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The contribution of healthcare smart homes to older peoples' wellbeing: A new conceptual framework

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ABSTRACT

Healthcare smart homes (HSH) are promoted as a possible solution in response to demographic ageing. They encourage ageing-in-place by enabling residents to remain in their own homes by utilising smart technologies to allow safe and independent living. However, the degree to which they currently encourage relational wellbeing of residents and their wider networks is novel. This critical narrative review provides a theoretical contribution to the growing body of social science literature around the impacts of HSH living. It highlights the potential links between HSH living and impacts on relational wellbeing of residents and wider networks. Arguing that existing HSH literature has often focused on single technology devices and the perceived benefits of HSH living by technology and home developers, rather than lived experiences of HSH residents, it presents a new conceptual framework, around which HSH should be promoted, focussing on individual residents and their caring networks, rather than technological possibilities. Specifically, the new framework highlights the importance of HSH resident wellbeing which we suggest may be maintained and enhanced through ensuring a sense of home, relational rather than independent living, accounting for potential spatial inequalities and the importance of an appropriate use of language. This paper aims to generate discussion around better understandings of what it means to live with healthcare technologies at home, and how these may act to (dis)empower those wishing to age-in-place or otherwise.

1. Introduction

Globally the population is ageing. Since 1980, the number of people aged over 60 has more than doubled in size and is projected to do so again by 2050 to 2.1 billion (2017). The impacts of demographic ageing have been widely discussed and include overburdened health and social care services (Layzell et al., 2009). Demographic ageing is changing the demands on healthcare services, and older people are increasingly self-managing their long-term conditions (Garnett et al., 2018). Due to particular attention being paid to this self-management within the Global North, debate in previous research and this paper focuses within these geographic locations. With digitalisation and demographic ageing, 'eHealth technologies, smart homes and digital applications to facilitate social interaction have considerable potential to support individual and community wellbeing' (Philip and Williams, 2019: 620), as well as facilitating desires to remain living at home (Bennett et al., 2017). In this paper, we define HSH as any digitalised home that aims to promote independence and wellbeing through technology (HSH) devices utilised through networked automation systems, combining passive and active monitoring technologies for healthcare from a distance. Examples of HSH devices include wearable fall alarms, remote GPS trackers and portable heart rate monitors, devices that may encourage social connections such as Smart Phones, as well as ubiquitous smart devices like virtual assistants (e.g., Alexas, Siris).

Although the desire of older people to age-at-home is well documented (Visser, 2018, Sixsmith et al., 2017, Vasara, 2015), the consistency and quality of research about older people's perceptions and experiences of healthcare technology (e.g., telehealth and telecare) have varied. HSH and health technology visions neglect the range of desires that residents and their wider networks may hold, beyond the simple desire to age-at-home (Neven, 2015, Bergschöld et al., 2020). As Neven (2015:33)[2015 20 highlights, 'a common idea about older people is…[that they] want to live independently in their own homes for as long as possible…[and] it is also very common for designers, engineers and policymakers to link this idea about older people to technological interventions'. Furthermore, the dominant narrative for developing HSH, as a means to enable ageing-in-place, is based on the normative notion of the home as a 'good place' in which to 'be ill' or to recover from ill-

Abbreviations: HSH, Healthcare smart home(s); SHT, Smart home technology.

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ness. For example, Fit Homes, a type of HSH created in Scotland, aim 'to utilise data capture and Internet of Things capabilities to predict and prevent episodes that can lead to ill health. This should enable people to live independently at home for as long as they want, while potentially allowing for early hospital discharge' (TEC). However, a consideration of wellbeing, and its significance for older HSH residents, may challenge and change these somewhat idealistic visions. In this paper, we draw on state-of-the-art scholarship across several ontologies such as studies of home and relationality, highlighting connections to the current wellbeing agenda, with a particular focus on relational wellbeing. We begin with a narrative review of literature relating to wellbeing within ageing discussions (Section 2.1), conceptualisations of ageing (Section 2.2), and the role of home within HSH for older people (Section 2.3). We interrogate areas of previous focus and identify gaps, before introducing our new framework (Section 3). Concluding with recommendations for policy, practice and future research (Section 4), we aim to encourage greater debate around the experiences and impacts of HSH developments on older people and their caring networks.

2. A narrative review: older people, wellbeing and healthcare smart homes

This section offers a narrative review of the key components which have given rise to our proposed conceptual framework.

2.1 From wellbeing to relational wellbeing within discussions around ageing

Wellbeing emerged as a means to demonstrate, value and measure society, in alternative ways to GDP, employment or health levels (Dodge et al., 2012). Wellbeing is often presented as a synonym of health; however, many argue that having good health does not necessarily equate to good wellbeing, and prefer a definition that allows a connection between wellness and health (Deci and Ryan, 2015, Smith and Reid, 2018). Wellbeing is ultimately a hard-to-define term (Dodge et al., 2012). Although many authors have attempted to create a universally accepted definition, this has not yet been realised. Furthermore, wellbeing is often understood as both a concept and a desirable goal (Dodge et al., 2012).

