

Sutton-Lalani, Alexandra; Hernandez, Sebastian; Miedema, John; Dai, Jiamin;  
Omrane, Badr

**Working Paper**

## Redefining financial inclusion for a digital age: Implications for a central bank digital currency

Bank of Canada Staff Discussion Paper, No. 2023-22

**Provided in Cooperation with:**

Bank of Canada, Ottawa

*Suggested Citation:* Sutton-Lalani, Alexandra; Hernandez, Sebastian; Miedema, John; Dai, Jiamin; Omrane, Badr (2023) : Redefining financial inclusion for a digital age: Implications for a central bank digital currency, Bank of Canada Staff Discussion Paper, No. 2023-22, Bank of Canada, Ottawa, <https://doi.org/10.34989/sdp-2023-22>

This Version is available at:

<https://hdl.handle.net/10419/297091>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Redefining Financial Inclusion for a Digital Age: Implications for a Central Bank Digital Currency

by Alexandra Sutton-Lalani,<sup>1</sup> Sebastian Hernandez,<sup>1</sup> John  
Miedema,<sup>1</sup> Jiamin Dai<sup>2</sup> and Badr Omrane<sup>1</sup>

<sup>1</sup>Information Technology Services Department  
Bank of Canada  
[asuttonlalani@bankofcanada.ca](mailto:asuttonlalani@bankofcanada.ca); [shernandez@bankofcanada.ca](mailto:shernandez@bankofcanada.ca);  
[jmiedema@bankofcanada.ca](mailto:jmiedema@bankofcanada.ca); [bomrane@bankofcanada.ca](mailto:bomrane@bankofcanada.ca)

<sup>2</sup>McGill University



Bank of Canada staff discussion papers are completed staff research studies on a wide variety of subjects relevant to central bank policy, produced independently from the Bank's Governing Council. This research may support or challenge prevailing policy orthodoxy. Therefore, the views expressed in this paper are solely those of the authors and may differ from official Bank of Canada views. No responsibility for them should be attributed to the Bank.

## Acknowledgements

We thank Dinesh Shah, Scott Hendry, Roger Hatch, Francisco Rivadeneyra, Stephen Wild, Andrew Usher and Josianne Menard for helpful comments and discussion. We also thank Karen Moffat for support and guidance on earlier phases of this research. We are grateful to Meredith Fraser-Ohman and Alison Arnot for excellent editorial assistance. The views expressed in this paper are solely those of the authors and may differ from official Bank of Canada views. No responsibility for them should be attributed to the Bank of Canada.

## Abstract

Digitalization—the use of data, digital platforms and advanced analytics—has quickly become widespread in today’s society. This has introduced new opportunities, but it has also created new barriers and exacerbated existing inequities. This is likewise true in the realm of payments, where issues around financial inclusion, digital inclusion and accessibility compound the challenges for users. Our work expands on that of Henry et al. (2023). We base our research on two key premises. First, we apply the social model of disability to the Canadian payments landscape to identify opportunities to remove barriers that marginalize or hinder people. Second, we investigate beyond the standard economic measures and aggregate statistics related to these topics to build a nuanced understanding of the challenges inherent in the current system. Our findings highlight important areas of research and design consideration for new digital payment products and services, specifically for central banks contemplating the introduction of a central bank digital currency. We identify barriers that rural populations, Indigenous communities, Canadians with low incomes and persons with disabilities face in using financial products. We also note a deficiency in the current research and payment offerings for those with cognitive accessibility challenges. With these findings, we aim to build awareness of the inequities and challenges present in the current payments system and motivate existing financial technology providers to move toward offering more-inclusive products and services.

*Topics: Bank notes; Central bank research; Digital currencies and fintech; Digitalization; Financial services*

*JEL codes: A14, E42, E50, I31, O33, O51*

# Introduction

Policy-makers and experts agree that digital technologies have advanced more rapidly than any other innovation in recorded history (United Nations 2020). Canada is no exception, and while digitalization was well underway before the COVID-19 pandemic, shifts in consumer behaviour and technology use have since accelerated and are expected to continue (Lane 2021). This trend is particularly relevant when considering how Canadians make payments and manage their money. The availability of new technologies, coupled with ongoing demands for greater efficiency and flexibility, have resulted in a constant evolution of payment habits and patterns.

Perhaps most notable is the steady decline in the use of cash in favour of cards and digital payments. Digital payment options are inspiring researchers to think more broadly about digital money—the social implications are increasingly gaining attention (Nelms and Rea 2017) and prompting examinations beyond mere financial transactions to social interactions (Ferreira and Perry 2019). Design considerations for this evolving technology are already complex (Cassivi et al. 2010), given the range of users and needs already present in the financial technology (fintech) landscape. As new technologies are developed, opportunities arise to address accessibility issues and help people cope with challenges not adequately considered with current payment technologies. Although research continues to shed light on new technologies and specific opportunities, the large-scale digitalization taking place in today's society requires a broad understanding of the scale and scope of challenges related to payments.

Amid this shifting environment, the Bank of Canada is researching the design of a central bank digital currency (CBDC), to be ready should the need to issue one arise. Underpinning the Bank's CBDC research initiative is the idea that access to money is essential to participate in the economy (Bank of Canada 2020). A CBDC would have to be universally accessible—meaning it must be designed so that as many people as possible can use it to make payments online, at the point of sale and from one person to another. Such a design requires a strong understanding of the volume of end users and their specific needs. This understanding begins with insight into end users' current use of digital payments and the challenges they face. To identify these challenges more clearly, our research expands on the gap analysis of payment needs conducted by Henry et al. (2023), which suggests that most Canadians face few gaps in the payments market. By looking at variations in quality and experience, we uncover meaningful barriers and frictions that reveal considerable inclusion challenges.

A key motivation for this research is to conduct both a quantitative and qualitative analysis of the groups facing challenges in making digital payments and to address the perception that these barriers apply to small margins of people, such as those with disabilities or without access to the internet. We compile the existing but scattered quantitative data to discern the volume of users and their needs. In doing so, we seek to better promote awareness and understanding of these challenges, which are currently insufficiently understood by fintech designers and decision-makers.

## Research context

Payments and currency are, understandably, topics typically considered within the realm of economics and finance. While economic research on these topics does consider both financial inclusion<sup>1</sup> and digital inclusion,<sup>2</sup> the typical metrics for these concepts are access to a bank account and access to the internet. We propose that, while useful, these metrics obscure the nuanced circumstances that contribute to accessibility. The Ontario Human Rights Commission (2023) defines *equity* as the “process of recognizing differences within groups of individuals and using this understanding to achieve substantive equality in all aspects of a person’s life.” When we examine economic issues related to equity, we find that traditional metrics cannot be applied equally across groups and that aggregate statistics could conflate *equitable treatment* with *same treatment*.

