

Chapter 13

Receiving Care Through Digital Health Technologies: Drivers and Implications of Old-Age Digital Health Exclusion



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13.1 Introduction

We are living in a world undergoing comprehensive digitalisation. Services, behaviours and lifestyles are deeply influenced by the availability and exploitation of digital technologies in most of the spheres of life, such as interpersonal communication, commerce, and public services (OECD 2016, 2017). The continual development and refinement of sophisticated, connected and ubiquitous digital technologies have opened the door for a revolution of how most services are conceived, designed and delivered to populations, including older people (Schnoll 2014; Olsson et al. 2017).

Digital technologies are conceived within this chapter as those devices, such as smartphones, tablets, wearable devices, sensors and computers, which allow users to perform different kinds of activities mainly by connecting to the Internet (Lupton 2014). ‘Digital health technologies’ is a broader concept which refers to the application of digital technologies to the health systems, for example, to the following services: electronic health records (EHRs) and personalised health records (PHRs); ePrescriptions; remote consultation, monitoring and care services (*e.g.* telehealth, telemedicine); mobile health (mHealth) solutions for self-management of health, chronic conditions and physical activity (*e.g.* mobile apps, smartwatches,

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smart-wristbands); and health data analytics for clinical decision support systems (DSSs) (Bennett and Glasgow 2009; Barbabella et al. 2017; Sixsmith et al. 2017; World Health Organization 2017). In this chapter we focus on direct end-user technologies, based on the classification suggested by Weiss and colleagues (Weiss et al. 2018), targeting digital health. Direct end-user technologies are expected to be used by everyone, and thus by older people, for purposes of diagnosis, treatment, (self-) care, and communication with health and care professionals.

Health services are increasingly digitally-based in many European countries (Kummervold et al. 2008; European Commission 2018; Heart and Kalderon 2013), with direct effects on the behaviours of all patients and users. National and European policies promote and sustain such a trend, as the incorporation of digital health technologies is seen as a good strategy for improving the accessibility, quality and efficiency of current health systems which are challenged by an increased demand for care from an increasingly diverse and ageing population (Helbig et al. 2009; World Health Organization 2017; European Commission 2018).

It should be noted that digital health services are often, but not necessarily, linked to traditional health care providers. Usually these services are based on a health care infrastructure which consists of physical facilities and equipment, health professionals, patient information and further resources, which provide these digital health services with appropriate information, content and professional relationships with patients. For instance, telehealth services require (passive or active) remote monitoring by health professionals of an individual's condition and activity, and enable an interaction between the two (via connected devices or other equipment). Another possibility is that the digital health service is provided via a (quasi-) autonomous solution, *i.e.* an application or device that is used only by the patient without direct monitoring or correspondence with other health care staff. For instance, mHealth applications usually enable self-care for end users by providing notifications, reminders and advice on health status, lifestyle (*e.g.* diet, sleep) and physical exercise, on the basis of data reported manually or recorded automatically by the system. In this case, the digital health solution may or may be not connected to a specific health care facility within the framework of traditional health services.

Older people are one of the main user groups of health services (Robinson et al. 2015; Terraneo 2015), but also less likely to be engaged with these technologies (Peacock and Künemund 2007; Heart and Kalderon 2013; OECD 2017; König et al. 2018). Digital health technologies can improve the care of older people and its organisation, but also set some challenges with regards to old-age exclusion (Heart and Kalderon 2013; Czaja 2017; Olsson et al. 2017). The digital unpreparedness which characterises the circumstances of some older people can expose them to a higher risk of exclusion from the health services domain (Peacock and Künemund 2007). Hence, it is crucial to improve what is a limited understanding of the mechanisms of old-age digital health exclusion.

Despite the relevance and urgency of this topic, research in the field has not yet produced a coherent and systematic discussion of old-age digital health exclusion (Van Regenmortel et al. 2016; Van Regenmortel et al. 2018). The aim of this chapter is to conceptualise and discuss this phenomenon, contributing to a systematisation

of the discourse in this area. The key research question addressed by this work is: what are the mechanisms, causes and implications of old-age digital health exclusion?