Hedonic (or subjective) approaches consider wellbeing in terms of activities that create and nurture pleasure and happiness (Keyes and Annas, 2009). However, such an approach has been criticised as it assumes a singular pursuit of happiness and does not account for wellbeing achieved by activities that may not derive pleasure (Deci and Ryan, 2005). Meanwhile, eudaimonic (or psychological) approaches associate wellbeing with life satisfaction and human flourishing over time (McMahan and Estes, 2011). A critique of this approach is that it considers life satisfaction and self-fulfilment as objectively valuable (Tiberius, 2014). Absent in both these approaches is a focus on wellbeing in a more-than-individual sense, i.e., the role, and potential of, wider relationships and social interactions. As such, some authors (White, 2015, Atkinson, 2013, Gergen, 2009) have argued that wellbeing cannot be fully achieved by an individual and instead is relational (i.e., it is created through relationships). For White (2015: 11), [2015 [2relational wellbeing 'approaches people as subjects and aims to understand the ways they see the world in as near to their own terms as possible'. Meanwhile for Atkinson (2013: 138), key are 'the mutually constitutive interactions amongst the material, organic and emotional dynamics of places'. Whilst Gergen (2009) challenges the dominant normative thinking of autonomous bounded beings, from one of individuals who forge relationships, towards one of relationships that forge individuals. Thus, we argue that relational wellbeing may be particularly important as we age, in terms of maintaining strong personal relationships with places, spaces, and people (Francescato, 2017).

There are some common factors that these authors (White, 2015, Atkinson, 2013, Gergen, 2009) highlight as being important for achieving this relational wellbeing. Specifically, autonomy over one's decisions and surroundings (White, 2017), empowerment (Francescato, 2017), positive mood, functioning and life satisfaction (Francescato, 2017). Autonomy is a key predictor of wellbeing and maintaining autonomy in older age can be harder if everyday living tasks become more difficult to maintain (Fausset et al., 2011). Empowerment, achieved by enabling older people to make their own decisions over where they may wish to age (Francescato, 2017) can be a cyclical means of both: (i) improving health and wellbeing and, (ii) in creating the right circumstances for such improvements to occur. However, simply promoting empowerment and autonomy is unlikely to improve wellbeing in older age if the individual does not also possess a positive mood, functioning and life satisfaction, both from their own perspective and from that of their wider networks. These aforementioned characteristics are therefore particularly fundamental. How these characteristics are potentially fulfilled through our new conceptual framework will be discussed in Section 3.

In this paper, we argue that wellbeing will also impact on the desirability for, and experiences of, HSH, particularly given the political enthusiasm for HSH (e.g., Scotland's TEC Ready programme, or the UK's All-Party Policy Group for Assistive Technology) which may have far-reaching consequences if lived experiences of residents and wider networks are not properly interrogated and understood. For instance, HSH developments are often driven by technocentric (Courtney et al., 2008) or healthcare solutionism (Liu et al., 2016) (i.e., in terms of their promotion and representation within marketing). Although the lived experiences of HSH residents (Burrows et al., 2018) is gaining attention, there remain literature gaps around how these impacts manifest over multiple spaces and with multiple residents, for example, in Global South countries (Marikyan et al., 2019), areas with poor digital connectivity (Philip and Williams, 2019), or multiple-occupancy HSH (Burrows et al., 2018). In particular, 'the actors beyond the domestic end-users, such as relatives, clinicians, and technicians, who usually come into play as part of smart home and healthcare infrastructures' (Burrows et al., 2018: 117). This paper offers a new conceptual framework for developing HSH that may further the relational wellbeing of specifically older residents and wider networks.

2.2 Conceptualisations of ageing

Ageing is increasingly recognised as a socially and culturally constructed concept (Plath, 2008). Numerous authors (Fealy et al., 2012, Bytheway, 2005) have highlighted the use and reuse of 'old people/person', particularly in the Global North, as a means of 'othering': giving 'rise to the subjectivities that both stigmatise and sustain institutionalised ageism' (Fealy et al., 2012: 100). Whilst others (Peace et al., 2006, Amery, 1994) have highlighted that older people are often depicted as passive and burdensome recipients of health and social care. Ageing discourse has also been adopted within policy domains and reframed to fit certain policy ideals and desires (Fealy et al., 2012). The recent move towards neoliberalism, at least in the UK and USA, promotes the idea of 'active citizens' taking greater responsibility and autonomy for their welfare (Bevir, 2016). For example, in Scotland, the policy focus on Realistic Medicine (Scottish Government 2018), which has sought to move away from the 'doctor knows best' culture, has drawn attention to the role of the (often older) patient as an individual decision-maker in their own health and social care. Thus, there have been increasing discussions within gerontology of how older people are increasingly being polarised within society, as either 'can-do' participants, or 'dependency prone and at risk' [Katz's: 147] recipients of healthcare and surveillance. The idea of the dependent 'elderly' reflects dominant views in society, rather than the natural process of ageing (Fealy et al., 2012), and is traditionally associated with declines in health, mobility and freedom. It also shapes how older people may view their role in society. This unhelpful framing of older people, ageing and ageing-in-place, has paved the way for the emergence of potential technological solutions that promote independence and maintain a sense of identity (Neven and Peine, 2017). However, the polarisation of older people can also cause issues as the

