MIDDLE-AGED & OLDER ADULTS' INFORMATION & COMMUNICATION TECHNOLOGY ACCESS: A REALIST REVIEW

A SSHRC Knowledge Synthesis Grant
Final Report

GERONTOLOGY RESEARCH CENTRE

SFU SIMON FRASER UNIVERSITY
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Key Messages

1. There continues to be a gap in information and communication technologies (ICTs) access and use between younger cohorts that have grown up with the technology (generation X and younger) and the next previous cohort (baby boomers and older). This is more pronounced among cohorts born prior to the 1930s, which have low access and use rates. Birth cohort, education, and income interact to create differences in familiarity, skill, and personal preference such that older adults with more education and higher incomes are more likely to access and use ICTs.

2. Training and support is one strategy that has been identified as able to increase access and use of ICTs among middle-aged and older adults. However, training needs to be tailored, relevant, and ongoing. Community service organizations that provide training and support require infrastructure support to purchase computers and tablets every three years as new technology emerges. In addition, ongoing funding is required to provide necessary training and support. This could be connected with other home programs, as in-home services are preferable.

3. Negative stereotypes associated with ageist perspectives of older adults need to be systematically challenged and dispelled through public service campaigns and in mass media. Representations of older adults as incapable of learning how to use ICTs serves to perpetuate the digital divide.

4. Usable and accessible design can enhance use of ICTs as some adults experience physical challenges such as declines in vision and hearing, and increased arthritis in their hands. Applying principles of universal design, and creating products that are accessible, reliable, and functional for most people, including those with disabilities, can lead to a generation of products that meet the needs of older adults.

Executive Summary

The digital age has been marked by a stream of evolving and innovative technologies and while these offer numerous benefits to Canadians not all members of society have equitable access to or use of these technologies. The Social Sciences and Humanities Research Council (SSHRC) call to examine how emerging technologies can be leveraged to benefit Canadians, identified the following priority question:

> *"What is needed in order to maximize equitable access to information and communication technologies, foster digital literacy and participation, seize new opportunities, and mitigate the digital divide in Canada and the world?"*

To address this priority, an integrated knowledge translation (iKT) knowledge synthesis project was initiated to better understand the current state of the digital divide among community-dwelling middle-aged (aged 45-64) and older adults (aged 65+) by examining existing research knowledge regarding their access to and use of ICTs. The report includes implications of the project for policy, services, and industry, the detailed approach of the review process, analysis and results, and identification of knowledge gaps. This executive summary briefly covers the research approach, findings, and implications, in turn.

The knowledge synthesis methods used were informed by rapid realist review methodology[1] with a focus on academic literature published over the past decade (2006 -2016) and from data generated during a World Café event comprised of key stakeholders. Realist review is a theory-driven approach to knowledge synthesis that has an explanatory focus and uses a systematic, iterative approach to explore the mechanisms of how and why complex interventions thrive or fail, in particular settings.[1] The realist review approach addresses what works, for whom, in what circumstances, and why. The rapid realist review search yielded 748 peer-reviewed articles; a final subset of 55 articles met our inclusion criteria.

As part of the rapid realist review process it is imperative to get input from key stakeholders. We worked in partnership with bc211, a community based information and referral service in Vancouver, BC, who helped shape the research question. To further support this, and as part of iKT, we hosted a World Café event. This is a form of deliberative dialogue, where stakeholders, knowledge users, and key informants

interested in a topic come together to discuss and deepen understanding on a topic of shared interest. Our World Café event had 25 participants, including middle-aged and older adults, seniors' service providers, industry professionals, and academics.

Data extraction and analysis was guided by the Resources and Appropriation Theory proposed by Van Dijk,[2] a life course perspective, and an intersectionality based analysis.[3] Findings are detailed within the organizing principles of the realist review method: context, mechanisms, outcome, and intervention. Context focused on demographics. The three primary demographic factors that correlate with the gap in ICT access and use are education level, income level, and age. The first two are positively correlated, while age is negatively correlated with ICT access and use. Age is a complex variable, with cohort differences, rather than chronological age, providing the explanatory potential. Our World Café participants reiterated this:

> *"But if you work in the workplace [before the] '80s and '90s, you weren't forced to use technology and computers and computer technology …therefore, there's a portion of the population that got left behind in the revolution."*

In addition, three overarching mechanisms, mediated by differences in education, income, and age were identified: resources, motivation, and skills. Resources include: ability to purchase and maintain ICTs in the home, cultural perspectives on aging, and social encouragement. Motivation includes individual level impediments such as personal preferences, lack of confidence in skills, perceived lack of value of ICTs, and security concerns; and individual motivators include valuing ICTs, social encouragement, training, and sense of efficacy. ICT skills refers to the experience and comfort with ICTs, this is connected to exposure, familiarity, and design. As an example, one of our World Café participants stated:

> *"I think physically some of those things aren't that good. Like arthritic fingers are about twice the size of anyone else's so when I go to press a button or a key, I get wrong answers half the time. So that part, as well as vision. I think those are physical barriers."*

These factors interact and overlap to contribute to the observed differences in accessing and using ICTs among middle-aged and older adults. These mechanisms are summarized in Table 1, structured to capture the mechanisms associated with ICT use or non-use.

Table 1: Summary of ICT use & access mechanisms

ICT non-use	ICT use
Limited financial resources; not owning a home computer	Higher income; Having a home computer
Lower education attainment	Higher education attainment
Lack of familiarity, no training, limited skills, fear of damaging equipment	Practice, experience, exposure through work, family, friends, social support
Embrace ageist stereotypes related to ability of older adults to use ICTs, technology anxiety	Reject ageism, embrace aging process, curious, adventurous, active
Complex interfaces, constantly changing technology	Functional design, usability, accessible design
Fear of cyber security and privacy breaches	Social support, encouragement
Dislike or uninterested in ICTs; prefer familiar modes of communication	Value ICTs for communication, information, entertainment, and other resources, enjoyment
Physical limitations	Healthy and active

Using an intersectional lens throughout this review made visible a pattern of privilege related to choice in ICT access and use that can occur over one's life course. The interaction of demographics, and associated social locations, contributes to one's opportunity to choose whether or not to use ICTs. Framing the research question with ICT use as normative, and non-use as a problem to be solved can contribute to marginalizing the population that we are seeking to support and further limit alternatives to meeting the information and service needs of individuals that can not be (or are no longer able to be) ICT users. In addition, choice and self-determination is a means of maintaining power that is important for quality of life and wellbeing.

> *"For digital seniors, ICT use is not a binary, they want to have the flexibility to choose for themselves how to engage with ICTs."*[4(p702)]

From this analysis we propose three recommendations to support middle-aged and older adults' 'choice' to access and use ICTs: 1) targeted training and awareness; 2) encouraging using universal design principles; and 3) providing and supporting accessible alternatives to ICTs.

Project Report

Context

With the aging population, innovative approaches are needed to support aging persons' quality of life. Information and communication technologies (ICTs) can potential provide supports for aging persons. ICTs is an umbrella term for any communication devices or applications, such as cellular phones, computers, tablets, applications, and Internet services providing advanced, mainstream mechanisms for communication and information sharing, management and storage.

For middle-aged and older adults (defined here as aged 45-64 and 65+ respectively) ICTs have the potential to enable access to goods and services; maintain a safe and secure independent living environment; manage age-related challenges; and promote social participation.[5] Given the potential of ICTs to support quality of life, it is critical to identify and address inequities regarding accessibility, particularly among aging adults. The subject of this report is a realist review that synthesized evidence on ICT access and use in middle-aged and older adults using an intersectional framework[6] to identify inequities and to inform service and technology development.