For this purpose, we adopt a definition of social exclusion in old-age as operationalised by Walsh et al. (2017), who adapted the classical definition by Levitas et al. (2007). Old-age digital health exclusion is considered indeed as a mechanism initiated by a lack or denial of health rights, resources, goods and services, which impacts health and social well-being of older people, as well as societal equity and cohesion [see Walsh et al. this volume for a more extensive discussion].

The chapter is structured in three main parts. First, the main causes of old-age digital health exclusion are defined and discussed according to structural, environmental, individual and socio-technical drivers. Second, the major implications for exclusion of older people are analysed in the context of a digital society. Third, we develop and describe a conceptual framework illustrating the process of old-age digital health exclusion. Finally, key issues, risks and challenges are addressed in relation to the current state and projected future progress on digital technologies.

13.2 Drivers of Old-Age Digital Health Exclusion

Research offers evidence that old-age exclusion in the field of digital health is based on complex social mechanisms, which mainly rely on four types of drivers and their combinations: (1) structural drivers, which include social norms, values and discourses, as influenced by policies and market evolution; (2) environmental drivers, such as the physical contexts where communities and older people live; (3) individual drivers, concerning personal, social and economic characteristics of older people (Helsper and Reaisdorf 2016; Olsson et al. 2017), as well as their awareness of, interest in and willingness to use digital technologies (Siren and Knudsen 2017); and (4) socio-technical drivers, which include the design, development and evaluation of digital health technologies, which may intrinsically facilitate or limit digital use (Fisk et al. 2009).

The first three types of drivers are factors which are well-known in old-age exclusion research (Scharf and Keating 2012), whereas the fourth – the socio-technical drivers – is a necessary complement to include and consider the actual object of technology and the interaction between it and older individuals.

13.2.1 Structural Drivers

By reallocating resources, directing investments and conveying social norms and values, policy and the market – and their interaction – influence inclusion-exclusion dynamics and individuals' life chances. In the context of promoting digital health, structural factors can redefine the ways in which older individuals have or do not

have access to health and care and, thus, determine the prerequisites for benefitting from such services. Old-age exclusion from health services can result from a mismatch between prerequisites that are structurally defined and the resources on which an individual can count.

Digitalisation in the health sector has been largely promoted by European and national policies as a way to enhance health systems and make them more sustainable (European Commission 2018). Although the use of digital health services holds potential (Czaja 2017; Lindeman 2017), such policies introduce a deterministic view about the impact of a digital shift in the health sector – which relates to the concept of ‘techtopia’ (Turner 2010). As described by Peine (2019), policy discourse has mostly stressed the need to establish a ‘technification of later life’, which is meant to solve most issues of ageing societies. Within this perspective, digital health is promoted as an opportunity for users to be more in control of their own health, to receive more personalised care and to benefit from more accessible and efficient health systems (Lupton 2013; European Commission 2018).

However, such positive policy discourse seldom considers existing challenges for digital-based service provision for older people. Political action is lacking with regards to systematic investment in digitally-driven health systems, training of care professionals on how to deal with this digital shift, and improving technological infrastructure (Bennett and Glasgow 2009; Barbabella et al. 2017; Sixsmith et al. 2017; World Health Organization 2017). Moreover, limited attention is given to the digital inequalities which largely exist among older people. This reduces the efforts to ensure that the new services based on digital health technologies are inclusive, and that alternative services are provided where appropriate.

Positive discourse about ageing and new technologies are also market driven. The digital health solutions market has identified older people as a large consumer group to be targeted and as an opportunity for investment (Mostaghel 2016). Overall, the global digital health market is expected to grow from 140 to 380 billion USD in the period 2018–2024 (Capgemini 2018). Important technological advancements with the potential for improving health service provision are introduced, but it is crucial that market dynamics are not prioritised over individuals’ needs and interests.

13.2.2 Environmental Drivers

The physical environment, be it the immediate home or wider community environment, is a key element in facilitating or preventing inclusion of older people (Mahmood and Keating 2012; see also section V, this volume). The appropriateness of places, transportation and services can support individuals’ empowerment and participation. Two environmental drivers, linked to structural elements, are central to hindering the use of digital health technologies.

First, poor technological infrastructures generally constitute a major barrier to the access and use of digital services (König et al. 2018). Connectivity issues, which often characterise rural areas, are an example of a common limitation in

infrastructure which limit the internet access in private and public spaces and reduce opportunities to access digital health services through digital health technologies (Berner et al. 2014; Salemink et al. 2017). In those areas where the poor connectivity combines with the lower socio-economic status of rural dwelling older individuals, the lower use of digital services is even more pronounced (Berner et al. 2014).