potential technology devices are 'bound to specific sets of numbers, standards, and profiles linked to a tyranny of healthy activities and lifestyle expectations developed for stereotypical older people' (Katz and Marshall, 2018: 64). Also, treating older people as a homogenous group fails to recognise that individuals have different needs, wants, and resources, at their disposal, as well as identities which may change and evolve. Nevertheless, these different framings also help to show how the HSH narrative has emerged and may be useful in understanding the relationship between HSH and wellbeing. This relationship is now explored further concerning the framing of the home within HSH for older people.

2.3 The home within HSH for older people

Gram-Hanssen and Darby, (2018) argue the home should be a: site of security and control; site of activity; place for relationships and continuity; and a place of identity and values. There is also a vast existing literature highlighting the importance of the home for good health and wellbeing (Tuan, 1980, Imrie, 2004). For Tuan (1980), home is important as a site of recovery from illness, and for Burrows (Burrows et al., 2018), the sense of at-ease-ness facilitated by feeling and being at home during times of illness cannot be understated. Thus, the potentials for and motivations behind HSH development, as a site to both maintain a sense of home and 'tbe well' are clear. Furthermore, these homes often combine telecare[1], telehealth[2] and smart home technology[3] devices to enable 'ageing-in-place' (Currie et al., 2015). Ageing-in-place emerged in recent years as an alternative to residential or infirmed care (Sixsmith and Sixsmith, 2008), providing greater autonomy (Kaika, 2004), connection to social networks (Visser, 2018), and cost benefits (Ehrenhard et al., 2014). Furthermore, it is often preferred by older people themselves (Milligan, 2009) and may encourage more localised healthcare by enabling individuals' greater involvement in their health and social care, which in turn may be more empowering.

The diversity of conditions, technologies, geographies, and ownership arrangements of HSH have meant the impacts on wellbeing have been hard to assess. Furthermore, there have been few systematic reviews which have specifically focused on HSH for older people [for exceptions see Liu et al. (2016), Reeder et al. (2013), and Peek et al. (2014)]. Even looking more broadly, systematic reviews of smart homes (Marikyan et al., 2019, De Silva et al., 2012, Wilson et al., 2015) have focused on either a single device or single resident, ignoring the multifunctionality of the home (i.e., for multiple purposes or multiple residents), or on the perceived benefits at the design stage rather than real-world resident experiences (Marikyan et al., 2019) (i.e., the performance gap). However, this does not take into account the multifunctionality of residences as, for instance, people proactively move to or transform existing homes into HSH to improve their health and care. Moreover, this understanding ignores that homes can be shared and that other people who share the home or visit frequently, may have a different sense of home. Relatedly, few studies recognise, or explain, how the sense of home may alter after moving, or reconfiguring one's existing home, into an HSH (Brintazolli, 2018).

Multiple systematic reviews (Liu et al., 2016, Reeder, 2013, Zwijsen et al., 2011), have shown that although there are many potential benefits of HSH and living with smart health devices, there has not yet been adequate investment in such homes on any great scale. Given this lack of investment, there are related literature gaps around: the experiences of (multiple) resident(s), and wider networks of living in fully-fledged HSH (Burrows et al., 2018); the potential specific impacts of the spatial differences in HSH living; and the connections between wellbeing and living with, or in some cases moving to a HSH Carnemolla (2018). In terms of spatial differences, there has been little HSH research investigating rural areas (Philip and Williams, 2019). Moreover, such existing studies have focused on single devices rather than fully-fledged HSH. HSH research to date has predominantly focused on the Global North and fails to account for differences such as geography and population dynamics (Philip et al., 2017), the variety of healthcare systems and access to devices (Carnemolla, 2018).

Numerous studies have been conducted in recent years concerning usability, perceptions and acceptance of specific smart healthcare devices, including personal sensors for identifying location (Aceros et al., 2015), safety (Bennett et al., 2017), or wellbeing (Patel et al., 2012). From a healthcare disciplinary perspective, Patel et al. (2012) reviewed the existing research concerning the use of wearable sensors to detect wellness, disorders, and treatment efficacy, and found that such interventions needed to address issues of high costs to enable these sensors to improve the care for older people. More recently, there have been social science contributions. Aceros et al. (2015), explored personal telecare alarm use by older people and found that different framings of 'good ageing' require different interventions and that on occasions these various interventions (e.g., devices), can undermine one another. This highlights the difficulties that may emerge with idealistic notions of HSH, to 'solve' multiple health and wellbeing issues in older age, when the various devices may contradict one another. Furthermore, the potential impacts such contradictions may have on a sense of home will be further explored in Section 3.3.