Further, we consider the social model of disability, which identifies problems faced by marginalized people or those facing challenges related to disability as the result of external factors (Parliamentary and Health Services Ombudsman 2020). We take an analytical approach based on this model and place the existing economic research within broader societal considerations. This approach is also in line with the Bank’s equity, diversity and inclusion strategy (Bank of Canada 2021), which commits to integrating considerations of equity, diversity and inclusion more fully into Bank initiatives—including CBDC planning and research. To this end, we seek to complement existing research on accessibility and inclusion in the area of payments by identifying material barriers and describing the realities of inequity underlying the aggregate statistics that are commonly used.

Our analysis primarily builds on earlier work by Dai et al. (2023). We further examine the scale of need for universal access to electronic payments and a possible digital currency as well as the nature of the challenges Canadians face. We focus on three types of inclusion that, when combined, are central to the development of a universally accessible payment method:

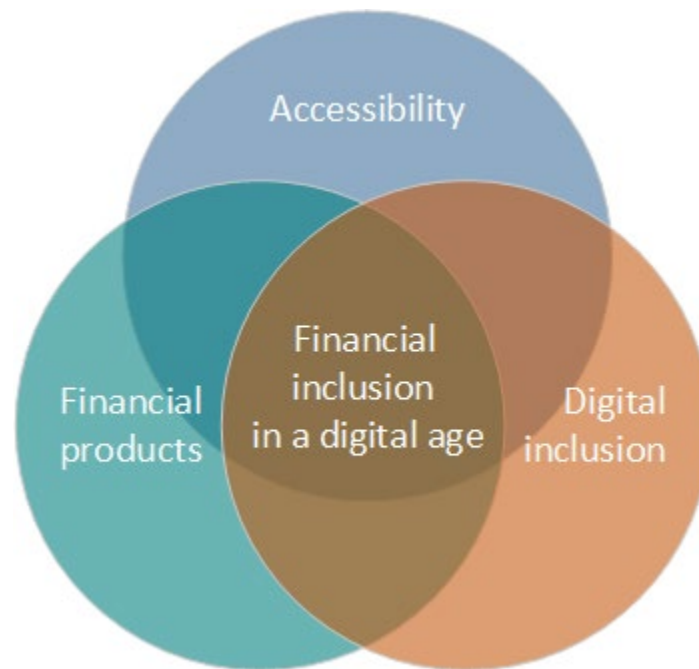
- financial inclusion
- digital inclusion
- accessibility

---

<sup>1</sup> The World Bank (2022) defines financial inclusion as the state when individuals and businesses can access useful, affordable financial products and services that meet their needs and that are delivered in a responsible and sustainable way.

<sup>2</sup> The United Nations (2022) defines digital inclusion as equitable, meaningful and safe access to use, lead, and design digital technologies and services, and provide associated opportunities for everyone, everywhere.

Figure 1: Modern financial inclusion is achieved through accessible financial products and digital inclusion



It is important to note that each type of inclusion involves both the primary users of the digital technology (i.e., people making payments) and secondary users (i.e., people supporting or associated with others making payments).

Quantifying these two user groups to fully understand their scale and the barriers they face with existing digital financial products is crucial to derive insights that can be applied to the design of digital payment methods. In the same way that we cannot assume that only a minority of users have accessibility concerns, the design of a digital payment method should not assume that most people are already able to make digital payments. Further, the quality of access varies due to the variety of accessibility factors. The universal access requirements of any potential digital currency should be identified in specific terms, capturing the quantitative scale of people with accessibility needs and providing rich qualitative descriptions of the nature of their concerns. While the potential issuance of a CBDC or any new digital payment technology may not address all issues related to accessibility, a strong understanding of the size and scope of challenges is an important starting point.

## Understanding universal access

We group our findings by type of inclusion, as described earlier—financial inclusion, digital inclusion and accessibility. The barriers that impact each type are distinct and must be addressed in a targeted way. The presence of even one obstacle could highly impact a user’s experience. In other words, for a payment solution to be universally accessible it must mitigate barriers from all three inclusion types simultaneously. While barriers can only make an experience worse, their removal does not make the experience good—

merely less bad. Given the varied needs and challenges of users, a range of mitigations and technologies must be considered to reduce barriers.

While research findings have shown considerable diversity, several themes recurred across the three inclusion types, including:

- trust
- literacy and knowledge
- variety and breadth of challenges and needs

## Financial inclusion

As we noted earlier, the World Bank defines financial inclusion as when “individuals and businesses have access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way” (World Bank 2022). It has been described as a key factor in reducing poverty and identified as a G20 priority (Global Partnership for Financial Inclusion 2017). This commitment characterizes the ability to make transactions as a basic step for financial inclusion, making it an especially relevant consideration for digital payments. As well, increasing financial inclusion is often cited specifically as a primary motivation for issuing a CBDC in developing countries (Tan 2023).

Financial inclusion is often measured by access to bank accounts. The Bank of Canada’s [2021 Methods-of-Payment Survey](#) indicates that 98% of Canadian adults have a bank account and a debit card (Henry, Shimoda and Zhu 2022). This finding suggests that the population of unbanked adults—those who do not have a bank account—in Canada sits around 2%. However, additional research finds that this proportion is higher among low-income and vulnerable Canadians (Banjoko 2021). The [2021 Methods-of-Payment Survey](#) also finds that 87% of Canadian adults have a credit card (Henry, Shimoda and Zhu 2022). The remaining 13% who do not have a credit card may face limited options to make online purchases.



**The 13% of Canadians who do not have a credit card may not have sufficient online payment methods to participate in the digital economy.**

While financial inclusion might seem like an obvious aim of the global financial system, the profit incentive for private financial institutions does not motivate them to offer services to lower- and middle-income segments of the

population, leaving these groups largely underserved (King 2021).

Typical measures might suggest that most adults should be able to make payments without facing any barriers; however, we argue that a more nuanced view of financial inclusion reveals the presence of meaningful frictions and challenges. For example, underbanked Canadians—those who have a bank account but still face barriers—may be more likely to rely on fringe financial services, such as pay-day lenders and cheque cashers (Buckland 2011). These services charge significantly higher interest rates and fees to clients who are already likely to have lower incomes or be financially vulnerable, putting them at a further disadvantage. The reasons why someone remains underbanked are diverse and could include differing costs and quality of services, limited financial literacy and lack of trust. These particular issues are



especially common in vulnerable communities and for persons with disabilities who may encounter accessibility barriers before or when signing up for financial services.