Second, the compatibility of digital health technologies with existing health care facilities is another key factor influencing social exclusion (Ross et al. 2016). Many local health systems and care organisations in Europe are progressively investing in and implementing solutions based on digital technologies, for example telehealth. Yet, these developments amidst great challenges and barriers that are often related to interoperability issues, lack of digital skills of or resistance by health professionals, unclear regulatory frameworks, and scarce financial resources (Bennett and Glasgow 2009; World Health Organization 2016; Barbabella et al. 2017; Sixsmith et al. 2017; World Health Organization 2017; Melchiorre et al. 2018a).

13.2.3 Individual Drivers

Individual drivers consist of those individual characteristics which make an older person more vulnerable to exclusion from digital health technologies. Several studies have investigated what predicts the use, non-use and low-use of digital technologies. Older people with lower levels of education and lower income are less likely to be digitally engaged, and more likely to have lower digital skills and perform a more limited range of activities when using digital technologies (Hunsaker and Hargittai 2018). Older people living alone are less likely to be digital users, presumably because of the lack, or absence, of help from family members or a partner in using new technologies (Friemel 2016). However, other studies found that living with children does not necessarily improve older people's digital engagement and digital skills, but rather it mostly increases the availability of digital technologies at home (Eynon and Helsper 2015).

Health status was found to be a relevant predictor, and both physical and cognitive impairments reduce the use of digital technologies among older people (Hunsaker and Hargittai 2018; Czaja et al. 2019). Overall, older people who are non-users are more likely to show a lack of motivation and interest in using digital technologies (Friemel 2016) and tend to report a lower perceived usefulness of new technologies, higher anxiety and lower self-efficacy regarding the use of digital technologies compared to their counterparts who are digitally-engaged (Czaja et al. 2006). Finally, the non-use of digital technologies, including digital health technologies can be also determined by individual preferences and choice (Wyatt 2003).

13.2.4 Socio-Technical Factors

The progressive introduction and rapid evolution of digital health technologies bring an additional level of complexity to the dynamics of old-age digital health exclusion. This relates to the characteristics of the technology itself and interactions (enabled or possible) with end-users. It also refers to the socio-material constitution of old-age (Peine et al. 2015; Peine 2019), as old-age is becoming increasingly permeated by digital objects and because major changes are occurring in older people's perceptions and experiences of technology in daily life.

In concrete terms, digital health technologies should facilitate interaction between technological objects and older users. Two main factors may contribute to exclusion of older people in this respect, leading to biased research and development (R&D) activity, selective implementation of digital health services, and limited opportunities for older people or groups with certain characteristics to use new technologies.

First, the paternalist design of technology can limit the choice and liberty of older people to decide how to use the digital health solution. Science and technology studies (STS) have been researching how technological objects are conceived, shaped and produced by designers and developers. In this sense, they try to imagine future users and inscribe a limited set of features and usage patterns within the socio-technical object (Akrich 1995). This means that, by default, any digital technology already offers a pre-fixed 'script' to end-users, which can be followed (ideally) or broken (non-desirable). In the case of older users, a design paternalism is usually imposed by technologies themselves (Peine 2019), as they embed certain ideas, visions and social roles of older individuals within technology. In this sense, older people would not be free to explore other uses, nor to learn by doing, failing and retrying.

Second, digitised service interfaces are often designed with a 'healthy' and 'active' person (user) in mind. There is growing concern that some groups of older people (typically the most disadvantaged) are systematically excluded from studies conducted within the field of digital health solutions. The oldest old, those with lower educational attainment, those with low digital skills and those with low familiarity with new technologies are more likely to be underrepresented in this kind of research, and hence their needs, attitudes and preferences are less often acknowledged and addressed in the design, development and evaluation process (Fisk et al. 2009; Poli et al. 2019).