While there are federal, provincial, and municipal services that aim to enable seniors to optimize their autonomy, wellbeing, safety, and security in later life, such objectives are not equitably achieved by all persons. A recent report by the Office of the Seniors Advocate[7] suggests that a gap exists in service utilization and awareness by seniors. With increasing focus on home-based and community services (i.e., to enhance aging in the right place[8]), gaps in information access and use are a significant issue. Additionally, the current system of community services and resources available to older adults and their caregivers is complex and challenging to navigate, even with adequate access and ICTs skills. Sixsmith and Sixsmith[9] argue that while policies and services to support aging-in-place are beneficial in terms of enhancing wellbeing and autonomy, and reducing costs, effective provision of community services will face a number of short- and long-term challenges such as: increasing demand and consumer expectations of the baby boom generation; inadequate and inappropriate

infrastructure; and limited resources within the formal social service system. ICTs can help overcome some of these challenges since information on public programs and services is essential to helping older adults remain independent and involved in their communities.[10]

Given that ICTs can offer solutions to enable people to live independently in their homes, an understanding of middle-aged and older adults' access to and use of ICTs is needed.[11] Using a life course perspective to examine ICT access and use is valuable in determining use among the current cohort of older adults as well as in predicting use by future cohorts of seniors. With technology advancement there has been a critical body of research and concern regarding information inequality.[12] While this remains an area of exploration in its own right, of particular interest here is what is often referred to as the digital divide. This concept became mainstream in reaction to a 1995 report, 'Falling through the Net', which discussed the unequal access to emerging ICTs within and between countries.[12] While the first decade of research on the digital divide focused on physical access to ICTs (e.g., being able to buy a computer or having Internet access), the current body of evidence incorporates more complex variables.[13] The digital divide is understood in this project as the unequal and/or inequitable access to the benefits of ICTs due to limitations of motivation (e.g., confidence, interest), physical access, or capacity to use.[14]

Research on inequality in physical access to ICTs from the late 1990s to early 2000 has been synthesized, and captured demographic differences in digital usage (including income, education, geographical location, gender, and age variables) as a means to inform policy and programs that can ameliorate the digital divide. In developed countries, there remains "a gap of about 50% between the highest and the lowest social strata (90% diffusion as compared to 40% diffusion; p. 226)"[14]; and though the gender divide has essentially disappeared, education and income remain important contributors to ICT access and use.[14] Physical access to ICTs is highest among 25-40 year olds, followed by a steady decline into old age.[14] For example, Statistics Canada reports that Internet usage in 2000 ranged from 95% of teenagers to 5% of adults over 80 years old.[15] However, as SSHRC has identified, the Internet and associated technologies have changed significantly since the turn of the century, a

synthesis of the current evidence and trends over the last ten years (2006-2016) is needed.

Though older people have typically been underrepresented in the technology marketplace, middle-aged and older adults are consumers and sizeable users of ICTs; and with the rise of the "silver surfer", seniors are recognized as the fastest growing demographic of Internet users.[16] Indeed, social media marketing sites emphasize that adults aged 65 and older are the only user group that is demonstrating growth in social media uptake.[17] However, older adults are a heterogeneous group with significant variation in social identities and positions. Thus, it is imperative for the discussion of ICTs to consider and respond to the variety of ways in which older people engage with technology, how technology shapes the social landscape within which people live, and the benefits technology can have on social participation and wellbeing in later life.

While ICTs can support "aging in the right place", a number of concerns remain and studies indicate that users have mixed feelings about using certain ICTs. On the one hand, technologies are seen as helpful in staying independent in the community, and on the other, loss of privacy, autonomy, and human contact, and the potential for stigmatization are concerns.[18–23] These issues capture potential motivational and psychological access issues that need to be considered when examining the digital divide in recent literature. Given the centrality of ICTs to supporting quality of life, it is critical to identify and address inequities in access, particularly for aging adults.

Research Questions

In this project we sought to better understand the current state of the digital divide as it pertains to middle-aged and older adults based on literature published over the last decade. This time period was selected because there are earlier review articles available describing the digital divide up until 2006[14] and the technology landscape has changed significantly since then. To ensure we captured current community concerns, we hosted a World Café dialogue event with key knowledge users (community-dwelling middle-aged and older adults, service providers, decision makers, academics, and industry professionals).

The knowledge synthesis was guided by objectives to identify: knowledge gaps relating to middle-aged and older adults access to and use of ICTs; and recommendations for policy, service, and research to address the digital divide. Guiding questions for the knowledge synthesis included:

1. How is the digital divide relevant to the current cohort of middle-aged and older adults?
2. What are the characteristics of middle-aged and older adults who are excluded from ICT use (e.g., gender, geographical location, race/ethnicity, socioeconomic status, education level)?
3. What factors shape exclusion from ICT use (e.g., motivation, physical access, skills)?
4. What are the implications of the findings from this synthesis for policies, services, and research that influence middle-aged and older adults' access to and use of technology?

Implications

Policy Implications

Based on the findings in this review three primary policy implications were identified for addressing the differential access and use of ICTs for community dwelling older adults, who, through this differential access could experience negative consequences in their quality of life and wellbeing:

1. Attend to inappropriate stereotypes of older adults through an anti-stigma campaign against ageism.
2. Develop Internet safety guidelines for older adults and caregivers that highlight risk areas, such as in cases of cognitive decline.
3. Provide infrastructure and ongoing funding to organizations, such as community centres, senior centres, libraries, and other non-profit community groups, to support computer and Internet training and support programs. Funding should provide coverage for equipment and application upgrades, as well as replacement costs every three years.
4. Continue to provide and support traditional (print materials, postal delivery, telephone) methods of communication for access and information on social

services, government forms, and resources for middle aged and older adults that are not using ICTs.

Practice Implications

From the findings in this review there are two primary practice implications for older adult community service providers:

1. Enhance computer and Internet training by making it relevant and empowering, tailoring training opportunities to the needs of middle-aged and older adults. Ongoing supports need to be built into programming such that after the formal sessions help can be accessed if challenges arise; and consider the possibility of making house calls.
2. Support continuation of traditional modes of communication for information and promotion such as providing resources and information available in print, television, and over the telephone.

Industry Implications

There are two main implications of this realist review for industry professionals, specifically ICT product and app developers and distributors, acknowledging that while older adults currently encompass a less saturated market, in the coming years older adults will be more experienced ICT users.

1. Incorporate universal design principles in development. Engaging older adults and other differently abled individuals in early product development would support this process. Supporting functionality, ease of use, for all users while also meeting the needs of older adults (e.g., can be used for arthritic hands or easily accommodates vision impairment)
2. Include older adults in marketing campaigns to challenge ageist stereotypes.

Approach

This knowledge synthesis project, informed by rapid realist review methodology,[1] synthesized peer-reviewed literature published over the past decade (2006 -2016) and data generated during a World Café event comprised of key stakeholders.