Traditionally, access to cash has played a key role in financial inclusion, since cash is a form of public money that ensures all Canadians can make transactions. While it continues to be accepted in a wide range of circumstances—such as at the point of sale at bricks-and-mortar establishments or for peer-to-peer payments—cash’s prevalence as a method of payment is declining. The share of the volume of transactions made using cash declined from approximately 53% in 2009 to below 21% in 2021 (Henry, Shimoda and Zhu 2022). Those who must rely on bank notes cannot use them to make online payments and are at a higher risk of being excluded from the digital economy. In this sense, financial inclusion becomes contingent on the quality and level of digital inclusion and access to an expanded choice of goods and services, a relationship we explore further in the findings below.

## **Payment habits and money management**

While Canadians have a diverse range of payment habits, certain trends have emerged across different demographics. For example, 43% of Canadians stated that the COVID-19 pandemic had changed their payment preferences to digital and contactless for the long term (Payments Canada 2021). However, consumers still rate cash as an easy-to-use, low-cost, secure and widely accepted payment method. It is a specifically relevant method of payment for older Canadians. Henry, Huynh and Welte (2018) find that bank notes remain most commonly used by those who:

- are age 55 and older
- have an annual income of less than \$45,000
- have only a high school education
- have a low rate of financial literacy

This indicates that especially for members of these demographics, it may be beneficial to replicate the desirable qualities of cash in a digital format to improve access to payments and expand consumer choices.

## **Understanding and trust**

Financial literacy and trust in institutions are recurring themes across research on financial inclusion. Perhaps unsurprisingly, knowledge and comfort are key factors in determining the extent to which people will benefit from financial products and services. In some cases, this relates to the format of these financial offerings. For example, survey research shows that even among those who pay bills online, a paper bill is still preferred as assurance when transacting with banks and billing firms (McNeish 2015). Beyond format, perceptions may also play a big role in how fully users benefit from financial services. Earlier research in low-income neighbourhoods in Manitoba reports that many vulnerable users, especially those who are Indigenous, turn away from traditional financial services toward fringe banking because of past discrimination. The reasons for this may be structural, in that some particular forms of identification from Indigenous communities are not often accepted by financial institutions, or they may be interpersonal, related to feelings of mistreatment and alienation (Martin, Curran and Lapierre 2006). More recently,

Statistics Canada survey data show that of the 46% of Black respondents who indicated they experienced discrimination, 51% said they experienced it in a store, bank or restaurant. The same is true for 42% of the 36% of First Nations, Métis or Inuit respondents who experienced discrimination (Statistics Canada 2019). While these data combine experiences across these three types of businesses, media reports reinforce the ongoing prevalence of discrimination in financial institutions and banks.

In terms of financial literacy, research shows that some people with low incomes have an appetite for improved financial planning and management. In their financial diary study involving 13 low-income Canadians in Toronto and Winnipeg, Buckland, Fikkert and Gonske (2013) report that most participants were willing—and several were eager—to more deliberately track their finances and think about their financial future. The study finds that education and services need to be offered together to improve access to traditional financial services for lower-income Canadians (Buckland, Fikkert and Gonske 2013). While broader research in this area is required, these findings are especially relevant when considering what type of education, awareness and product support should accompany new digital payment products aimed at increasing financial inclusion.

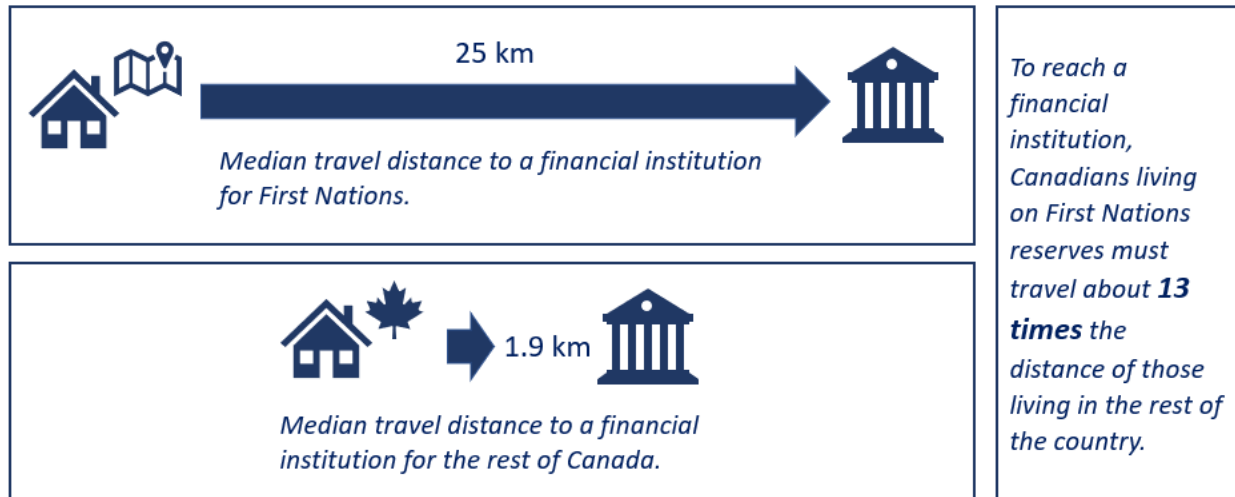
## **Availability and equity of services**

Though it could be argued that digitalizing financial services makes them ubiquitously available and reduces potential human bias, a number of users must still rely on bricks-and-mortar bank branches to meet their needs. This includes users who cannot access digital services for a variety of reasons—such as internet connectivity and affordability (outlined further below)—and who may also rely on cash. While financial institutions remain common in urban and well-populated areas, their distribution is not equitable across regions. Research on access to cash shows that 97% of urban Canadians and 92% of rural Canadians have access to an automated banking machine (ABM) in their community (Chen and Felt 2022), although further studies reveal nuances underlying this statistic.

For example, while bank branches are commonly accessible in urban centres, they become more difficult to access in remote or less populous regions. A 2021 study of access to cash for people on First Nations reserves reveals that the median travel distance from band offices to the closest branch of a financial institution is about 25 kilometres,<sup>3</sup> and the median distance to the closest cash source is 3.7 kilometres (Chen et al. 2021). Note that a cash source may not be an ABM but could include retailers like gas stations and grocery stores, some of which could charge a fee or introduce frictions to accessing cash.

---

<sup>3</sup> For comparison, in 2017 the median travel distance to a branch of a financial institution for Canadians in general was 1.9 kilometres (Chen, Strathearn and Voia 2021).



To further understand financially vulnerable communities, we consider the findings of a study of 49 First Nations reserves in Canada that are more than 100 kilometres away from an ABM or financial institution branch (Chen et al. 2022). The results show that these areas have poor access to cash sources and in-person financial services as well as limited access to digital payments and electronic banking. These same communities are ranked among the lowest in Canada according to a measure of community well-being (Chen et al. 2022). These findings are significant across multiple dimensions:

- They demonstrate a double marginalization, in that many of the users in these demographic groups face both financial exclusion and digital exclusion.
- They highlight the relationship between financial inclusion and equity across vulnerable or remote populations.
- They underline opportunities for future innovation, especially in the realm of offline digital payments (Minwalla et al. 2023), in regions where online connectivity may remain unreliable in the near term.