Relatedly, the second key area of research has focused on the potential HSH benefits conceived by the technology and home designers, rather than resident's lived experiences. This is also known as the performance gap, whereby the perceived benefits do not align with the actual experiences (Allard et al., 2018). Moreover, HSH studies, have assumed that ultimately the resident will have some degree of choice in their HSH living decisions (Amiribesheli, 2015). Such studies also assume the resident will be fully engaged with, and aware of, what happens in terms of the sharing of their health data or other data (Ranasinghe et al., 2016) (e.g., movement or location). Much of the HSH benefits research, perceived or actual, has focused on whole healthcare service level, for instance highlighting efficiency or cost-savings for healthcare systems (Majumder, 2017). There is an assumption that these perceived benefits will transfer down to individual residents, however, this does not always occur (Deci and Ryan, 2005). This existing performance gap is especially important when considering HSH, in terms of residents and locations, which are atypical in terms of geographic location, having multiple comorbidities, or living in a multi-occupancy HSH. These issues will be explored further in Section 3.

Finally, there is an increasing body of literature exploring resident experiences. For instance, Burrows et al. (2018) explored how people of various ages navigate boundaries and borders in an HSH. They found that there is a greater need for mechanisms to control the interpretations of data and flow of information about them and their home. The positive experiences of HSH residents such as improved independence (Courtney et al., 2008), or a better understanding of one's health (Patel et al., 2012) have also been highlighted. However, negative experiences, such as reduced sense of home Brintazolli (2018) and loneliness from fewer meaningful interactions (Greenhalgh et al., 2013) have also been reported. Furthermore, few studies have specifically explored the experiences of older HSH residents, instead focusing on residents of various ages with specific health conditions (e.g., dementia) Amiribesheli (2015). Overall, the research on residents' experience has highlighted that the experiences are often unique to the individual (Burrows et al., 2018), and their relationships with their wider net-

[1] Telecare is a technology that monitors 'aspects of an individual's activity, or related activities, in the home e.g. fall alarms and motion sensors' (Rubinstein and Parmelee, 1992).

[2] Telehealth technologies 'require active involvement form the patient to take readings e.g. blood pressure, that are regularly submitted for review by health professionals' (Rubinstein and Parmelee, 1992).

[3] Smart home technology uses devices connected to the Internet of Things to automate and monitor in-home systems, e.g. smart thermostats, energy monitors, lighting, home security systems, wireless speakers, Alexa/ Siri, remote door locks, and even the smartphone.

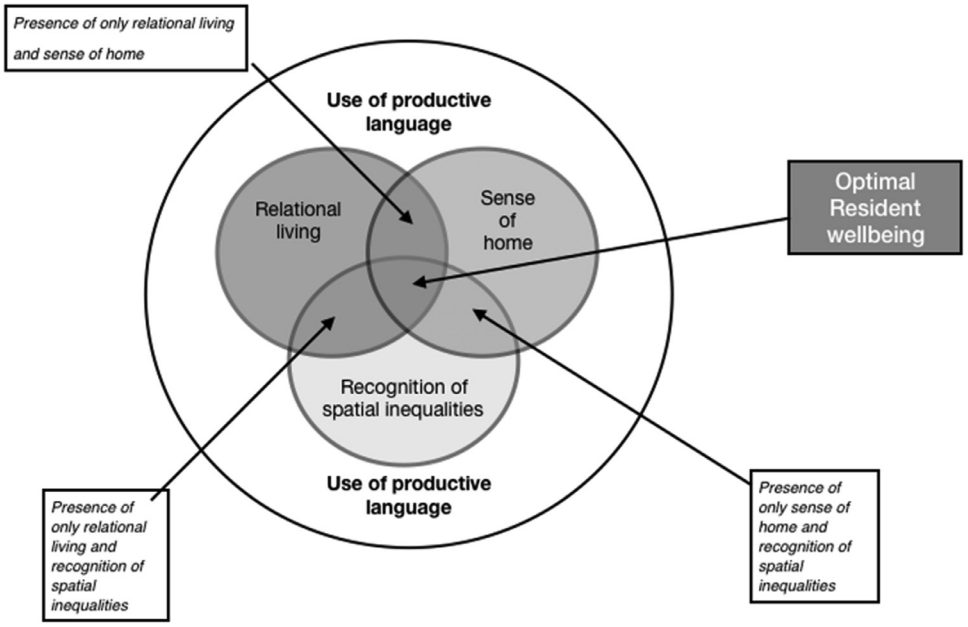

Fig. 1. New conceptual framework: for developing healthcare smart homes that promote optimal resident and wider network relational wellbeing.

works, emphasising the importance of relationality within HSH living and wellbeing. Despite the contributions outlined thus far, there remain some significant gaps in understanding, as we now explore.