13.3 Implications – Why Old-Age Digital Health Exclusion Matters

Old-age digital health exclusion has several significant implications at an individual, organisational and societal level. At an individual level, it leads to an increased risk of exclusion from access to health services which, in turn, can result in poorer individual health outcomes (Terraneo 2015). Indeed, if access to health services primarily depends on the use of digital health technologies, the health and care needs of older people who are non-users or low-users, either by choice or as a result of structural, environmental and individual circumstances, will not be fully addressed (Olsson et al. 2017) and can lead to the worsening of some older people's health. In addition, the feeling of not being able to benefit from available services provided by digital means can generate a sense of social exclusion, especially among those who perceive those services as useful (Seifert et al. 2018). On the other hand, the lack of availability of services based on digital health technologies in deprived areas (rural, mountain or remote areas) forces older adults to exploit directly administered health care resources, if available, which in turn can mean enduring significant travelling time and stress arising from difficulties in access [see Cholat and Daconto, this section].

Given that older people are one of the main user groups of health services (Tavares and Zantomio 2017) and are more likely to face challenges in accessing and using digital technologies, the growing allocation of resources into digital health provision might be less efficient than expected (Helbig et al. 2009). Previous studies found that e-government initiatives failed due to, among others, the limited adoption of the services and the return to the traditional services by many citizens (Janssen et al. 2013; Anthopoulos et al. 2016).

Moreover, if those older people who are less likely to use digital health technologies are also those who are most in need of care, the digital shift in health service provision can contribute to widening old-age inequalities (Robinson et al. 2015). Older people who have access and those who do not become increasingly dissimilar (Robinson et al. 2015). The former get more opportunities to address their health and care needs and possibly achieve better health outcomes; the latter are either prevented from accessing health services, if new services based on digital health technologies have replaced traditional variations, or have to choose among a more limited range of service options. Hence, some older people may benefit greatly from the incorporation of digital health technologies, but some others are at risk of being disadvantaged (Heart and Kalderon 2013).

13.4 Conclusion: Towards a Conceptual Framework on Old-Age Digital Exclusion

Health care provision in Europe is increasingly characterised by digital health. The use of digital health technologies has been promoted at European and national levels as a strategy for tackling the challenges facing health care systems (European Commission 2018) by a population which is ageing and increasingly more heterogeneous (Phillipson 2013). Digital health technologies are described as a way to make health care provision more efficient and sustainable, while guaranteeing good quality, equity and inclusiveness of services (European Commission 2018). Older people are expected to use such new digital-based services in order to address health and care needs (Helbig et al. 2009).

In general terms, the transition from traditional to digitised services can lead to new forms of digital health exclusion for older individuals (Helsper and Reaisdorf 2016; Olsson et al. 2017). The analysis of these mechanisms in relation to digital health should be framed within the more general concept of old-age social exclusion, as defined by Walsh et al. (2017) – see also Walsh et al. this volume.

By adopting this view, old-age digital health exclusion can be defined as a process in which older people are prevented, or limit themselves, from using digital health technologies and from benefitting fully from their use, due to a lack, or denial, of health rights, resources, goods and services.

On the basis of these dynamics, we present a conceptual framework which describes the process of old-age digital health exclusion in Fig. 13.1. We identify four types of drivers of old-age digital health exclusion, namely structural, environmental, individual and socio-technical, which combine and intersect with each other to