Rapid Realist Review

Realist review is a theory-driven approach to knowledge synthesis that has an explanatory focus. A realist review uses a systematic, iterative approach to explore the mechanism(s) of how and why complex interventions thrive or fail, in particular setting(s).[1] The realist review approach addresses what works, for whom, in what circumstances, and why. The underlying principle of the realist approach are the links between the *intervention, contexts, mechanisms,* and *outcomes.*[1]

While a full realist review requires considerable time and resources, a rapid realist review is a good alternative for time sensitive projects such as this one.[24] The rapid realist review retains the core elements of the traditional realist review methodology, following the six steps that comprise a realist review: 1) refine research question, 2) search for the evidence, 3) selection and appraisal, 4) data extraction, data analysis, 5) synthesis, and 6) dissemination. An important aspect of the rapid realist review process is the involvement of key knowledge users to shape the final review product. That is, the rapid realist review is designed to engage knowledge users and stakeholders to streamline the research process, producing results that are context-focused[24]; this was achieved by partnering with a knowledge user community organization (i.e., bc211) and hosting a World Café dialogue event.

The rapid realist review search yielded 748 peer-reviewed articles; a final subset of 55 articles met our inclusion criteria. Details of the rapid realist review process can be found in Appendix A.

World Café

A World Café is a deliberative dialogue approach for creating space and opportunity to generate and deepen discussion on a topic of shared interest. The idea behind the World Café structure is that participants' and hosts' understanding of a topic will become more expansive and nuanced throughout the event.[25] It is a method that brings new people together to evoke the collective wisdom of the group. One of the key features of the World Café method is creating a casual, comfortable atmosphere, similar to a café like space, with careful attention to details such as having round tables, table clothes, food, and flowers. Another valuable feature of the World

Café is the ability to enhance dialogue by encouraging participants to move between tables that have varying conversational questions and attendees, enabling participants to be exposed to new and diverse perspectives and explore progressively deeper lines of inquiry through several conversational rounds.

Our World Café event had approximately 5 – 7 participants at each of five tables, with a host and note taker at each, engaging in concurrent small group discussions. Participants (n=25) included middle-aged and older adults, seniors' service providers, industry professionals, and academics. The table host facilitated the discussion and brought themes and ideas forward to subsequent conversations. The table hosts were the investigators on this project and the note takers were students and colleagues working in aging and technology. The World Café conversations informed the data analysis process of the realist review and the transcripts were coded and key quotes pulled to deepen analysis and illustrate key messages. Simon Fraser University Office of Research Ethics approved reviewed and approved the protocol for this project. A second World Café is planned for October 20, 2016 in Montreal, QC in connection with the annual AGE-WELL NCE (a Canadian Network of Centres of Excellence for aging and technology) and Canadian Association of Gerontology conferences, to further validate and mobilize findings from this research.

Theory

The realist review process began by refining the research question in collaboration with our stakeholder partner organization (bc211) and identifying an explanatory theory to guide our review process. The theory of the digital divide selected was Van Dijk's[2] *Resources and Appropriation theory,* which seeks to capture the multiple influences on ICT access and use inequality (e.g., personal and positional categories, distribution of resources, and features of ICTs) and outlines a step-wise progression of access (moving from motivation, to gaining material access, to skills development for access, and finally to use) [see Appendix B for further details] .

The Resources and Appropriation theory was a useful guiding framework from which to develop our data extraction tool and initial data analysis. To effectively synthesize the evidence, and simultaneously reduce the perpetuation of stereotypes

and inequalities, an Intersectionality framework was applied. Intersectionality is an analytical perspective and framework founded on the idea that combined social and cultural factors create disproportionate access to resources and life chances for individuals.[26] This framework is well suited for project as a key principle is the concept of 'centring in the margins'[27] whereby marginalized experiences are prioritized. Subsequently, the application of the Intersectionality Based Policy Analysis framework[3] enabled the integration of both theory on the digital divide and a life course perspective, while providing a novel theoretical lens for the project.

Results

A review of the literature over the last decade is clearly needed, as the access and use of ICTs in North America has shifted during this time. For example, the Pew Research Centre[28] released their population survey of American Internet use reporting that 13% of Americans are not online (87% are online). In the first year of the survey (2000) almost half of all Americans (48%) were offline, though this declined to 24% by 2010. Similar shifts have occurred in other countries. Today there are still access and use differences between and within countries. For example, findings from the Netherlands suggest a 95% Internet use rate,[2] while the UK rate is similar to the US, with 88% of the population using the Internet.[29] In 2011, Internet penetration in China was at 36% of the population.[30] The most recent Canadian Internet Use Survey in 2012 reported rates of 86% among the general population.[31]

The differences in ICT access and use across countries provides opportunities to observe and reflect on the context and mechanisms that are contributing to access and use gaps, thus the literature for this review was purposively international. Studies included in this review were from in the US (n=18), England (n=5), Spain (n=5), China (n=4), Canada (n=3), Australia (n=3), Netherlands (n=3), Sweden (n=2) and one from each of the following: Chile, Italy, Portugal, Switzerland, Serbia, Japan, Korea, Germany, Nigeria, Israel, Ireland, France. The focus of these articles on the digital divide among middle-aged and older adults were access, use, health information retrieval, and ICT training. The research methods used in the articles included in our realist review included survey (n=22), qualitative (n=11), mixed methods (n=10), and control trial (n=2; focused on training and skills).

Demographics and the ICT gap (Context)

There are a number of demographic variables that have been associated with non-use of the Internet reported both by large population statistics[28,29,31] and in the peer-reviewed literature.[2,32–37] The three primary demographic factors found to be associated with ICT access and use are: education level, income level, and age. Other demographics (disability status, relationships status, gender, etc.), discussed in the following sections, produce less consistent findings and provide less explanatory power.

Education Level

> *"The most salient divider in the American population with respect to attitudes towards ICT is education."*[38(p999)]

The primary predictive demographic variable identified by many of the studies reviewed and in population statistics[28,29,31] is education level. The more education acquired, the more likely the individual will have access and use ICTs, such as computers and the Internet.[32,35,39–51]

Income

> *"Income was identified early on in digital divide research as a key source of inequality and a decade later continues to be a key determinant of not only Internet access, but also online activity level."*[32(p514)]

Adults are more likely to use ICTs if they have higher incomes and the financial means to purchase a computer and pay for an Internet connection.[32,35,38–43,45,46,48–50,52–57]

Age

> *"For seniors older than 70 years, the relation between age and Internet use seems not to be linear but rather exponential. Only 4.9% of the seniors in the age group of 85+ years are using the Internet regularly, and within every 5 years younger cohort, this share approximately doubles (9.4%, 19.7%, 40.0%)."*[40(p324)]

Chronological age does not appear to be a causal factor in ICT access and use. However, in terms of identifying who is less likely to have ICT access and use, age and ICT access and use are negatively correlated.[2,13,32,34,35,40,50,55,58,59] That is, older adults are less likely to access or use ICTs. This is supported by corroborated by the Pew Research Centre, which indicates that 13% of the general US population does not access the Internet, and 41% of adults over age 65 do not access the Internet.[28]

Age versus Cohort: While age might be a useful tool for targeting policies and programs, it is important to consider the implications and nuances of this factor. First, middle-aged and older adults are more heterogeneous as the general population. Second, across all age groups, ICT access and use rates are following the same upward trend. Third, combining the negative association of age and ICT access and use with income and education produces more explanatory power than age alone. Fourth, age is categorized differently across studies, with some studies defining older adults as 55+ and others using 65+ to define older adults. For example, one study compared the age groups 19-54 and 55+[32] and another divided it by 5 year segments (e.g., 65-69, 70-74 etc.)[40]. Finally, over the ten-year period examined for this review, cohorts of older adults are changing; those aged 65-75 in 2006 are aged 75-85 in 2016. More nuanced ways of understanding age are being explored, including considerations that cohort rather than chronological age have more of a role in ICT access and use. It appears that cohort differences may have more powerful explanatory potential as it captures familiarity and life stage when technologies were introduced.[54,60]

> *"Birth-cohorts represent distinct sub-cultures within a society. Members of birth-cohorts experience historical events at roughly the same age range, which means that these events impact members in a similar way."*[60(p193)]

> *"The birth cohorts that are children and young adults when an ICT is introduced set the norms for that ICT's use."*[54(p194)]

Issues of cohort difference are explored in more detail as we consider motivational factors related to ICT access and use below.