As money and financial products and services become increasingly digitalized, modern financial inclusion seems possible only in conjunction with digital inclusion. In addition to the ability to make payments, the general experience of money management is quite varied for users facing barriers to using digital products. Manual tasks in managing money have largely become automated or eliminated with the digitalization of money. For example, basic activities like carrying and counting change for a purchase are eliminated when using digital payment methods. Users have even been found to prefer digital payment methods for purchases that would have resulted in receiving change (Chen, Huynh and Shy 2017). For users with low numeracy skills, eliminating this task can make money more accessible. Another basic advantage of digital payment methods is the reduced need to collect or deposit cash—a task that can be challenging for people without a cash source nearby and for users with accessibility needs. More advanced features like automated accounting, spending alerts and analytics, among others, are also made available through digitalization. Today's money management leverages metadata and task automation that only digital formats can provide. While cash remains an important part of the payments landscape, digital payment innovations continue to be introduced to expand the opportunities for modern financial inclusion.

## Digital inclusion

As noted earlier, the United Nations defines digital inclusion as equitable, meaningful and safe access to use, lead and design digital technologies and services, and provide associated opportunities for everyone, everywhere (United Nations 2022). In Canada, those who struggle with digital inclusion may have no phone, no internet access and low technology literacy. The UN has also reported that the digital divide—unequal access to digital opportunities—exposes and increases existing inequalities (United Nations 2022). In this context, digital inclusion is a key factor for universal accessibility of payments; users who lack digital connectivity cannot currently benefit from the online economy or new payment innovations and, as a result, also lack financial inclusion.

Measures of digital inclusion typically centre around internet access and device ownership. Recent data from the Canadian Radio-Television and Telecommunications Commission (CRTC) show that 91.4% of Canadian households have broadband internet coverage, but that number drops to 62% for those in rural communities. When it comes to mobile coverage, 99.4% of Canadians are covered by mobile LTE networks, but this number decreases slightly to 97.1% in rural communities (CRTC 2023). In terms of device ownership, the most recent Statistics Canada data indicate that 88% of Canadians over the age of 15 have a smartphone.

However, this number drops to 60% for Canadians aged 65 and over (Statistics Canada 2021a). These aggregate numbers suggest a relatively high level of digital inclusion.

However, nuances such as the decrease in

device ownership among older Canadians and inequities in network coverage across remote regions warrant a deeper look into digital inclusion, particularly for low-income or vulnerable populations.

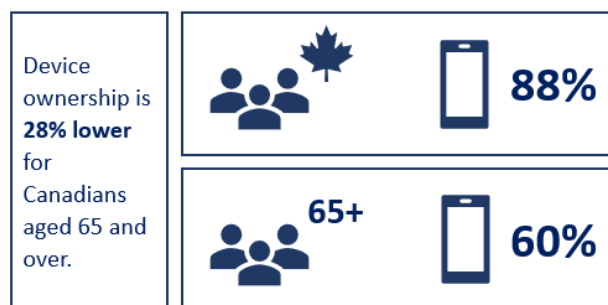
Patterns and barriers of digital inclusion may vary greatly due to additional factors such as:

- cost and affordability
- quality of services
- financial and technological literacy
- trust

When considering the design of a digital payment method, we cannot assume that all users have uniform connectivity, similar devices or the same knowledge and habits. Any payment innovations that aim to promote inclusion must be informed by more than just aggregate statistics; they should seek to address the subtle barriers at work in the digital payments landscape.

## Online habits and digital experiences around money

Patterns of internet use differ across demographic groups and can have a significant impact on a user's ability or appetite to access digital payments. As previously mentioned, internet use by people over the age of 65 is approximately 28% lower than the Canadian average (Statistics Canada 2021a). A comparison of other demographic groups with the country's average shows a similar dynamic. The average



percentage of users who have accessed the internet in the last three months is 92% overall but declines to 88% for Indigenous people, 87% for those living outside of a census metropolitan area, 85% for those not employed and 84% for people with a disability (Statistics Canada 2021b).

While these data on internet use speak to frequency of use, Statistics Canada also developed an internet-use typology using data from its 2018 Canadian Internet Use Survey. The categories of internet users are informed by 36 activities and skills of those surveyed, with advanced users accounting for 33.8%, proficient users 22.2%, intermediate users 19.7%, basic users 15.6% and non-users 8.7% (Wavrock, Schellenberg and Schimmele 2021). The typologies recognize that the user experience changes based on the complexity of tasks, and results show that proficiency level is positively related to income and educational attainment. Although basic users might read the news online or conduct online searches, they are significantly less likely than more advanced users to use the internet for online banking and to buy goods and services. This is probably because these tasks are more complex and may include challenges such as multi-factor authentication and integration of third-party apps. Expanding the analysis to include users of all proficiency levels, we note that approximately 28% do not participate in online banking and 42% do not make online purchases. If we apply these figures to the Canadian population at large, this suggests that a much larger proportion of users face barriers than what is implied by aggregate statistics on internet access.

Many factors drive internet use, but having access in a public versus private space is another key consideration, especially for older or low-income Canadians who may lack digital technology in their home. Public libraries provide internet access to those who lack connectivity of their own. Site observations conducted at five public libraries across Canada witnessed activities such as online shopping, exploring investment and business sites, and conducting online banking (Julien and Hoffman 2008). This range of activities suggests that these spaces are enabling online economic activity for those who may otherwise be excluded. Further, a study based on interviews and observations involving 11 participants in Toronto notes that public access facilities should not only target these services to those without other options to connect to the internet but also engage those who have access at home. If internet access is to be a vital, ongoing and complementary service much like public transportation (Viseu et al. 2006), users with some degree of internet access may still benefit from public access connectivity (just as those with access to a car still benefit from public transport). If we relate these discussions to digital payments specifically, trade-offs emerge between barriers to access and risks, particularly the privacy risks of conducting financial transactions on public computers or networks.

Beyond network access and payment habits, research shows diverse relationships exist between digital technology and money more broadly. For example, a single parent describes relief at being able to reliably receive payments by arranging for monthly electronic funds transfers through Ontario's online Child Support Service (Mersereau 2021). Alternatively, a nationally representative Canadian survey finds that religiosity is negatively associated with internet access and activity (Dilmaghani 2018), suggesting that more-religious communities likely do not benefit from the online economy or digital payments. These examples fall outside of the social dimensions typically considered for payment innovations, although we note them as context surrounding the broader digital money experience.