2.4 A summary

As discussed earlier, HSH for older people have emerged from a specific context: demographic ageing, ageing-in-place, the promotion and availability of smart technology, a drive to sustain communities and to promote resident wellbeing. The resulting HSH narrative is, however, idealistic, utopian, even evangelical, and critically, lacks a comprehensive grounding in critical social research with HSH residents. Whilst there have been advances in HSH research, there remains a lack of empirical research on impacts of, and (multiple) motivations for, using these technologies at home, specifically from social science perspectives (Marikyan et al., 2019), particularly concerning long-term relational wellbeing. Furthermore, it is unlikely such homes will be experienced in the same way by each resident. Existing research has found that HSH for older people may encourage social isolation (Zwijsen et al., 2011), reduce a resident's sense of home (Peek, 2014), and create an unrealistic view of ageing-in-place Carnemolla (2018). We argue that the narrative around the benefits of HSH living, and the impacts on any additional occupants and informal and formal care networks (Hine, 2019, Goulden, 2019), needs to be critically interrogated. We call for a focus on lived experiences rather than idealistic visions, and particularly, HSH which are more closely aligned with promoting resident wellbeing. Thus, we offer an alternative framework to explore the phenomenon of HSH living for older people.

3. A new conceptual framework for HSH

This section introduces a new conceptual framework. Useful conceptual frameworks developed to encourage ageing-in-place (Wiles et al., 2012), wellbeing (Dodge et al., 2012), and technology adoption Rogers (1995) exist but do not account for the new and emerging impacts from living in an increasingly smart world, or a focus on relational wellbeing. Our new framework (Fig. 1) develops these within an HSH for older people context. It is intended to focus on the older resident's (and their wider networks) wellbeing in relation to HSH experience, alerting policymakers and HSH developers to its importance. Furthermore, we have selected these particular criteria due to their potential importance for people as they age, and as a means to improve the wellbeing of both residents and their networks.

Our framework revolves around four interlinked theoretically underpinned criteria which we view as critical in the attainment of relational wellbeing: relational living; recognition of spatiality; sense of home; and society-wide use of appropriate language and images when referencing older people. Changes, and absences, in one criterion, could impact another, but all criteria are necessary to enable and enhance the wellbeing of the resident and their wider networks. The relative importance of each criterion will vary according to each context, and thus the order in which they are discussed in the paper does not signify or represent any level of importance to the authors. Each criterion will be discussed below, considering the potential implications for resident wellbeing in terms of the key characteristics of relational wellbeing highlighted in Section 2.1.

3.1 Promotion of relational living

Ageing-in-place literature suggests there may be several benefits of continued home-living (Sixsmith and Sixsmith, 2008, Gitlin and Piersol, 2016, Hillcoat-Nallétamby and Ogg, 2014), such as maintaining social relations and positive mood, independence, empowerment and autonomy, some of which are key characteristics of relational wellbeing. Yet, independence and autonomy gains may be lost in exchange for greater technological control in the case of HSH living. Moreover, alternatives to ageing-in-place (e.g., institutionalised care) are increasingly recognised as disempowering for and by older people, and thus stigmatising those who cannot or do not wish to age at home (Vasara, 2015). A focus on independence may therefore become problematic if these homes continue to promote and develop technologies that encourage individualistic and thus potentially isolating lifestyles. For example, devices that enable video conferencing may reduce the need for physical visits to the doctor or create societal divisions due to the costs of the devices and their upkeep. It is also at odds with recent research highlighting the importance of interdependent and relational living (Perkins et al., 2012, Clark et al., 2020), and the connections to relational wellbeing, in terms of positive relationships with others.

Increased independence may not be achievable if devices are not easy to use, maintain and fix without significant assistance from others (Hine, 2019). Hillcoat-Nallétamby and Ogg (2014: 1771) found that contemplation of a move in older age 'may be shaped more by a desire

to *attach* to people, rather than to remain in situ through a preference for preserving any *attachment to place'*. Current HSH developments may not fully recognise desires to maintain in-person social interactions, such as relationships with existing cohabitees or caregivers (Hine, 2019), or within the wider community (Thomas and Blanchard, 2009). However, the importance of such interactions are considered key within notions of relational living, whereby experiences and wellbeing are directly connected to the creation and maintenance of social and interpersonal interactions, especially as we age (Francescato, 2017). The promotion of relational, rather than independent, living is thus likely to be key in the attainment of relational wellbeing within a HSH.