In support of the idea that the digital divide is more a cohort issue than an age issue, World Café participants reported that when someone uses technology in the workplace they will be more likely to use technology in later life (i.e., post-retirement).

> *"In the '80s when you were in the workplace, you were forced to use computers. But if you work in the workplace [before the] '80s and '90s, you weren't forced to use technology and computers and computer technology …therefore, there's a portion of the population that got left behind in the revolution."*

Disability Status

> *"People of older age and people living with intelligence or mental restriction are less likely to be computer users, while people with a speech handicap have a*

higher likelihood to use a computer as they have no difficulty typing, seeing or hearing."[61(p208)]

Only a few studies included in this review examined how disability status affected access and use of ICTs, and the results were varied. However, having a learning disability or cognitive issues was associated with lower use as was having vision, hearing, or hand-related disability (e.g., arthritis).[40,52,57,61,62] Friemel[40] reported that approximately half of Internet non-users over age 85 years indicated that vision or hearing limitations were the primary reason for non-use.

Immigrant Status

Immigrant status was not reported in most studies, with the exception of two studies which had immigrant status as a primary variable of consideration.[32,63] Haight, et al.[32] reported that, based on an analysis of the Canadian Internet Use Survey (CIUS), Canadian-born and established immigrants (over five years in Canada) were 68% more likely to access the Internet than recent immigrants (within the last five years). However, recent immigrants who do access the Internet engage in more Internet activities than Canadian-born or established immigrants.

Rural/Urban Residence

Few studies compared rural or urban status of respondents. Based on CIUS data, a Canadian study identified that ICT access in rural and remote communities is a particular issue in Canada given the geographic spread.[32] This study found that urban respondents were 51% more likely to have Internet access compared to rural respondents.[32]

Relationship status

Some studies found that widows or other older adults living alone were less likely to use or access ICTs, though this was not consistent across studies.[38,40,44,64]

Gender

ICT access and use correlations with gender were inconsistent. Some studies found gender to be associated with use of particular ICTs or applications, such as networking sites.[32,37,55] Other studies found gender differences in access, though the relationship was not consistent in that some studies found women to use computers and

the Internet more than men while other studies reported the opposite.[44,47,52,53,60,61,65] Many studies found no relationship at all.[32,38,40–42,48,55,59,66]

Gender differences in ICT access and use among older adults may be better understood in terms of gendered experiences of education, work, and income.[40] For example, an Italian study found that men were more likely to own computers and use the Internet than women in their sample of adults aged 65-74.[64] However, they also found that women and men had similar use patterns of e-readers and tablets; and that women more often used mobile devices to access the Internet.[64] Comparatively, a study from Portugal found that the proportion of mobile and computer use among 500 urban older adults (65+) did not differ based on gender.[48]

Resources, Motivation, and Skills (Mechanisms)

The demographic variables described previously provide a snapshot of who is not accessing ICTs and begins to sketch a framework of the impact of information access inequities (i.e., the context). An understanding why and how these demographic differences interact to contribute to the digital divide is needed so that these can be addressed. Based on the analysis of the literature included for this review we found three primary mechanisms of the digital divide, mediated by differences in education, income, and age: resources, motivation, and skills.

Van Dijk's[2] Resources and Appropriation theory outlines multiple resources relevant to ICT access use: mental, material, social, cultural, and temporal. In addition, he includes material needs as influencing ICT access. While the stepwise access portion of the theory may be useful when considering specific technology diffusion (diffusion of innovation is a popular theory),[67] for the purposes of this review we found the evidence was best captured within these three mechanisms instead. One reason for this is parsing out all of these elements impedes the intersectional understanding of the inequities at play.

Resources

We found that critical to access and use of ICTs is access to necessary resources that facilitate or lead to opportunities to use ICTs. ICT use is associated with the family home, relationships, and activities supporting the access and use in day-to-day life and

functioning.[64] First, having the financial resources to purchase and maintain ICTs is a precursor to use; not having a computer or Internet access at home are frequently identified as barriers to use.[50,55,68]

> *"Access to the Internet at home was the most significant predictor of Internet use…non-Internet users cited the lack of access to the Internet as a frequent barrier to Internet use."*[50(p76)]

Home-based access to ICT is also important because it interacts with skills and motivation, as one's home is the preferred place to use ICTs and learn new skills.[45,50,51,68] For example, after a training program on using computers to access health information online with older adults that boosted computer confidence Chu et al.[51] found that 6 weeks post-training, "only 1% of the participants who could not afford a computer drove to the nearest public library to use the Internet,"[51(p17)] while 62% who had computers and Internet access at home continued to go online for health information.

Another critical resource is social support. This is important at the individual level and the cultural level when we are considering access to ICTs by older adults. At the cultural level societal norms can support or disrupt ICT use and access. For example, older adults that embrace ageist stereotypes portraying seniors as incapable of learning to use technology are less likely to attempt or consider themselves capable of learning how to use ICTs. For example, a study of potential attendees of a senior's computer training event found that higher aging anxiety (negative perceptions of aging) was associated with lower likelihood of attending the training.[65]

> *"Results of the path analysis suggested that, controlling for differences in access to ICT, seniors' level of agreement with ageist stereotypes partly determined their level of ICT usage competency, that is, the higher the level of agreement with age-based stereotypes, the lower the level of usage competency."*[69(p7)]

Social support at the individual level is also reported as a facilitator of ICT access. Being an engaged, socially active middle-aged and older adults is positively correlated with ICT use and access.[59,68] Older adults that are new users of ICTs report that children, grandchildren, and peers' encouragement and support compelled them to begin using ICTs.[4,35,36,40,68,70–73]

Motivation

Accessing and using ICTs is not only influenced and shaped by resources, but also by motivation and interest. For individuals with the resources to access ICTs, there are still individual differences that lead people to choose to use or not use ICTs. For example, one study that examined birth cohort differences found that persons born between 1929 and 1946 were more likely to associate their ICT use or non-use with choice rather than resources or skills.[54]

Motivational factors are important because these can inform policy and programs for bridging the digital divide. Here we review the detractors and the motivators to ICT use among middle-aged and older adults.

Detractors to ICT use: Impediments to ICT use include personal preferences or beliefs about ICTs, lack of skills to use ICTs, and concerns of privacy and security. General dislike of ICTs or personal preference include beliefs that ICTs are a superficial way to communicate, information obtained via ICTs is questionable, and traditional modes of communication (e.g., as face-to-face interaction and reading paper copies of the newspaper) are preferred.[4] Others report that there is no need or added value to using ICTs or consider ICT use to be a waste of time.[41,42]

> *"Instead of rejecting ICTs out of suspicion or asociality, they take a principled stance against their incorporation into their lives."*[58(p233)]

Casado-Munoz[60] found that among individuals aged 55+ who did not use a computer or the Internet, 26% indicated a lack of interest and another 10% reported having other interests.