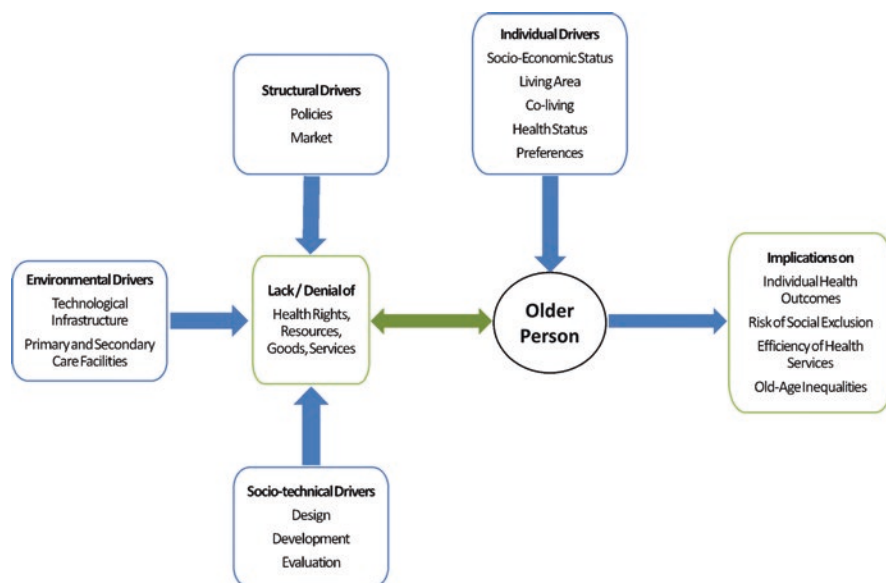


Fig. 13.1 A conceptual framework of old-age digital health exclusion

increase the vulnerability of older people to exclusion from health services. Structural, environmental and socio-technical drivers impact directly on digital health exclusion and are primarily only modifiable by organisational and high-level actors (*e.g.* policy makers, market players). Individual drivers influence the older person's preferences, capacities and behaviours towards digital health technologies, in accordance with their own will and social expectations. As a result of these multilevel and multifaceted drivers, implications of exclusion can be identified at individual, organisational and societal levels. Furthermore, older people's willingness to engage with digital technologies cannot be taken for granted. Non-use of digital technologies and, thus, of digital health services, can reflect individual decisions (Wyatt 2003).

The use of digital technologies and digital-based services should be promoted, explained and sustained by relevant institutional actors (Siren and Knudsen 2017). However, it is worth questioning how far digital health can be pursued and whether or not digital health can be the only option available for older people. The increased vulnerability of older people in relation to digital health must be addressed with research and policies aimed at disabling drivers of social exclusion and making services based on digital technologies more inclusive. Research on digital health needs to have a stronger focus on the inclusiveness of digital health technologies. Older people should be involved in the studies which conduct design and evaluations of digital health technologies that are relevant to them (Östlund 2015). It is especially relevant that participation of older people in evaluations of digital technologies is not selective, and that study participants reflect the full heterogeneity of the target populations (Merkel and Kucharski 2018; Poli et al. 2019; Allemann and Poli 2020; Poli et al. 2020). Policies, in turn, should go beyond the mere promotion of digital health by actively shaping and impacting on key barriers and factors preventing full opportunities for older users (Melchiorre et al. 2018b). By doing so, the potential of digital health can be better exploited, and can actually contribute to enhancing current health care provision, for example, by reaching older people in underserved areas or by improving the care provided to people with complex conditions (Barbabella et al. 2017).

Digital health technologies can have exclusionary and inequality effects on older people (Poli et al. 2019; Poli et al. 2020). Such effects must represent a major concern for research, policy and practice, as digital health technologies are increasingly utilized in health systems and evolve rapidly. It is crucial to identify and address the mechanisms generating these exclusions and inequalities in order to turn digital health technologies into an available, relevant and impactful opportunity for most older adults, thus achieving inclusive digital ageing societies.

Editors' Postscript

Please note, like other contributions to this book, this chapter was written before the COVID-19 pandemic of 2020. The book's introductory chapter (Chap. 1) and conclusion (Chap. 34) consider some of the key ways in which the pandemic relates to issues concerning social exclusion and ageing.

