. Antonio said that smart technologies are 'novel and very important to develop myself emotionally, physically and economically. I feel more empowered, I feel I grew up another step'. (Antonio; male, 71 years old).

Theme 6: Physical activity

The last theme was reported by 54 participants. Participants used smart technology to continue exercising, in particular those who already practiced physical activity previously. Most used Apps, YouTube videos and podcasts. This theme was mostly reported by Italian participants ($nIta = 23$; $nPort = 14$; $nSpan = 10$; $nMex = 7$). Ava reported that 'I do Yoga through an App and it works very well for me. I thought I couldn't do it, but it was easy to use this App'. (Ava; female, 75 years old).

Some older participants contracted the services of a personal trainer. Olivia verbalized, 'I started to have a personal trainer and that has been fantastic'. (Olivia; female, 78 years old). Additionally, some participants started new physical activities. Amelia referred that 'I started to do Pilates and I follow my step counter at home and in the garden, I never do less than 10,000 a day to stay healthy. To stop is to die'. (Amelia; female, 77 years old).

Senior athletes continued to train on a daily basis, but shared the need to adapt to the contingencies of smart technology. Jessica explained that, 'I exercise through Zoom with my dance colleagues. It is not the same, the atmosphere is lacking but it is also an opportunity to socialise'. (Jessica; female, 75 years old).

Discussion

This exploratory study aimed to fill a knowledge gap about older adult perceptions of how smart technology influenced their meaning in life during the Covid-19 PHEP. Findings indicate that older adults from different cultures perceived meaning in life in diverse and rich manners.

Meaningful Relations was the theme most frequently indicated by older adults, most of which Mexican participants. Participants indicated that technology helped them connect with family, colleagues and friends. The literature reiterates that smart technology helps older people socially connect, positively benefit their well-being, self-rated health, and mental health (Lewnard & Lo, 2020). Being connected with others is critical to the experience of meaning in life, but older adults often have poor social networks (Duppen Rn et al., 2019). The most-used technology to achieve social engagement were social networks, but also emerging technologies, such as virtual or augmented reality applications and virtual assistants that make use of artificial intelligence for social connectedness (Lewnard & Lo, 2020).

Home confinement was mandatory for older adults and infected people, which may have increased the feeling of social isolation and loneliness among older adults, thus making individuals in advanced ages doubt their meaning in life and lose confidence in the value of life (Lewnard & Lo, 2020). Participants used smart technologies for companionship and to decrease loneliness. Research has showed that smart technology mitigates social isolation among older adults through four mechanisms: connecting to the outside world, gaining social support, engaging in activities of interest, and boosting self-confidence (Lewnard & Lo, 2020). Moreover, social connectedness contributes to a meaningful life in older age (Low, von Humboldt, Kalfoss, Wilson, & Leal, 2019; von Humboldt, 2016; von Humboldt & Leal, 2015).

Interestingly, due to smart technology, new models of social relations and social networks among older adults have emerged (Lewnard & Lo, 2020). Indeed, Ayalon and his colleagues (2020) highlighted that older adults make proactive use of technology to shape their social contexts.

The second most mentioned theme was Rewarding Activities, mostly indicated by the Portuguese participants. Smart technology was an important instrument for carrying out their activities, explore their hobbies, learn new competences and participate in enjoyable and distracting activities. In this way, older participants used smart technology as a means to accomplish rewarding activities, such as listening to podcasts and music, learning new recipes and gardening techniques with tutorials, exercising with virtual personal trainers, among others. Indeed, smart technology can help older people pursue rewarding activities and add meaning to their lives. Accessible information, different forms of entertainment, convenient and communication tools can enrich older people's lives, maintain cognitive skills, keep them from feelings of emptiness and loneliness, and help them experience meaning in life (Ayalon et al., 2020).

Spirituality was the third most mentioned theme. Spanish older individuals were who most mentioned this theme. Spirituality was important to give meaning to participants' lives and help them face this difficult phase. The literature indicates a relationship between spirituality and a good life in old age (Roman et al., 2020). In addition, spiritual care is about providing compassion and empathy during times of greater stress, anguish and anxiety (Roman et al., 2020). Spiritual care has been a factor of great importance for holistic management of health, especially in terms of coping with suffering, illness and death (Roman et al., 2020). Likewise, COVID-19 led participants to reflect on quality of life, health, well-being, meaning in life and especially about the end of life, which corroborated the literature (Lewnard & Lo, 2020). Furthermore, participants used smart technology to assist their spiritual and religious devotion, using tools such as apps and websites to improve their religious education and devotional emails, and improve their spiritual experiences. Indeed, smart technology can facilitate participation and growth in religious and spiritual life (Roman et al., 2020) and religiousness is related to a sense of meaning in life in old age (Roman et al., 2020).

The next most indicated theme was Health and Safety-Related Support, again mentioned especially by Spanish participants. Older people value health-related technology that gives them independence, safety and protection, allows them to manage their own health, and helps them in their daily activities (Vaportzis et al., 2017). In this line, participants indicated that

with smart technology it was possible to maintain assistance in health and safety. These participants felt connected with the outside world, namely in relation to the evolution of Covid-19. Note that the quality of life of older adults can be improved by the use of innovative technologies, mainly by monitoring their health situations through remote controlled technology; by increasing self-esteem, since they no longer depend on other people; by reducing loneliness, through the interaction with specific online groups; by keeping senior individuals active through online communication; and by providing formal medical care and preventive care (Anderberg, 2020).