Lacking the skills or confidence to use ICTs and being unfamiliar with ICTs can be a deterrent as the use of ICTs can be anxiety-provoking, perceived as something too difficult to learn, lead to damaged equipment, and constantly changing.[50,70,73,74] Bearing in mind that education level is positively correlated with Internet use, it would stand to reason that adults who do not gain familiarity with ICTs during their work or school lives and do not have a pattern of learning established, might find it particularly daunting or unappealing to learn ICT skills.

Concerns around maintaining privacy and protecting oneself from cybercrime was another detractor from ICT use, particularly for individuals with limited Internet and computer skills, who may feel ill-equipped to protect themselves from cyber threats.[52,74]

Motivators to ICT use: Motivators to use of ICTs include perceiving value in ICTs, social encouragement, training, and sense of efficacy. Reasons for perceiving value in ICTs include: accessing information, keeping up social connections despite geographical distances,[32,38,48,68] connecting with family/friends and for emergencies,[32,36,48,63,73,74] enjoyment, leisure, staying current/trendy, avoiding exclusion,[68,71–74] and broadening knowledge about topics on which to connect with friends and family.[4,68,75]

Social encouragement or pressure can be a motivator, particularly when provided to gain access and learn how to use ICTs.[4,35,36,40,68,70–73] For example, seeing peers and others use ICTs can be compelling.[72] Once a device has been obtained, receiving ongoing supportive training that is encouraging, affordable, tailored, and culturally relevant can increase motivation to use.[42,51,68,70,73,75]

> *"Encouragement by others exerted influence on Internet self-efficacy and outcomes expectations"*[75(p198)].

In line with this, World Café participants reported that it is easier for people to learn technologies while in the workforce as compared to later in life when they are being pressured to use technology. There was a distinction made by participants between social encouragement to use technology and pressure (that creates stress) to use technology.

> *"I think it depends on the time people were first introduced to computers. If they were introduced when they were still working, it is a little bit easier then once they try it and suddenly someone is pushing on them, children, grandchildren or someone like this."*

As well, individual characteristics such as curiosity, confidence, and being adventurous motivate ICT use.[35,59,70] Sense of self-efficacy and willingness to learn new skills is likely connected to experiences of learning throughout life.

Finally, the functionality and usability of ICTs can serve to motivate or discourage use; poorly designed ICTs decrease motivation.[36,70,71]

Skills

Related to resources and motivation are ICT skills. Essentially, the more experience a person has using an ICT, the more comfortable they will be using it.[40,50,64,68] While some older adults attributed age to be a factor in their lack of skills, this appears to be less a function of chronological age and more about exposure to ICTs.[38,48,55,60,68] Non-users report lack of knowledge, skills, and training on ICTs as primary reasons for non-use.[35,42,60] As well, the amount of computer use an individual engages in pre-retirement, is related to later Internet use.[40] Numerous studies reported that ICT users primarily developed their ICT skills while at work, with the help of family, or on their own. For example, older adult (60+) Internet users in one study reported that they learned to use the Internet from family (36%), in their workplace (25%), or were self-taught (25%).[50]

In accord with this, World Café participants reported that once middle-aged and older adults use one kind of technology they more easily learn additional technologies.

> *"One of the things we did was gave her a tablet, taught her how to play one game and that has opened up the discovery of a whole variety of applications, Internet access, and usage patterns that she didn't have."*

To bridge the digital divide a number of the studies have evaluated ICT training programs tailored to older adults. These studies found that older adults reported being more likely to use ICTs after attending training.[42,51,68,75] Tailored training and ongoing support are critical to giving people the skills to use ICTs, with recommendations to consider integrating ICT training into other programs of interest (e.g., photography course), be culturally relevant, or be individualized to participants' specific goal for ICT use (e.g., staying connected with family).

Ongoing ICT support is important as one study[76] found that motivation to continue to use among current ICT users can be jeopardized by lack of skills to optimize use of a device or address unexpected issues; physical difficulties such as arthritis or remembering passwords; or unfriendly user interfaces, too many steps needed to complete tasks, computer security, technical jargon, and software problems (e.g., freezing).

Among the methods to encourage people to use technology reported by participants at the World Café, middle-aged and older adults need to see the value added and to feel confident in their technology use.

> *"I think it's all about inspiring them and them seeing how it's actually going to integrate and help them in what they're doing in their lives already."*

> *"There's a lot of different ways of being able to access the information but I think it's the lack of knowledge of where to look, having the confidence to access it and finding out really what works for you. Everybody's different."*

Finally, design features can support or deter ICT use and skill development for middle-aged and older adults. For example, design elements that reduce the number of steps required to complete a task makes it easier to learn new skills (the iPad interface is an example of this).[72] As Lam and Lee conclude: "With better computer equipment and better technical support, [older adult] students increase their expectations on what they can achieve from using the Internet."[77(p198)] User-friendly designs and skills support increases self-efficacy.

In agreement with these findings from the literature, participants at the World Café reported that physical challenges associated with aging are a barrier to technology use.

> *"I think physically some of those things aren't that good. Like arthritic fingers are about twice the size of anyone else's so when I go to press a button or a key, I get wrong answers half the time. So that part, as well as vision. I think those are physical barriers."*

The interaction of these resources creates the opportunity for access and use. As Niehaves and Plattfaut[35] found, the more older adults understand the potential benefits of ICTs, the more they are willing to use. One way to know the potential benefits is through use. For example, older adult Internet users (65+) in Larsson et al.'s[68] study reported that the more they used the Internet, the more they learned and incorporated new Internet-based activities into their lives. Conversely, the Internet non-users identified that a lack of knowledge about the Internet contributes to their lack of uptake. Walsh and Callan[78] discuss the challenges that individuals have in imagining the application of technologies with which they are not familiar in their lives. Familiarity is, in part,

required in order to be able to fully consider the potential value or challenge that ICTs might pose.

Consistent with these findings from the literature, participants at the World Café reported that safety and privacy concerns are barriers to technology use for middle-aged and older adults.

> *"…My mother who's 75 and above, she won't use Facebook because she's concerned and sees media reports of people being scammed or over-sharing information or being exposed or having their identity stolen because of that. And so the barrier is that there's no trusted source of information to remediate that or to help her understand where she can be safe."*

Atkinson and colleagues[45] summarize the complexity of the interaction between age and cohort factors, income, familiarity with ICTs, ageist stereotypes, and training:

> *"Older informants said that their age made it difficult to understand ICTs and, given their limited incomes and the cost associated with these technologies, they found it difficult to access ICT services. Members of this cohort also mentioned their lack of personal 'comfort' or the extent they often felt uncomfortable approaching ICT and believed they were 'stupid' for not understanding how to use the technologies. Finally, inadequate ICT training was identified as an issue for older members of the community because they believed that many training organizations did not address their specific needs."*
> 45(pp487-488)

The resources, motivation, and skills described thus far and how these interact in connection to ICT use and access in middle aged and older adults is summarized in Table 1 in Appendix C. The table divides specific mechanisms by those associated with ICT non-use and those associated with ICT use.

Intersectional analysis and the ICT gap (Outcomes)

Using an intersectional lens throughout this review made visible a pattern of privilege related to choice in ICT access and use that can occur over one's life course. The interaction of social locations and demographics described above contributes to one's opportunity to have choice in whether or not to use ICTs. On the other hand, the concept of 'choice' is potentially removed in the types of research questions asked which tend to seek to explain why there is a digital divide and how can it be bridged. For the most part the research is not asking how people prefer to engage with their

communities, resources, services, information, and family; and the preferred role of technologies in these activities. As a result, the research focus leads to implications and solutions that are primarily access driven (e.g., reducing costs, publicly available computers, training programs) rather than accessibility driven (e.g., providing materials in the preferred format of your client, maintaining postal service).