Without recognising the importance of relational living and social interactions, HSH may lead to greater potential for social isolation as residents are presented with fewer opportunities to continue social ties and a sense of community. Relatedly, without a focus on the importance of social interactions, residents may not be able to rely on their social networks if, or when, they encounter difficulties using their devices. This in turn may create feelings of disempowerment if residents are unable to continue to use such devices (Vaportzis et al., 2017). Furthermore, there have been multiple calls within wellbeing (Smith and Reid, 2018) and new materialisms scholarship (Barad, 2014), on the need for more relational approaches for achieving wellbeing, given the entangled nature of our lives and bodies. Continued and further research is required to understand the degree to which older HSH residents can, and do, experience and appreciate relational living whilst living in a HSH, and the role that relational wellbeing may play in such experiences.

3.2 Consideration of spatial differences and inequalities

The second key criterion is a consideration of spatial difference, which was introduced as a key literature gap in Section 2, and a key characteristic of relational wellbeing in terms of having autonomy over one's surroundings (White, 2017). Ageing-in-place is promoted to sustain communities (Currie and Philip, 2019), a sense of identity (Wiles and Jayasinha, 2013) and independence (Peace et al., 2011). Maintaining a sense of community has been popularly articulated as a rationale for ageing-in-place, whereby residents continue their social ties and daily routines within their communities (Aceros et al., 2015). Also, key, is the importance that individuals may place on their healthcare visits for generating social interactions and maintaining routines (Ridgway et al., 1994).

Although there has been research conducted around the feasibility and acceptance of telehealth and telecare technologies in rural areas (Currie et al., 2015, Dowds et al., 2018), there is little existing research on the experiences of fully-fledged HSH for older people. As such, there is a lack of empirical research on the specifically rural aspects of HSH living, such as the digital divides [e.g., Philip et al. (2017)]. The use of HSH in enabling rural ageing-in-place may also add to discussions around the rural idyll, in which rural living is romanticised as something timeless, and untouched (Shucksmith, 2018). As illustration, rural areas can be stereotyped as 'idyllic places of peace, as repositories of national identity' [(Shucksmith, 2018: 163)]. Currently, HSH can continue this idyllic vision, but can also become an antithesis to the rural idyll, whereby rural areas can be modernised through smart technology. Yet ageing-in-place, through HSH, does have potential to sustain attachment to place, be that urban or rural, by helping retain connections to the past (Rubinstein and Parmelee, 1992), and obtain enhanced relational wellbeing in later life and nourishment from place (Francescato, 2017). Thus, consideration of the wider dwelling (Ingold, 2000) may be helpful, whereby the wider environment, rather than merely the house, is considered in terms of appropriateness of design, availability of local services and amenities, perceptions of neighbourhood safety. Without improvements in the provision of services and digital infrastructures, particularly in some rural areas (Williams et al., 2016), HSH development across all geographical settings may prove difficult, if not impossible.

Without any consideration of space or geographical circumstances, it may be difficult to encourage and foster resident wellbeing for several reasons. Without such consideration, HSH may not be fit-for-purpose, for instance, in locations where levels of internet connectivity are low, such as some remote and rural areas (Philip et al., 2017). Issues may also arise relating to the implications on the three pillars of the digital divide (Philip et al., 2017, Salemink et al., 2017), specifically digital infrastructure, digital literacy, and appropriate use and upkeep of digital devices (e.g., inadequate long-term training on how to use smart devices such as tablets, smartphones or smart heating systems). Relatedly, without consideration of spatial inequalities, HSH developments may be limited to those who can afford to purchase HSH devices (Bennett et al., 2017), or those who live in areas with appropriate digital connectivity (Salemink et al., 2017). Finally, HSH living may limit the opportunities for residents to maintain a sense a community if, for instance, the residents are no longer required to visit the shops or the GP due to increased online shopping and GP appointments via videoconferencing. This can also link to the ability to maintain a sense of home.

3.3 Maintaining a sense of home

Several assumptions underly the dominant HSH narrative. Darby (2018), although discussing smart homes more generally, highlights that they are often presented as neutral apolitical places, absent of conflict. This relates to the misplaced assumptions about the seamless ubiquitous nature of SHT which can improve quality of life (e.g., motion sensors alerting others if the resident falls, yet motion sensors can also make mistakes and become a 'nuisance' in terms of false alerts) (Schüll, 2016). Thus, the home is required to fulfil multiple roles, and the introduction of technology may impact on the extent to which it can continue to fulfil these criteria. HSH marketing materials may promote the assumption that older people will continue to feel 'at home' in their home, even after it has become healthcare-smart (Tuohy, 2019, ProInstall 2019, SafeWise, 2020). Furthermore, although HSH can allow for longer home-based living, in reality, what constitutes an 'at home' feeling may have changed as household tasks become more difficult (Fausset et al., 2011), health and functional abilities decrease (Vasara, 2015), or family roles change (Hooyman and Kiyak, 2011). This connects to the relational wellbeing characteristics of autonomy over one's surroundings, empowerment and positive mood and functioning and further research is warranted to begin to fill the literature gap on the connection between resident wellbeing after moving to, or transforming their home into, an HSH.