## Trust and digital literacy

Trust and comfort with digital payments also impact digital inclusion, especially when it comes to older adults. A survey by the Financial Consumer Agency of Canada (FCAC) finds that 11% of seniors use online banking daily and 28% use it at least once a week. The main barriers for seniors who do not bank online are safety or security concerns (32%), a preference for in-person banking or telebanking (20%) and no internet use/access (20%) (FCAC 2019). This demographic group's inclination to use telebanking is highly relevant for digital payments design and research, as voice-user interfaces for payments are one alternative to typical online payment technology interfaces. In a study by Elueze and Quan-Haase (2018), issues around trust are illustrated through interviews with older adults in East York, Toronto. For example, the fear of possible illegal activities motivated one participant to do his online banking through an encrypted desktop computer. Another participant was concerned about fraudulent unauthorized access to his information when engaged in online banking. Testimonials from another study include, "I would never do banking online. That to me is just taboo," and, "I'm just worried that somebody's going to hack into my account. I went for years without having an online account. And just recently I started. I worry about it" (Quan-Haase and Ho 2020). These comments suggest that to gain traction among those who currently face barriers to digital inclusion, a digital payment method must not only *be* secure and trustworthy, but it must also be *perceived* to be so.

Digital literacy is another theme that is strongly related to the use of and trust in digital payments. Of particular note when considering digital inclusion are the "near-users," a subset of "non-users" in Reddick, Boucher and Groseilliers (2000). Near-users have varying degrees of interest in being connected to the internet but are unable to due to several barriers—primarily lack of both affordability and literacy. Similarly, even though Indigenous youth frequently use digital devices, they are less confident in their digital literacy skills than their non-Indigenous peers by approximately 13% (Schrumm, Bell and Smith 2021). These examples suggest that addressing inclusion must go beyond availability and access to services. This is especially relevant when considering digital payments because users with less confidence or know-how are likely to be slower to adopt new technologies for important tasks like payments and banking.

## Availability versus equity of services

Although internet service is reported as widely available across Canada, the quality and speed of services vary. For example, only 24% of households in Indigenous communities have access to quality, high-speed internet (Schrumm, Bell and Smith 2021). Though internet quality is expected to be higher in urban centres, the Local News Data Hub (LNDH) reported the results of 69,000 internet speed tests conducted from locations in 53 communities, many of which were major metropolitan areas, across Canada. The study found that 51 communities fell short of meeting the CRTC's basic service objectives (LNDH 2021). These findings challenge the assumption that urban Canada experiences a uniformly high quality of internet service and instead suggest that inconsistencies exist across all types of communities.

In both urban and rural communities, the elevated cost of high-speed internet services introduces affordability barriers. In a recent survey by Andrey et al. (2021) of 2,500 Toronto residents aged 16 and older, 52% of low-income households and 48% of those over the age of 60 have internet speeds below 50

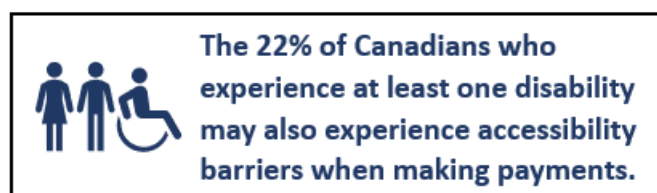
megabits per second (Mbps)—a significant gap from the national goal of 90% of households.<sup>4</sup> Further, one-third of households said they are worried about paying their home internet bills, with people with low incomes, newcomers, single parents and racialized groups most likely to be concerned. The survey also highlighted that of the 2% of households not connected to the internet, 61% said the lack of home internet access has impacted their ability to access critical services in the last six months. This is especially relevant because many critical services—including health care and education—shifted online during the COVID-19 pandemic. The main type of services frequently used by those with internet access is government services and information (32%), followed by banking (27%), health care (27%), education (25%) and work (15%). These findings show that the cost of services introduces barriers to digital inclusion that can have a significant impact on quality of life and access to support.

The research highlights the varied factors that impact digital inclusion and the concerns and inequities that they bring for users. These findings are highly relevant when considering digital payments, where reliability, cost and equitable access are crucial characteristics—and potential barriers—to financial inclusion in a digital age. Moreover, the service-based nature of these characteristics deserves special consideration, given the implementation, delivery and customer support channels that must accompany any new digital payment product.

## Accessibility

Issues surrounding accessibility have gained prominence in Canada, especially with the introduction of the *Accessible Canada Act* in 2019. Employment and Social Development Canada (ESDC) describes improving accessibility as “creating barrier-free communities, workplaces and services for all Canadians” (ESDC 2023). The emphasis on *all Canadians* is an important nuance that expands the discussion of accessibility needs beyond individuals typically considered—namely older adults (Jin, Kuang and Fan 2021; Latulipe, Dsouza and Cumbers 2022) and people who face sensory, motor or cognitive barriers (Kameswaran and Muralidhar 2019). While the aging population and improved awareness of disabilities both play an important role in accessibility, the rapid pace of technological change and its impact on daily tasks risks burdening all users with increased complexity and cognitive load.

Looking at traditional metrics, we can see that the proportion of Canadians who identify as having a disability is significant and set to increase as the population ages. The *Canadian Survey on Disability, 2017* shows that 22% of Canadians (6.2 million people) aged 15 and over have at least one disability (Statistics Canada 2018). This number encompasses a variety of disability categories, including physical—such as those related to pain or motor skills—and mental—such as developmental or memory. The most recent



Statistics Canada data about the aging population show that 7 million Canadians—nearly 1 in 5—are aged 65 or older. In 2021, 860,000 were aged 85 or older, and this number could triple by 2046 (Statistics Canada 2022a). Seniors are almost twice as likely to

<sup>4</sup> The CRTC has set target internet speeds for all Canadian homes and businesses at 50 Mbps for downloads and 10 Mbps for uploads (CRTC 2022).

have a disability than are people of working age. Another element to consider is the cognitive decline that typically accompanies aging (National Institute on Aging 2023). While this is difficult to measure with traditional methods (Wright 2016), the ease with which an older person can adapt to new technology is significantly lower than that of a younger person.

Accessibility is a key factor to consider for digital payments because a user could experience no typical financial or digital inclusion barriers but still face challenges that relate to the design and user interfaces of different payment options. The connection between digital inclusion and accessibility requires consideration of not only the design of the digital payment interface but also the complexity of the payment experience and the cognitive demands it places on a user. This includes how a user might adopt a payment method, learn about it and explore how it interacts with other methods in the payments ecosystem. Bank notes, traditionally seen as an accessible method of payment, are decreasingly being used in favour of digital options. Because of this, it is especially important to consider potential accessibility features and services that can be used in new payment technologies to ease the growing complexity of a digital product.