References

- Akrich, M. (1995) *User representations: Practices, methods and sociology*. Pinter.
- Allemann, H., & Poli, A. (2020). *Designing and evaluating information and communication technology-based interventions? Be aware of the needs of older people*. London: SAGE Publications Sage UK.
- Anthopoulos, L., Reddick, C. G., Giannakidou, I., & Mavridis, N. (2016). Why e-government projects fail? An analysis of the Healthcare.gov website. *Government Information Quarterly*, 33(1), 161–173. <https://doi.org/10.1016/j.giq.2015.07.003>.
- Barbabella, F., Melchiorre, M. G., Quattrini, S., Papa, R., & Lamura, G. (2017). *How can eHealth improve care for people with multimorbidity in Europe*. Copenhagen: European Observatory on Health Systems and Policies. <https://pubmed.ncbi.nlm.nih.gov/29144695/>
- Bennett, G. G., & Glasgow, R. E. (2009). The delivery of public health interventions via the internet: Actualizing their potential. *Annual Review of Public Health*, 30(1), 273–292. <https://doi.org/10.1146/annurev.publhealth.031308.100235>.
- Berner, J., Rennemark, M., Jogr us, C., Anderberg, P., Sk oldunger, A., Wahlberg, M., et al. (2014). Factors influencing internet usage in older adults (65 years and above) living in rural and urban Sweden. *Health Informatics Journal*, 21(3), 237–249. <https://doi.org/10.1177/1460458214521226>.
- Capgemini (2018) *Digital health: Transforming healthcare*. <https://www.capgemini.com/be-en/wp-content/uploads/sites/17/2018/10/Digital-health-final-paper-22-10.pdf>. Accessed 13 Oct 2019.
- Czaja, S. J. (2017). The potential role of technology in supporting older adults. *Public Policy & Aging Report*, 27(2), 44–48. <https://doi.org/10.1093/ppar/prx006>.
- Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., et al. (2006). Factors predicting the use of technology: Findings from the center for research and education on aging and technology enhancement (create). *Psychology and Aging*, 21(2), 333–352. <https://doi.org/10.1037/0882-7974.21.2.333>.
- Czaja, S. J., Boot, W. R., Charness, N., & Rogers, W. A. (2019). *Designing for older adults: Principles and creative human factors approaches*. Boca Raton: CRC press.
- European Commission (2018) *Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions on enabling the digital transformation of health and care in the Digital Single Market; empowering citizens and building a healthier society*. Brussels: European Commission. https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=51628.
- Eynon, R., & Helsper, E. (2015). Family dynamics and internet use in Britain: What role do children play in adults' engagement with the internet? *Information, Communication & Society*, 18(2), 156–171. <https://doi.org/10.1080/1369118X.2014.942344>.
- Fisk, A. D., Rogers, W. A., Charness, N., Czaja, S. J., & Sharit, J. (2009). *Designing for older adults: Principles and creative human factors approaches*. Boca Raton: CRC Press.
- Friemel, T. N. (2016). The digital divide has grown old: Determinants of a digital divide among seniors. *New Media & Society*, 18(2), 313–331. <https://doi.org/10.1177/1461444814538648>
- Heart, T., & Kalderon, E. (2013). Older adults: Are they ready to adopt health-related ICT? *International Journal of Medical Informatics*, 82(11), e209–e231. <https://doi.org/10.1016/j.ijmedinf.2011.03.002>.
- Helbig, N., Ram on Gil-Garc a, J., & Ferro, E. (2009). Understanding the complexity of electronic government: Implications from the digital divide literature. *Government Information Quarterly*, 26(1), 89–97. <https://doi.org/10.1016/j.giq.2008.05.004>.
- Helsper, E., & Reaisdorf, B. C. (2016). The emergence of a “digital underclass” in Great Britain and Sweden: Changing reasons for digital exclusion. *New Media & Society*, 19(8), 1253–1270. <https://doi.org/10.1177/1461444816634676>.
- Hunsaker, A., & Hargittai, E. (2018). A review of internet use among older adults. *New Media & Society*, 20(10), 3937–3954. <https://doi.org/10.1177/1461444818787348>.