HSH, as with all technology, are not neutral devices (Zuboff, 2019). They should be considered as powerful objects. HSH technology may alter the routines of its inhabitants, such as fewer physical GP visits, or inhabitants losing the routine of turning off their lights and appliances due to automatic lighting, which could impact on a resident's wellbeing and sense of home. The home, as a site of safety and refuge (Sixsmith, 1986), may be redefined as a site of pain and scrutiny, after it has become 'healthcare smart'. As such, there are also many links between technology and power, and so portraying the smart home as conflict-free (Gram-Hanssen and Darby, 2018) is unlikely to be accurate.

The rise in ageing-in-place has prompted further discussions on the relationship between space and place 'in its meaning of house (objective space), home (emotional space) and dwelling (comfortable space)' (Cristoforetti et al., 2011: 225). These are fluid concepts that require further unpacking, particularly when ageing-in-place is proposed alongside new health and social care practices (e.g., HSH). HSH may also alter the idea of homes as more quasi-public-private places, which may change a resident's sense of place and home over time. Milligan (2009) has referred to this as the institutionalisation of the home, whereby the boundary of public and private space can become increasingly blurred as external actors (e.g., hospital and care staff, family and friends) start to play a greater role in the home care of the resident, through data sharing and

surveillance. There are also connections to ontological security which relates to the importance of having continuity and order over an individual's life experiences (Colic-Peisker et al., 2015), and further links to some of the key relational wellbeing characteristics. Indeed, healthcare and smart technologies may be forced upon the residents, or their cohabitants, within the auspices of remaining in their homes (Hine, 2019, Goulden, 2019). Thus, the inclusion of SHT for healthcare may impact on the sense of home and control over one's life that the resident experiences, especially when routines are altered.

HSH technology is often promoted as unobtrusive, seamlessly fitting into the homes and lives of residents (Peine and Neven, 2020). Yet, the inclusion of any technology will impact the residents and may configure homes and residents in a certain way, such as to create social change Östlund et al. (2015). The inclusion of healthcare at home can blur the boundaries between the home and body as the two become increasingly intertwined ()(Lupton and Maslen, 2018). Within HSH, residents become both more visible, with increased surveillance through continuous monitoring and collection of personal health data (e.g., via motion sensors), and potentially less visible through fewer in-person healthcare visits. Understanding, and thus maintaining, a resident's 'sense of home', and the importance of their specific routines, is of key importance when developing HSH to ensure they are effective and appropriate.

Without consideration of the importance of maintaining a sense of home within HSH, it may be more difficult for residents to feel well whilst living in HSH. If residents do not feel 'at home', there may be less chance that they can maintain a sense of community (Aceros et al., 2015), as the two are interlinked. HSH can encourage wellbeing in the home by creating homes in which residents' feel more capable and in control (van Hoof et al., 2016), yet they can potentially reduce resident wellbeing by diminishing the 'at home' feeling. Without this feeling, residents may come to associate their house more with a lack of control and security (Burrows et al., 2018), and with pain and surveillance (Dyck et al., 2005) as it becomes a more public rather than private space, due to an increased gathering of their personal health and movement data by external sources which they cannot view. With this, it may become a disempowering space if residents do not associate the space - their home - with safety, refuge, and privacy, linking to the importance of empowerment within relational living and wellbeing (Mitra et al., 2020). Furthermore, homes need to be considered as spaces with potentially multiple occupants. Smart homes and HSH and their devices often target individual residents or can be controlled from afar by other family members for example (Hine, 2019, Goulden, 2019). This highlights the complexities that can arise from a focus on the singular resident, single device, or a single understanding of 'sense of home'. Thus, HSH can promote or obstruct wellbeing, depending on how the homes are developed and subsequently experienced. Thus, maintaining the sense of home is also of utmost importance in developing healthcare smart homes rather than merely healthcare smart houses.