For middle-aged and older adults who have not had opportunities for exposure or regular access to ICTs, due to financial limitations, not introduced during formative years (not a social norm), and/or ICTs were not inherently a part of their work life, their choice is then altered, restricted, or unavailable. Not having the skills, or insight into potential benefits, or comfort with ICTs, further limits one's ability to make an informed choice. However, this is not the only scenario. There are retired professionals who used computers during their careers, are financially secure in their retirement, and understand the potential benefits to ICT use, but choose to not use them. They prefer to rely on 'traditional' modes of: communication, information access, banking, and so forth, because it suits their lifestyle. This is an informed choice. While a number of other trajectories related to choice are possible, this theme of choice needs to be considered when developing programs and policies to address the digital divide between aging adults and younger persons.

> *"For digital seniors, ICT use is not a binary, they want to have the flexibility to choose for themselves how to engage with ICTs."*[4(p702)]

The challenge with inequitable access to and use of ICTs is that those who could most benefit from ICTs are often the least likely to access and use them. Thus, the exclusion of individuals who occupy marginalized social locations is perpetuated by digital inequities. This is particularly relevant as technology solutions are often utilized to save costs. For example, as government and social services and resources are becoming digitized and moving toward operating exclusively online, individuals in need of government supports (e.g., rent supplements) could be excluded due to their lack of ICT access. In addition, a number of solutions for the issues experienced by older adults, such as social isolation, will not reach those in need given the cycle of exclusion.

> *"Through enabling hobbies, social contact, and everyday tasks, DT [digital technology] facilitated more enjoyment, support, and flexibility into the lives of*

participants. This in turn supports social inclusion by enabling social connectedness, computer mediated social networks, and also opens up opportunities to introduce more enabling uses of DT." [74(p419)]

Supporting choice in ICT access and use (Intervention)

Three primary recommendations to support middle-aged and older adults' 'choice' to access and use ICTs emerged through this review: 1) training and awareness; 2) universal design; and 3) accessible alternatives.

Training and awareness

Providing tailored and affordable, encouraging, and relevant training opportunities to middle-aged and older adults at convenient locations, such as seniors' centres and libraries, is recommended. The preferred location of training and support is in the home or in other familiar spaces.[68] Training needs to be connected to an avenue of ongoing support, which could be through providing caregivers tips, having follow-up sessions, or peer volunteers. In addition, training should provide tips and guidelines on how to protect ICT users from being exploited through online scams and fraud. In order to encourage participation at training programs, promotion of the benefits, entertainment value, and ease of skill development is required. This might include campaigns that challenge ageist stereotypes, inclusion of older adults in advertising for ICT products, and providing opportunities to test products.

Participants at the World Café support the challenge involved in maintaining up-to-date technology for community-based service providers.

> *"If you give the tools, if you give the learning opportunity. Senior centers are place where [people can access computers]. I know cost can be a real barrier for an individual—not just for the technology, but for the data access. And for senior centers, with improvements and changes in technology, you can make an investment in technology, take classes, and a few years down the road you have to do that all over again; in a way that with other learning opportunities, you may not. So there's an ongoing cost that's often not built in."*

Universal Design

Usability and accessibility of ICTs influence the uptake and ongoing use of ICTs in middle-aged and older adults. The average older adult does not necessarily want to use a product that has been designed for seniors, particularly if they do not see

themselves as a senior or as in need of speciality products. "Universal design is the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability."[79] Encouraging technology developers to apply universal design principles in the development of products could improve access and use for all ICT users, particularly those with physical disabilities or cognitive challenges who might otherwise be excluded. This could be encouraged through regulations as well as policy guidelines.

Participants at the World Café support the literature suggesting that technology has been poorly designed for middle-aged and older adults and that this is a barrier to use.

> *"There's still people in their mid-80s to 90s and 100s that have still not been able to access the technology. And I think now it's kind of at a point where they may not physically have the ability to access it… A small screen, buttons sliding – is that a button, is that not a button? And so the technology, the way it's designed is kind of preventing them from being able to access it."*

> *"I'm using technology, I have Apple, but I have to have the big print, 150%; and some web pages, I don't use it because I have no flexibility or they have flashing figures going or picture popping up, which disturbs my retina, so I just don't use it…Barrier for using is lack of consideration of people…"*

Accessible alternatives

Finally, while it is important to support and encourage middle-aged and older adults who are non-users to develop ICT skills given the potential of technology to support health and wellbeing, it is important to recognize that use of these ICTs is a choice and social services and resources should be equally accessible in non-digital format. As well, since social interaction can support the uptake of ICTs, person-to-person contact (e.g., peer support) should be encouraged as opportunities to build knowledge of and familiarity with ICTs.

State of Knowledge

Overall, the demographic variables associated with ICT access and use are well established in the literature. In the Canadian context, however, further exploration is required in specific areas, such as in Aboriginal communities, particularly rural and

remote, on and off reserve. Remote Canadian communities continue to have broadband access issues,[32] which needs to be explored, particularly in terms of who is most affected, what outcomes of non-use are, and potential solutions.

Tablet devices are a nascent technology that has not been sufficiently evaluated. The studies that reported on tablets indicated that older adult ICT users used computers or laptops more than tablets[33,50]; and another indicated that the design of iPads, when provided to older adult ICT users, is preferable to computers.[72] In the World Café event we heard from participants that tablets are increasing in popularity. Thus, tablets should be explored further in terms of providing access, training, and informing design principles to support accessibility for middle aged and older adults.

Data from the World Café suggested that middle-aged and older adults are increasingly using technology to monitor and track their health (e.g., steps per day counted).

> *"I'm now seeing people really using tablets and starting to use devices to monitor their medical conditions…there's the blood pressure monitors and that type of thing."*

Given the concerns for safety and privacy, it is important to identify the cyber risks, persons who are most at-risk, and strategies to protect those at-risk (structural strategies and individual level strategies). Given middle-aged and older adults are increasingly online, there is the potential for a corresponding increase in cyber scams leaving these individuals in financial difficulties or worse.

Emerging literature is exploring how technology shapes the social landscape within which people live, and the benefits technology can have on social participation and wellbeing in later life.[80] This area of research needs further support and development particularly as we see ICTs increasing use and potential with older adults.