## Diverse experience and challenges

Beyond the aggregate number reported above, the *Canadian Survey on Disability, 2017* reports on 10 disability types. Many respondents reported having more than one type of disability, and so the challenges they face are multi-faceted. The highest proportion of disabilities are related to pain, flexibility, mobility and mental health (Statistics Canada 2022b). However, the proportions reported across other disability types, such as those related to hearing, vision and learning, are not insignificant. It is also important to recognize the limitations in survey data for research of this kind, as disability is not a fixed construct. Individuals may experience varying types or degrees of functional limitations at different times throughout their life, or barriers may be so embedded, and therefore normalized in everyday experience, that they are hard to identify.

Research on accessibility challenges related to payments often centre around point-of-sale transactions. For example, an ESDC study on electronic payment terminals identified challenges such as small screens and font size, low contrast and a lack of audio cues for people with visual impairments, and variations in payment routines across stores for people with cognitive impairments (ESDC 2022). Further, research by Payments Canada reveals that no standards exist for payment terminals, and the high variation can further exacerbate inequities and barriers in the payment experience (Payments Canada 2023). People with disabilities might also experience pressure to complete a transaction faster than they are able to while dealing with these accessibility barriers. This pressure, in turn, may cause stress or errors and compel the person to ask for assistance from others, which can place them at increased risk of fraud (ESDC 2022). This is an important factor to consider for any new digital payment method because, to be widely accepted, the payment method will likely have to work with existing merchant terminals, which means it risks inheriting these same accessibility challenges at the point of sale.

E-commerce and the digital economy have presented new opportunities for those with disabilities. Mobility-related barriers may be significantly reduced because consumers are no longer required to be physically present at a payment location. Canadians reported using “shop online” features for a greater



variety of purchases than they did before the COVID-19 pandemic (Payments Canada 2023). The prevalence of online payments can allow users to customize the accommodations they use through assistive technology (such as screen readers), but the variety of new technologies and the range of options may also increase cognitive demand.

## Unbalanced attention

Although the nature of the disabilities that Canadians experience is diverse, current research does not reflect this breadth. We find in the literature an unbalanced representation across different disabilities, with much of the research focused on vision-related disabilities. This dynamic is best revealed through two recent international literature surveys of accessibility papers in top human-computer interaction



**Two to 4.8 times more accessibility-related studies focus on visual disabilities than cognitive, despite similar prevalence in the Canadian population.**

publications. The two literature surveys highlight areas that have received disproportionate attention and those that are underserved. Over 43% of the papers reviewed in one study discuss accessibility for people

who are blind or have visual impairments, while only around 9% of the papers focus on cognitive and older-adult disabilities (Mack et al. 2021). Similarly, in the other study, research on vision impairment makes up almost one-third of the papers reviewed, while disabilities involving the brain, cognition or learning account for less than 14% and disabilities in the elderly less than 17% (Colley, Kränzle and Rukzio 2022). The authors suggest that “*visual disabilities* are more graspable for researchers and practitioners” and that research funding could be more evenly distributed to different topics that better reflect the prevalence of disabilities in the world (Colley, Kränzle and Rukzio 2022).

A similar dynamic exists in the current payments market. Payment service providers have taken steps to improve the accessibility of payment methods, mainly by adding targeted features for the blind and partially sighted communities. For example, Mastercard has introduced accessible debit and credit cards. These “Touch Cards” include different notches that allow users to tactilely determine if it is a credit or debit card and help users to correctly orient the card to the terminal (Alcántara 2021). Similarly, Google and Apple have included in their digital wallets accessibility features for the blind and partially sighted communities (Payments Canada 2023). Other emerging features that may increase accessibility focus primarily on biometrics and include voice and facial recognition and fingerprint scanning. While these new technologies present opportunities to help some users, features targeted specifically toward cognitive accessibility are less common. Cognitive accessibility and neurodiversity (i.e., variations in the human brain and cognition [Armstrong 2011]) remain areas of potential opportunity for digital payments, given the relative lack of information and existing products that address this need as well as the rapid pace of change and the complexity of the payments ecosystem.

# Implications for a central bank digital currency and the design of digital payments

When we consider the three types of inclusion that together contribute to universal accessibility of digital payments—financial inclusion, digital inclusion and accessibility—we can find opportunities to reduce barriers and improve access. While a high volume of users can access bank accounts and the internet, variations in the quality, cost and experience suggest that barriers to inclusion remain even when these services are accessible.

A key take-away from the research is the extent to which many of the barriers to digital payments are deeply embedded into the wider societal infrastructure. The implications of this are two-fold:

- A CBDC product that is designed to maximize inclusion must be both developed and introduced strategically into the existing payments ecosystem to avoid replicating existing barriers. This will mean that accessible product design must be accompanied by accessible and inclusive service delivery. A significant part of the service delivery and implementation will be to accommodate users who have differing levels of knowledge, trust and comfort with change.
- Many of the issues that impact universal accessibility of digital payments, such as access to network connectivity and financial services, are not normally considered within the purview of central bankers. While systematic issues such as these will require social investment and public policy initiatives to be addressed more broadly, they remain highly relevant for consideration when developing a CBDC.

To this end, understanding the current digital payments landscape and recognizing a central bank's traditional role in providing bank notes as an accessible payment method reinforces the importance of considering the issues described above in the design and delivery of any potential CBDC. The payments landscape where bank notes were once dominant involved transactions that were primarily offline and largely private by nature. Those characteristics did not require consideration of digital and financial inclusion because most retail payment needs could be satisfied using cash—without online connectivity or the use of a bank account. While bank notes have remained largely the same over time, the payments ecosystem that surrounds them has changed drastically. Although bank notes may have been effective at addressing barriers in the past, to be universally accessible, a CBDC must address the barriers inherent in today's—and tomorrow's—evolving technical landscape. Modern financial inclusion relies on digital inclusion and accessibility in a more concrete way than it did before.

A prominent element to consider for CBDC design is cognitive load—for example, the number of decisions needed per transaction. This is especially relevant for digital payment methods because, if not designed thoughtfully, new technology can involve higher cognitive requirements. Cognitive overload can affect different people at different stages of life, depending on a range of factors that include but are not limited to disability. Cognitive challenges are already prevalent in today's society and are expected to increase as the population ages. Despite the increased attention that accessibility is receiving, gaps exist in both the research and existing product offerings for those with cognitive accessibility challenges. Further work in this area is needed to better understand which payment features and services can best serve this

community. But a crucial element of designing a CBDC for all types of accessibility is to include, early in the development process, the populations that face barriers.