3.4 Use of appropriate language

The HSH narrative often promotes these homes as an efficient solution to overburdened healthcare services, yet this may harm older people who cannot age at home (Vasara, 2015), or who require additional support to use SHT (Peine and Neven, 2020). Furthermore, language is a powerful tool for enacting control, and recent reframings of older people as active and successful citizens have helped to enable the possibility for ageing-in-place, as highlighted in Section 2.2. Hence the use of productive language is key throughout all of our framework. This productive language may help to further the relational wellbeing characteristics of empowerment, positive mood and functioning and life satisfaction. Terms such as elderly or frail carry with them certain negative connotations and stereotypes, as do images and user-representations based on vague stereotypical ideas of ageing and older people Katz (2000). Such terms and images have unfortunately been commonly used, as well as critiqued, within research on ageing (Fealy et al., 2012, Hooyman and Kiyak, 2011, Weicht, 2013). We would welcome a more neutral use of language within the HSH narrative which considers older people in a more positive light where possible, rather than as a problematic 'elderly demographic time-bomb' Layzell et al. (2009: 66). Instead, HSH should act as spaces to promote the wellbeing of older people and encourage the continuation of their lives and activities to the best of their abilities. Furthermore, ageing should be considered through a more social and geographical lens (Currie and Philip, 2019), to account for spatial specificities. As there may be huge differences in ageing in urban rather than rural areas. Within urban areas, older residents generally experience comparatively better transport links and live within closer proximity to family members and healthcare services (than in rural areas) (Currie and Philip, 2019). However, such differences can also be experienced simultaneously within various urban and rural areas.

3.5 Summary

This framework highlights that having in-person interactions, and thus a more relational rather than an independent and potentially isolating style of living, may enable older people to feel empowered to try HSH. There should also be greater recognition of the importance of place and home, and appropriate use of language, within HSH developments and other future options for ageing, whereby solutions cannot be one-size-fits-all. There should be a consideration of the individual preferences of each resident and their wider networks (including additional residents within HSH), as this too will encourage wellbeing. However, wellbeing will be manifest in different ways for each individual. As such, it is important to promote all criteria within the framework, as the degrees to which each criterion are important may differ according to each individual. In other words, each resident, and their wider networks, will experience their wellbeing in slightly different ways. A consideration of relational wellbeing understands the more-than individual nature of wellbeing that we believe HSH development should follow. Ultimately, the specific resident and their individual experiences need to be central to each decision and development to ensure that the other conditions are fulfilled. Maintaining a sense of home for new HSH dwellers is also potentially key to the building, or indeed maintaining, of resident wellbeing (Lê et al., 2012), by creating HSH that allow older people to continue their existing routines as safely as possible. The new framework promotes the importance of all aspects; however, we recognise it could be adapted if additional criteria emerge over time as potentially important for prospective HSH residents and their networks. Such adaptations should be expected in the future as the motivations for, and impacts from, smart healthcare technology use continues to evolve.

4. Conclusions and Recommendations

In this paper, we have argued that the current narrative surrounding HSH promotion needs to be better grounded in the longer-term lived experiences of older HSH residents, and their wider networks and cohabitees. The existing assumptions underpinning ageing-in-place, such as the importance of independence, are often intertwined with notions of power, as well as static, rather than fluid, ideas of 'home' and 'place'. The different constructions of 'older people' and ageing can also help to further particular paths of development or policies. Ageing-in-place is aided through the introduction of HSH but there are numerous links to wellbeing, such as: through new connections between the body and healthcare through wearable smart devices; and, the home and healthcare, with the home being considered a site of both refuge and pain. HSH may help respond to an increasingly growing demand for ageing-in-place, however, the evidence basis for this lacks real-world experiences. In our new conceptual framework, we have suggested four areas where future research could be developed. Indeed, our framework has highlighted: that building and encouraging wellbeing is critical; the need for adopting an ontological approach that recognises relational rather than

independent living; the need for paying greater attention to spatial differences and inequalities; the necessity of maintaining a 'sense of home' within HSH living; and, crucially, the use of more appropriate and positive language. This will lead to better understandings of what it means to live in a HSH and how these homes may act to (dis)empower those wishing to age-in-place or otherwise, and thus, create better experiences for older people.

We offer key recommendations to encourage the development of more appropriate and useable HSH. Firstly, we suggest there needs to be greater involvement of older people, and their caring networks, in the development of HSH, through citizen's panels or multiple focus groups, to create designs which may enable their residents to feel more at home, and less isolated due to a consideration of relational living and spatial inequalities. Ultimately HSH designed with greater input of older people and their caring networks (including any potential cohabitees) throughout, are likely to enhance wellbeing. Secondly, there needs to be more critical social science research around the multitude of impacts from HSH living. We recommend further and future research into the lived experiences of people with a variety of conditions, technological abilities, ages, and geographical locations, to highlight the variety of potential experiences, by way of ethnographic methods with not just the residents but also their wider networks. Furthermore, a shift in the policy agenda is needed from talking about ageing-in-place towards exploring the importance of space and place within the context of ageing-at-home, including more research and consideration of HSH and ageing in more than simply urban and Global North locations. Relatedly, researchers and practitioners from technology, healthcare and social science cannot continue to work in relative silos. Given the speed at which this technology is being rolled out, particularly during, and as a result of, the COVID-19 pandemic, there is an urgency to this interdisciplinary research to ensure that the technology and homes that are developed can be beneficial, rather than detrimental, to the resilience and wellbeing of our communities and ageing populations.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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