- Janssen, M., van Veenstra, A. F., & van der Voort, H. (2013). Management and failure of large transformation projects: Factors affecting user Adoption. In Y. K. Dwivedi, H. Z. Henriksen, D. Wastell, & R. De (Eds.), *Grand successes and failures in IT. Public and private sectors* (pp. 121–135). Berlin, Heidelberg: Springer.
- König, R., Seifert, A., Doh, M. (2018). Internet use among older Europeans: An analysis based on SHARE data (Journal Article) 17(3), 621–633. <https://doi.org/10.1007/s10209-018-0609-5>.
- Kummervold, P. E., Chronaki, C. E., Lausen, B., Prokosch, H.-U., Rasmussen, J., Santana, S., et al. (2008). eHealth trends in Europe 2005–2007: A population-based survey. *Journal of Medical Internet Research*, 10(4), e42–e42. <https://doi.org/10.2196/jmir.1023>.
- Levitas, R., Pantazis, C., Fahmy, E., Gordon, D., Lloyd-Reichling, E., & Patsios, D. (2007). *The multi-dimensional analysis of social exclusion*. Bristol: University of Bristol. <https://repository.uel.ac.uk/item/8666q>.
- Lindeman, D. A. (2017). Improving the independence of older adults through technology: Directions for public policy. *Public Policy & Aging Report*, 27(2), 49–52. <https://doi.org/10.1093/ppar/prx011>.
- Lupton, D. (2013). The digitally engaged patient: Self-monitoring and self-care in the digital health era. *Social Theory & Health*, 11(3), 256–270. <https://doi.org/10.1057/sth.2013.10>
- Lupton, D. (2014). Health promotion in the digital era: A critical commentary. *Health Promotion International*, 30(1), 174–183. <https://doi.org/10.1093/heapro/dau091>.
- Mahmood, A., & Keating, N. (2012). Towards inclusive built environments for older adults. In T. Scharf and N. Keating (Eds.), *From exclusion to inclusion in old age: a global challenge* (pp. 145–162). Bristol: The Policy Press.
- Melchiorre, M. G., Papa, R., Rijken, M., van Ginneken, E., Hujala, A., & Barbabella, F. (2018a). eHealth in integrated care programs for people with multimorbidity in Europe: Insights from the ICARE4EU project. *Health Policy*, 122(1), 53–63. <https://doi.org/10.1016/j.healthpol.2017.08.006>.
- Melchiorre, M. G., Lamura, G., & Barbabella, F. (2018b). eHealth for people with multimorbidity: Results from the ICARE4EU project and insights from the “10 e’s” by Gunther Eysenbach. *PLoS One*, 13(11), e0207292. <https://doi.org/10.1371/journal.pone.0207292>.
- Merkel, S., & Kucharski, A. (2018). Participatory design in gerontechnology: A systematic literature review. *The Gerontologist*, 59(1), e16–e25. <https://doi.org/10.1093/geront/gny034>
- Mostaghel, R. (2016). Innovation and technology for the elderly: Systematic literature review. *Journal of Business Research*, 69(11), 4896–4900. <https://doi.org/10.1016/j.jbusres.2016.04.049>.
- OECD. (2016). *OECD science, technology and innovation outlook 2016*. Paris: OECD Publishing. https://doi.org/10.1787/sti_in_outlook-2016-en.
- OECD. (2017). *OECD digital economy outlook 2017*. Paris: OECD Publishing. <https://doi.org/10.1787/9789264276284-en>.
- Olsson, T., Samuelsson, U., & Viscovi, D. (2017). At risk of exclusion? Degrees of ICT access and literacy among senior citizens. *Information, Communication & Society*, 1–18. <https://doi.org/10.1080/1369118X.2017.1355007>
- Östlund, B. (2015). The benefits of involving older people in the design Process. In J. Zhou & G. Salvendy (Eds.), *Human aspects of IT for the aged population. Design for aging* (pp. 3–14). Cham: Springer.
- Peacock, S. E., & Künemund, H. (2007). Senior citizens and internet technology: Reasons and correlates of access versus non-access in a European comparative perspective. *European Journal of Ageing*, 4(4), 191–200. <https://doi.org/10.1007/s10433-007-0067-z>.
- Peine, A. (2019). Technology and ageing—Theoretical propositions from science and technology studies (STS). In *Ageing and digital technology* (pp. 51–64). Springer.
- Peine, A., Faulkner, A., Jæger, B., & Moors, E. (2015). *Science, technology and the ‘grand challenge’ of ageing—Understanding the socio-material constitution of later life*. Elsevier.
- Phillipson, C. (2013). *Ageing*. John Wiley & Sons.