The fifth theme indicated by participants was Self-Growth, a topic mentioned most by Portuguese participants. Older adults use smart technology to invest in their internal growth, which can contribute to meaning in their lives (Morrow-Howell et al., 2020). Smart technology can be used to expand one's mood and wisdom, which affects meaning in life. Moreover, older people use the Internet and social media to support informal, self-directed learning goals, to empower themselves and to develop their inner being (Morrow-Howell et al., 2020). Accordingly, some participants shared that this phase provided important life lessons, such as being in peace with themselves, looking for meaning in daily situations, meditating, enjoying the current moment, and being grateful.

The recent literature indicates that the use of technology to help meditate, self-help, report mood and support mental health is beneficial for the internal growth of older adults (Finn, 2020). In addition, smart technology offers new opportunities for old people in distress when traditional resources are unreachable, unattainable or require special effort (e.g. online therapy and counselling, online support groups) (Finn, 2020). Furthermore, the use of smart technology empowers older adults by engaging them in critical thinking and decision-making, which leads to self-efficacy and empowerment, and further triggers their positive feelings towards themselves and their control over life, and their self-growth and meaning in life (Lewnard & Lo, 2020).

The last theme mentioned was Physical Activity, and mostly indicated by the Italian participants. There has been a major impact on physical activity behaviour worldwide due to COVID-19, which forced people to stay home and isolate themselves. Technology-based exercise interventions can improve physical activity and exercise adherence in older people and can contribute to feelings of empowerment and self-esteem. Moreover, smart technology applications offer well-accepted methods to realize exercise programmes for older adults, improving healthy behaviours, psychological outcomes, clinical parameters, motivation and enjoyment (Buyl et al., 2020). Many participants continued exercising with the help of Apps, online personal trainers, tutorials on YouTube and others. Dancing, gymnastics and exergaming were the most indicated physical activities. New technological tools, such as Fitbit, are increasingly being used as an alternative to conventional rehabilitation-based exercises (Buyl et al., 2020). Research showed that older adults exposed to exergame training are able to improve a variety of physical functions, such as balance control, cardio-respiratory fitness and gait speed (Buyl et al., 2020).

The present study has a number of limitations. The number of participants was relatively small, which limits the comparability and generalization of findings, and there was an uneven sampling of nationalities. Considering the cultural differences, a more balanced distribution would be advantageous, and a greater sample size to incorporate a broader selection of older adults. Even though the study was designed to be free of bias, one core area was predefined. Hence, interviews tended to steer to this area, which could have biased the findings.

Notwithstanding these limitations, this exploratory study is valuable for a number of reasons. Firstly, it includes a sample with four nationalities, which allows for intercultural comparison. The user-driven findings reveal a variety of cultural perspectives, which contribute to knowledge about interventions that can reduce costs and improve health and quality of life during a pandemic. Considering that people in different cultures show different meanings for their experiences, qualitative research provides access to the varying perspectives of older adults' meaning in life.

Planning public health resources, expertise and intervention programmes that aim to reduce frailty and social isolation should include assessments of meaning in life among older adults, and the attitudes of older individuals regarding technology. Moreover, there is a need for meaningful activities that improve health and well-being of older adults in the community (Duppen Rn et al., 2019).

Worldwide, the number of old people in the population and the need to adequately help them is increasing. Older adults may feel powerless in face of new technologies, however an effective use of smart technology permits their integration in current daily life and access to a convenient and ergonomic high-tech life (Ayalon et al., 2020). Smart technology offers

older people more ways to realize their own value and achieve meaning in life. However, Covid-19 challenged their meaning in life by having to live through adversity, in many cases in isolation during an unprecedented period of their lives. These older participants found ways to socially reconfigure their day-to-day lives through smart technology and experience meaning in everyday life. This use of technology supports Peace et al. (2011) notion of 'option recognition', wherein older people strategically modify their behaviour and living environments to maintain a sense of connection with a living space. During COVID-19, smart technology created affordances for the older people in this study to live in place with a sense of meaning.

Moreover, older participants from diverse cultures used technology differently in developing their meaning in life. Meaningful relations were reported mainly by Mexican participants, while rewarding activities were mostly indicated by Portuguese participants, and spirituality was mostly reported by Spanish older adults. Indeed, understanding how older adults perceive technology is essential to facilitate implementation and maximize its potential to provide them an independent life. Moreover, it is of utmost importance to continue to reduce the gap between frail old people, health professionals and health providers, and new technologies, bringing together the diverse views on technology. Although the development of smart technology seems to entail many obstacles for older adults, devices focussed on communication, access to information, personal investment, entertainment, safety and monitoring behavioural, and medical issues can help older people find meaning in life. In brief, the impact of this period of isolation on the future meaning in life, well-being, both physical and emotional, of older adults is still being determined. This exploratory study adds value to the still unknown relation between smart technology and meaning in life among older adults from different cultures, highlighting the pertinence of meaningful relations, rewarding activities spirituality, health and safety-related support, self-growth, and physical activity in old age.

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The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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