Additional Resources

Minoru Seniors' Centre: The Minoru Place Activity Centre (MPAC) offers an inviting environment for adults 55+ to enjoy a healthy and active lifestyle. A vast range of activities and programs including registered programs, out trips, special events, health

and wellness clinics, and support groups are offered for all levels of ability. richmond.ca/parksrec

West End Seniors' Centre: West End Seniors' Centre inspires and supports older adults to live involved, vibrant and fulfilling lives. It improves the quality of life of adults aged 55+ by providing social, educational and recreational programs and services that foster connection and inclusion in the broader community. wesn.ca

eGurus: eGurus provides one-on-one, in-home tutoring services to help individuals stay connected. They provide set up, training, support on computer and related technology products such as smartphones, eReaders, digital cameras, printers, scanners. egurus.ca

bc211: A comprehensive information and referral service for people to find and connect with the community, social, or government services they need. bc211.ca

Gerontology Research Centre: The GRC serves as a focal point for research, education, and information on individual and population aging and actively promote publications in key areas of research. sfu.ca/grc

AGE-WELL NCE: AGE-WELL is dedicated to the creation of technologies and services that benefit older adults and caregivers. AGE-WELL's aim is to help older Canadians maintain their independence, health and quality of life through technologies and services that increase their safety and security, support their independent living, and enhance their social participation. agewell-nce.ca

Centre for Universal Design: Established by the National Disability Authority (NDA), the Centre for Universal Design is working towards supporting universal access by contributing to the development of Universal Design standards, providing education and professional development and building awareness. universaldesign.ie

Knowledge Mobilization

This project has endeavoured to implement an integrated knowledge mobilization strategy. Central to the integration component is having a community stakeholder partnership, guiding the research questions and contributing to project development. Similarly, our first World Café event expanded our stakeholder engagement, informing the realist review data extraction and analysis. The second

upcoming World Café event will allow for validation and further iteration of the findings. Bringing together diverse stakeholders, these events not only enrich the review findings and broaden our reach, but also create learning and networking opportunities for participants. For example, through engagement during the first World Café event, we now are working with a new industry partner (eGurus) to develop a collaborative grant proposal to address the gaps identified through this review. As well, all World Café participants who gave permission for follow-up will receive an electronic version of the full project report and other project summaries.

For end-of-grant knowledge dissemination we have begun presenting to multidisciplinary academic audiences. We presented preliminary findings at the 10th World Conference of Gerontechnology in Nice, France in September 2016. Forthcoming, is an oral presentation at the 45th Annual Scientific and Educational Meeting of the Canadian Association on Gerontology, October 2016, in Montreal, QC; and an abstract has been submitted to the International Association for the 21st World Congress of Gerontology and Geriatrics, July 2017 in San Francisco, CA. Based on these presentations and this final report, at least one academic paper will be developed and published in a peer-reviewed journal.

To reach a broader audience, blog posts are under development for both AGE-WELL (the Canadian network for aging and technology) and a multi-authored blog site (e.g., Medium or Monkey Cage). In addition, a lay summary of the project will be published in the Gerontology Research Centre (GRC) quarterly newsletter, which is distributed to an international audience of more than 2,000 academics and non-academics. Promotion of all of our products will be done through social media platforms including LinkedIn and Twitter associated with the project investigators, utilizing the networks of the GRC, SFU, bc211, and AGE-WELL.

Conclusion

In this project we sought to better understand the current state of the digital divide (within the past 10 years) as it pertains to middle-aged and older adults, based findings from a rapid realist review. Our findings revealed that there are a number of demographic variables that interact to shape ICT use, including education, age,

income, disability status, urban/rural geography, relationship status, and gender. The three key variables that were significantly associated with ICT access and use were educational attainment, income level, and age. Middle-aged adults who had more education and higher income were more likely to use ICTs. Disability status, relationships status, gender, urban/rural geography, and gender were less consistent or otherwise provided less explanatory power to ICT access and use. However, within the Canadian context, further exploration is required in specific areas, such as in Aboriginal communities, particularly rural and remote, on and off reserve.

In terms of mechanisms for understanding ICT use, resources, motivation, and skills mediated by differences in education, income, and age shaped ICT use over time. Lastly, an intersectional applied in this review made visible a pattern of privilege in terms of ICT use related to choice. For individuals who had limited or no opportunities for exposure or regular access to ICTs, due to financial limitations, not a part of work or formative lives, 'choice' was altered, restricted, or unavailable. To enable choice in ICT use, three key recommendations to support older adults in ICT access and use emerged from this review: tailored and affordable training, use of universal design, and provision of accessible alternatives, particularly for middle-aged and older people who choose not to use ICTs.

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Appendix A: Research method details

A rapid realist review involves the following six steps:

1. Clarify the scope and refine research question(s)
2. Search for evidence
3. Evidence selection and appraisal
4. Data extraction
5. Data analysis and synthesis
6. Dissemination of findings

The following provides details of each of those steps taken for the purposes of this project.

Step 1

The research questions were refined in collaboration with our stakeholder (bc211). The primary guiding questions for the review were:

I. How is the digital divide relevant to the current cohort of middle-aged and older adults?
    a. What are the characteristics of middle-aged and older adults who are excluded from ICT use (e.g., gender, geographical location, race/ethnicity, socioeconomic status, education level)?
    b. What factors affect exclusion from ICT use (e.g., motivation, physical access, skills)?

II. What are the implications of the findings from this synthesis for policies, services, and research that influence middle-aged and older adults' access to and use of technology?

These questions are pertinent to understanding how the digital divide applies to community-dwelling middle-aged and older adults' knowledge of, access to, and use of ICTs (i.e., outcome of interest).

Step 2

Eligible articles that were published in peer-review journals and met the project's inclusion criteria were identified through a systematic search of multiple online databases (e.g., CINAHL; AgeLine; PsychINFO; Communication & Mass Media). A librarian assisted in the identification of relevant databases for the project.

The inclusion criteria for the peer-reviewed literature included:

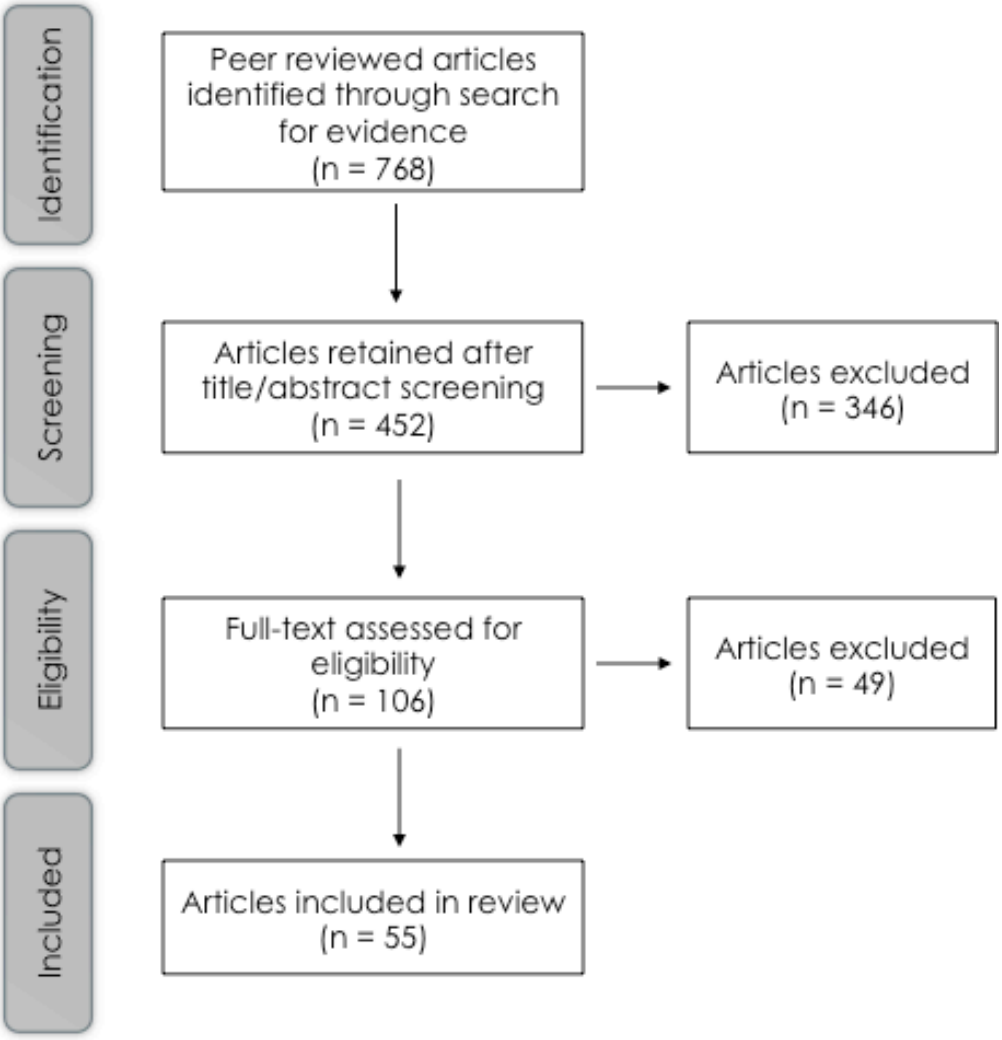
- Language: published in English
- Year: ten-year publication period (January 2006 – June 2016)
- Population: community-dwelling adults aged 45 years and older
- Concepts: middle-aged and older adults; access to and use of ICTs; digital divide