## Conclusion and future work

Our findings suggest that the circumstances surrounding universal accessibility for digital payments are significant and diverse. We find that beneath the key indicators typically used to measure financial inclusion, digital inclusion and accessibility, a complex environment of experiences, barriers and needs exists. Our analysis suggests that the number of individuals who face barriers or exclusion is much larger than was previously assumed, and that users who face even one obstacle could be excluded from important aspects of the economy.

Moreover, we uncover the challenges in measuring areas of disability and inclusion because these are unstable and often shifting constructs. While financial inclusion and digital inclusion are highly relevant to the design of any digital payment method, we find a relative lack of attention to accessibility of payments and, more specifically, cognitive accessibility. If we assume that digitalization and aging are to continue at current paces and proportions, then the scope of challenges related to inclusion will likely increase. Research shows that the probability of experiencing physical accessibility and cognitive accessibility challenges compounds with age, meaning those who are 65 years of age and older are far more likely to encounter barriers. The aging Canadian population makes cognitive accessibility an essential consideration for any digital payment technology.

While further work remains to be done, these initial findings serve to inform the design of future digital payment products and services and CBDCs. Deeper research into design for cognitive accessibility will help uncover further challenges and opportunities associated with new technologies and collaboration. However, we also hope that the work around digital and financial inclusion motivates wider policy initiatives and cooperation to ensure that the broadest population possible may benefit from accessible digital payments.

## References

- Alcántara, A.-M. 2021. "[Mastercard Introduces Accessible Card for Blind Users.](#)" *Wall Street Journal* (October 26).
- Andrey, S., M. J. Masoodi, N. Malli and S. Dorkenoo. 2021. *Mapping Toronto's Digital Divide: January 2021*.
- Armstrong, T. 2011. *The Power of Neurodiversity: Unleashing the Advantages of Your Differently Wired Brain*. Cambridge, Massachusetts: Da Capo Lifelong.
- Banjoko, M. 2021. "[Combating the Lack of Financial Inclusion in Canada—A Case for Open Banking.](#)" *Open Finance Network Canada* (blog). July 30.
- Bank of Canada. 2020. *Contingency Planning for a Central Bank Digital Currency*.
- Bank of Canada. 2021. *Bringing Our Values to Life: Equity, Diversity and Inclusion Strategy 2022–24*.
- Buckland, J. 2011. "[Passing the Buck? Examining Canadian Banks Approaches to Financial Exclusion.](#)" University of Winnipeg Research and Working Paper #49.
- Buckland, J., A. Fikkert and J. Gonske. 2013. "[Struggling to Make Ends Meet: Using Financial Diaries to Examine Financial Literacy Among Low-Income Canadians.](#)" *Journal of Poverty* 17 (3): 331–355.
- Canadian Radio-Television and Telecommunications Commission (CRTC). 2023. [Broadband Fund: Closing the Digital Divide in Canada](#).
- Canadian Radio-Television and Telecommunications Commission (CRTC). 2022. [What You Should Know About Internet Speeds](#).
- Cassivi, L., P. M. Léger, M. Wybo and P. Hadaya. 2010. "[The Level of International Business and Its Association with Different Internet E-Commerce Practices.](#)" In *ICDS '10: Proceedings of the 2010 Fourth International Conference on Digital Society*, February 10–16. St. Maarten, Netherlands Antilles: Institute of Electrical and Electronics Engineers.
- Chen, H., W. Engert, K. P. Huynh and D. O'Habib. 2021. "[An Exploration of First Nations Reserves and Access to Cash.](#)" Bank of Canada Staff Discussion Paper No. 2021-8.
- Chen, H., W. Engert, K. P. Huynh and D. O'Habib. 2022. "[Identifying Financially Remote First Nations Reserves.](#)" Bank of Canada Staff Discussion Paper No. 2022-11.
- Chen, H., K. P. Huynh and O. Shy. 2017. "[Cash Versus Card: Payment Discontinuities and the Burden of Holding Coins.](#)" Bank of Canada Staff Working Paper No. 2017-47.
- Chen, H., M. Strathearn and M. Voia. 2021. "[Consumer Cash Withdrawal Behaviour: Branch Networks and Online Financial Innovation.](#)" Bank of Canada Staff Working Paper No. 2021-28.
- Chen, H. and M.-H. Felt. 2022. "[Canadians Access to Cash Before and During the COVID-19 Pandemic.](#)" Bank of Canada Staff Discussion Paper No. 2022-15.
- Colley, M., T. Kränzle and E. Rukzio. 2022. "[Accessibility-Related Publication Distribution in HCI Based on a Meta-Analysis.](#)" In *CHI EA '22: Extended Abstracts of the 2022 CHI Conference on Human Factors in*

- Computing Systems*, 1–28. Proceedings from the Association for Computing Machinery Conference on Human Factors in Computing Systems, April 29–May 5. New Orleans, Louisiana: Association for Computing Machinery.
- Dai, J., J. Miedema, S. Hernandez, A. Sutton-Lalani and K. Moffatt. 2023. "Cognitive Accessibility of Digital Payments: A Literature Review." In *W4A: Proceedings of the 20th International Web for All Conference*, 116–121. Proceedings of the Web4All 2023 conference, April 30–May 1. Austin, Texas: Association for Computing Machinery.
- Dilmaghani, M. 2018. "[Religiosity and the Digital Divide in Canada](#)." *Communication Review* 21 (3): 181–211.
- Elueze, I. and A. Quan-Haase. 2018. "[Privacy Attitudes and Concerns in the Digital Lives of Older Adults: Westin's Privacy Attitude Typology Revisited](#)." *American Behavioral Scientist* 62 (10): 1372–1391.
- Employment and Social Development Canada (ESDC). 2022. [The Accessibility of Electronic Payment Terminals: A Summary](#).
- Employment and Social Development Canada (ESDC). 2023. [Towards an Accessible Canada](#).
- Financial Consumer Agency of Canada. 2019. [Survey on Banking of Canadians: Final Report](#).
- Ferreira, J. and M. Perry. 2019. "[From Transactions to Interactions: Social Considerations for Digital Money](#)." In *Disrupting Finance: FinTech and Strategy in the 21<sup>st</sup> Century*, edited by T. Lynn, J. G. Mooney, P. Rosati, M. Cummins, 121–133. Palgrave Pivot Cham.
- Global Partnership for Financial Inclusion. 2017. [Baden-Baden G20 Communiqué Commits to Advance Financial Inclusion](#).
- Henry, C. S., K. P. Huynh and A. Welte. 2018. "[2017 Methods-of-Payment Survey Report](#)." Bank of Canada Staff Discussion Paper No. 2018-17.
- Henry, C., M. Shimoda and J. Zhu. 2022. "[2021 Methods-of-Payment Survey Report](#)." Bank of Canada Staff Discussion Paper No. 2022-23.
- Henry, C. S., W. Engert, A. Sutton-Lalani, S. Hernandez, D. McVanel and K. P. Huynh. 2023. "[Unmet Payment Needs and a Central Bank Digital Currency](#)." Bank of Canada Staff Discussion Paper No. 2023-15.
- Jin, X., E. Kuang and M. Fan. 2021. "[Too Old to Bank Digitally?: A Survey of Banking Practices and Challenges Among Older Adults in China](#)." In *DIS '21: Proceedings of the 2021 ACM Designing Interactive Systems Conference*, edited by W. Ju, L. Oehlberg, S. Follmer, S. Fox and S. Kuznetsov, 802–814. Proceedings from DIS '21: Designing Interactive Systems Conference, June 28–July 2. Virtual event: Association for Computing Machinery.
- Julien, H. and C. Hoffman. 2008. "[Information Literacy Training in Canada's Public Libraries](#)." *Library Quarterly* 78 (1): 19–41.