- Poli, A., Kelfve, S., & Motel-Klingebiel, A. (2019). A research tool for measuring non-participation of older people in research on digital health. *BMC Public Health*, *19*(1), 1487. <https://doi.org/10.1186/s12889-019-7830-x>
- Poli, A., Kelfve, S., Klompstra, L., Strömberg, A., Jaarsma, T., Motel-Klingebiel, A. (2020). Prediction of (Non)Participation of Older People in Digital Health Research: Exergame Intervention Study. *J Med Internet Res*, *22*(6):e17884. <https://doi.org/10.2196/17884>.
- Robinson, L., Cotten, S. R., Ono, H., Quan-Haase, A., Mesch, G., Chen, W., et al. (2015). Digital inequalities and why they matter. *Information, Communication & Society*, *18*(5), 569–582. <https://doi.org/10.1080/1369118X.2015.1012532>
- Ross, J., Stevenson, F., Lau, R., & Murray, E. (2016). Factors that influence the implementation of e-health: A systematic review of systematic reviews (an update). *Implementation Science*, *11*(1), 146. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5080780/pdf/13012_2016_Article_510.pdf.
- Salemink, K., Strijker, D., & Bosworth, G. (2017). Rural development in the digital age: A systematic literature review on unequal ICT availability, adoption, and use in rural areas. *Journal of Rural Studies*, *54*, 360–371. <https://doi.org/10.1016/j.jrurstud.2015.09.001>.
- Scharf, T., & Keating, N. (2012). Social exclusion in later life: A global challenge. In T. Scharf & N. Keating (Eds.), *From exclusion to inclusion in old age: A global challenge* (pp. 1–16). Bristol: The Policy Press.
- Schnoll, H. J. (2014). *E-government: Information, technology, and transformation*. Armonk: Routledge.
- Seifert, A., Hofer, M., & Rössel, J. (2018). Older adults' perceived sense of social exclusion from the digital world. *Educational Gerontology*, *44*(12), 775–785. <https://doi.org/10.1080/03601277.2019.1574415>.
- Siren, A., & Knudsen, S. G. (2017). Older adults and emerging digital service delivery: A mixed methods study on information and communications technology use, skills, and attitudes (Article). *Journal of Aging and Social Policy*, *29*(1), 35–50. <https://doi.org/10.1080/08959420.2016.1187036>.
- Sixsmith, A., Mihailidis, A., & Simeonov, D. (2017). Aging and technology: Taking the research into the real world. *Public Policy & Aging Report*, *27*(2), 74–78. <https://doi.org/10.1093/ppar/prx007>.
- Tavares, L. P., & Zantomio, F. (2017). Inequity in healthcare use among older people after 2008: The case of southern European countries. *Health Policy*, *121*(10), 1063–1071. <https://doi.org/10.1016/j.healthpol.2017.08.011>.
- Terraneo, M. (2015). Inequities in health care utilization by people aged 50+: Evidence from 12 European countries. *Social Science & Medicine*, *126*, 154–163. <https://doi.org/10.1016/j.socscimed.2014.12.028>.
- Turner, F. (2010). *From counterculture to cyberculture: Stewart brand, the whole earth network, and the rise of digital utopianism*. University of Chicago Press.
- Van Regenmortel, S., De Donder, L., Dury, S., Smetcoren, A.-S., De Witte, N., & Verté, D. (2016). Social exclusion in later life: A systematic review of the literature. *Journal of Population Ageing*, *9*(4), 315–344. <https://doi.org/10.1007/s12062-016-9145-3>
- Van Regenmortel, S., De Donder, L., Smetcoren, A.-S., Lambotte, D., De Witte, N., & Verté, D. (2018). Accumulation of disadvantages: Prevalence and categories of old-age social exclusion in Belgium (journal article). *Social Indicators Research*, *140*(3), 1173–1194. <https://doi.org/10.1007/s11205-017-1817-8>.
- Walsh, K., Scharf, T., & Keating, N. (2017). Social exclusion of older persons: A scoping review and conceptual framework. *European Journal of Ageing*, *14*(1), 81–98. <https://doi.org/10.1007/s10433-016-0398-8>.
- Weiss, D., Rydland, H. T., Øversveen, E., Jensen, M. R., Solhaug, S., & Krokstad, S. (2018). Innovative technologies and social inequalities in health: A scoping review of the literature. *PLoS One*, *13*(4), e0195447. <https://doi.org/10.1371/journal.pone.0195447>

- World Health Organization. (2016) *From innovation to implementation: eHealth in the WHO European Region*. Copenhagen. http://www.euro.who.int/__data/assets/pdf_file/0012/302331/From-Innovation-to-Implementation-eHealth-Report-EU.pdf.
- World Health Organization. (2017). *Global diffusion of eHealth-making universal health coverage achievable: Report of the third global survey on eHealth*. World Health Organization. <https://apps.who.int/iris/bitstream/handle/10665/252529/9789241511780-eng.pdf>
- Wyatt, S. M. (2003). Non-users also matter: The construction of users and non-users of the internet. In N. Oudshoorn & T. Pinch (Eds.), *How users matter: The co-construction of users and technology* (pp. 67–79). Cambridge: MIT Press.

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