Step 3

The evidence selection moved from title screening during Step 2, to full abstract screening, whereby two researchers independently reviewed each abstract to select articles for full-text review. Two researchers then independently reviewed all full-text

articles (n=106) to assess eligibility for inclusion in the review. The few discrepancies were discussed and resolved by a third reviewer. A total of 55 peer-reviewed articles met the project's inclusion criteria and were selected for full review.

Figure 1: Evidence selection flow diagram



Step 4

The first level of data extraction employed a data extraction table to organize data based on categories outlined in the Resources and Appropriation Theory (van Dijk, 2012). One researcher reviewed the 55 articles, populating the data extraction table with data of interest and provided a summary of the key findings. A second researcher reviewed the data extraction table and completed preliminary analysis summary.

Step 5

Using an intersectional lens, the second researcher read each full article, comparing and contrasting data with the Resources and Appropriate theory and pulling additional relevant data from the articles not captured on the data extraction table. Analysis was

deepened in order to identify the policy and practice implications from an intersectional perspective. Lastly, a third researcher integrated this literature analysis with key themes that emerged from the World Café data. World Café data were thematically analyzed and coded using NVivo, a qualitative software program, based on the data extraction template.

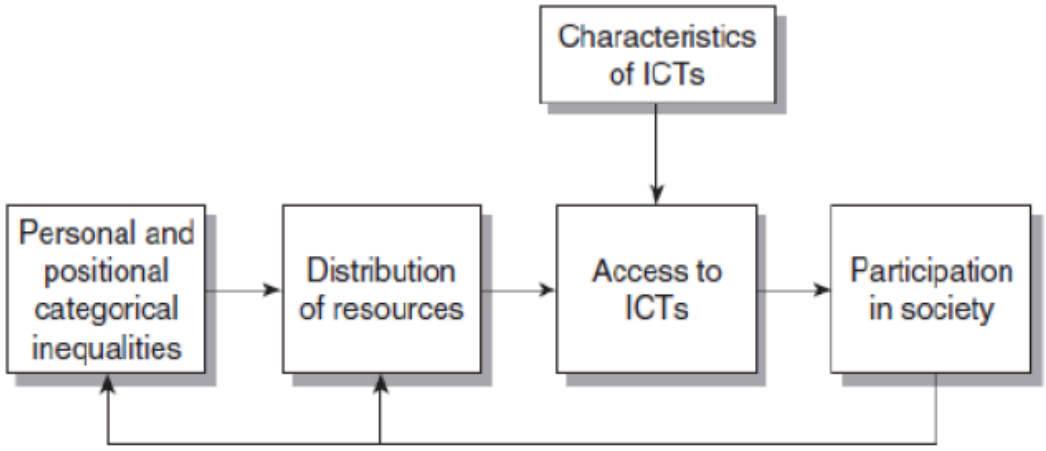
Step 6

Dissemination of the findings is ongoing. This report is one of the dissemination products as are the World Café events, one held already (August 2016) and one upcoming (October 2016). We presented preliminary findings at the 10th World Conference of Gerontechnology in Nice, France in September 2016. Forthcoming, is an oral presentation at the 45th Annual Scientific and Educational Meeting of the Canadian Association on Gerontology, October 2016, in Montreal, QC; and an abstract has been submitted to the International Association for the 21st World Congress of Gerontology and Geriatrics, July 2017 in San Francisco, CA. Further details are captured in the report.

Appendix B: Resources and Appropriation Theory

The digital divide theory that guided the realist review data extraction and analysis by Van Dijk[2] is succinctly summarized in the figures which Van Dijk created to illustrate the theory and reproduced here for reference purposes.

There are two components to the theory. First is the overarching explanatory theory of the resources and mechanisms that influence ICT use and access, reproduced here from Van Dijk.[2(p61)]



The second component is a proposed step wise progression of access at an individual level (appropriation), reproduced here from Van Dijk.[2(p62)]

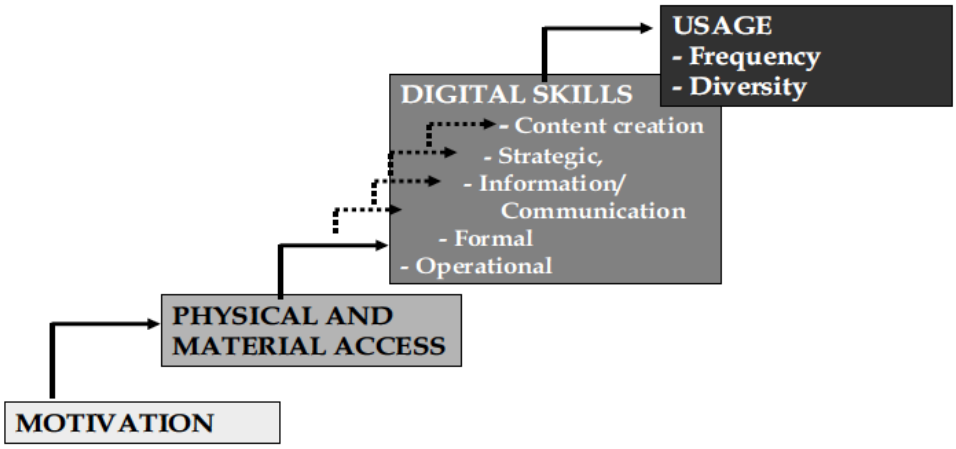


Figure 2. Four Successive Kinds of Access in the Appropriation of Digital Technology

Appendix C: Summary of results

Table 1: Summary of ICT use & access mechanisms

ICT non-use	ICT use
Limited financial resources; not owning a home computer	Higher income; Having a home computer
Lower education attainment	Higher education attainment
Lack of familiarity, no training, limited skills, fear of damaging equipment	Practice, experience, exposure through work, family, friends, social support
Embrace ageist stereotypes related to ability of older adults to use ICTs, technology anxiety	Reject ageism, embrace aging process, curious, adventurous, active
Complex interfaces, constantly changing technology	Functional design, usability, accessible design
Fear of cyber security and privacy breaches	Social support, encouragement
Dislike or uninterested in ICTs; prefer familiar modes of communication	Value ICTs for communication, information, entertainment, and other resources, enjoyment
Physical limitations	Healthy and active