- Kameswaran, V. and S. H. Muralidhar. 2019. "[Cash, Digital Payments and Accessibility: A Case Study from Metropolitan India.](#)" In *Proceedings of the ACM on Human–Computer Interaction*, 3 (CSCW), article 97, edited by A. Lampinen, D. Gergle and D. A. Shamma, 1–23. Proceedings of CSCW '19: Computer Supported Cooperative Work and Social Computing conference, Austin, Texas: Association for Computing Machinery.
- King, B. 2021. "[Preparing Future-Ready Professionals: Financial Inclusion through Digital Inclusion.](#)" International Federation of Accountants.
- Lane, T. 2021. "[The Digital Transformation and Canada's Economic Resilience.](#)" Speech delivered virtually to Advocis Western Canada Chapters, June 10.
- Latulipe, C., R. Dsouza and M. Cumbers. 2022. "[Unofficial Proxies: How Close Others Help Older Adults with Banking.](#)" In *CHI '22: Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*, edited by S. Barbosa, C. Lampe, C. Appert, D. A. Shamma, S. Drucker, J. Williamson and K. Yatani, 1–13. Proceedings from CHI '22: CHI Conference on Human Factors in Computing Systems, New Orleans, Louisiana: Association for Computing Machinery.
- Local News Data Hub (LNDH). 2021. [Internet Speed Story: National and Local Stories.](#)
- Mack, K., E. McDonnell, D. Jain, L. L. Wang, J. E. Froehlich and L. Findlater. 2021. "[What Do We Mean by 'Accessibility Research'? A Literature Survey of Accessibility Papers in CHI and ASSETS from 1994 to 2019.](#)" In *CHI '21: Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 1–18. Proceedings of the Association for Computing Machinery Conference on Human Factors in Computing Systems, May 8–13. Yokohama, Japan: Association for Computing Machinery.
- Martin, T., A. Curran and J. Lapierre. 2006. "[Banking in Winnipeg's Aboriginal and Impoverished Neighbourhood.](#)" *Canadian Journal of Native Studies* 26 (2): 331–359.
- McNeish, J. 2015. "[Consumer Trust and Distrust: Retaining Paper Bills in Online Banking.](#)" *International Journal of Bank Marketing* 33 (1): 5–22.
- Mersereau, M. 2021. "[The Essential Internet: Results from a Study into Household Internet Use at the Toronto Community Housing Corporation.](#)" *First Monday* 26 (3).
- Minwalla, C., J. Miedema, S. Hernandez and A. Sutton-Lalani. 2023. "[A Central Bank Digital Currency for Offline Payments.](#)" Bank of Canada Staff Analytical Note No. 2023-2.
- National Institute on Aging. 2023. [How the Aging Brain Affects Thinking.](#)
- Nelms, T. and S. Rea. 2017. "[Mobile Money: The First Decade.](#)" UC Irvine: Institute for Money, Technology and Financial Inclusion.
- Ontario Human Rights Commission. 2023. "[Appendix 1: Glossary of Human Rights Terms.](#)" *Teaching Human Rights in Ontario—A Guide for Ontario Schools.*

- Parliamentary and Health Services Ombudsman (United Kingdom). 2020. [Introduction to the Social and Medical Models of Disability](#).
- Payments Canada. 2021. [Payments Accelerated: Global Pandemic Accelerates the Rise of Digital Payments—Canadian Payment Methods and Trends Report 2021](#) (September).
- Payments Canada. 2023. [Inclusivity in Canadian Payments: Barriers for People with Disabilities](#).
- Quan-Haase, A. and D. Ho. 2020. "Online Privacy Concerns and Privacy Protection Strategies Among Older Adults in East York, Canada." *Journal of the Association for Information Science and Technology* 71 (9): 1089–1102.
- Reddick, A., C. Boucher and M. Groseilliers. 2000. [The Dual Digital Divide: The Information Highway in Canada](#). Public Interest Advocacy Centre.
- Schrumm, A., S. Bell and T. Smith. 2021. "Building Bandwidth: Preparing Indigenous Youth for a Digital Future." Royal Bank of Canada Thought Leadership article (July).
- Statistics Canada. 2018. [Canadian Survey on Disability, 2017](#).
- Statistics Canada. 2019. [Experiences of Discrimination Among the Black and Indigenous Populations in Canada, 2019](#).
- Statistics Canada. 2021a. Table 22-10—115-01. "Smartphone use and smartphone habits by gender and age group." Canada Internet Use Survey, 2020.
- Statistics Canada. 2021b. [Canada Internet Use Survey, 2020](#).
- Statistics Canada. 2022a. [In the Midst of High Job Vacancies and Historically Low Unemployment, Canada Faces Record Retirements from an Aging Labour Force: Number of Seniors Aged 65 and Older Grows Six Times Faster than Children 0–14](#).
- Statistics Canada. 2022b. [Measuring Disability in Canada](#).
- Tan, B. 2023. "Central Bank Digital Currency and Financial Inclusion." International Monetary Fund Working Paper No. 23/69.
- United Nations. 2020. "The Impact of Digital Technologies." UN75 2020 and Beyond: Shaping our Future Together.
- United Nations. 2022. "Digital Inclusion." Office of the Secretary-General's Envoy on Technology.
- Viseu, A., A. Clement, J. Aspinall and T. L. M. Kennedy. 2006. "The Interplay of Public and Private Spaces in Internet Access." *Information, Communication & Society* 9 (5): 633–656.
- Wavrock, D., G. Schellenberg and C. Schimmele. 2021. "Internet-use Typology of Canadians: Online Activities and Digital Skills." Statistics Canada Analytical Studies Branch Research Paper Series 11F0019M No. 456.
- World Bank. 2022. [Financial Inclusion](#).

Wright, H. H., ed. 2016. *Cognition, Language and Aging*. Amsterdam: John Benjamins Publishing Company.