Constructing Household Routines with the Internet: Assessing the Role of the Internet in Normalizing Household Productivity

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Abstract

Despite an abundance of literature highlighting the necessity of achieving digital parity in low-income communities, a concrete characterization of the internet as essential household infrastructure remains elusive. The original research presented in this paper uses Social Systems Theory as a framework for investigating how social housing residents use at-home internet to support their household activities and domestic routines. The findings illustrate how internet use within the household can increase the efficiency and breadth of routine activities, and become normalized within the household as a result. The results also highlight the motivations for internet adoption in older adult households, as well as the implications for household labour and finances associated with internet service termination in family households. These findings are relevant for scholars interested in domestic internet use in elderly and family households, and for policymakers hoping to alleviate digital inequity in low-income communities.

Keywords: Digital inclusion; Digital inequity; Urban Digital Divide; Internet policy; Household internet use; Internet as essential infrastructure

Introduction

The following discussion presents results of research into the internet supported household activities of residents at the Toronto Community Housing Corporation (TCHC), North America's second largest social housing[1] undertaking, comprised of 60,000 residential units that provide housing for more than 100,000 low-income individuals. The primary objectives of the study were twofold: to explicate the role of the internet in normalizing household routines associated with the provisioning of basic needs; and to ascertain changes in household routines related to the adoption of, and any unanticipated disconnection from at-home internet services. Primary data was collected from rent-geared-to-income (subsidized) residents at three residential facilities whose dominant populations are characterized by elderly, single, and family occupants. The study was conducted prior to the onset of the COVID-19 pandemic, between December 2018 and April 2019, and employed a combination of semi-structured interviews, activity visualization exercises, and analysis of secondary documentation (governance reports, capital budget reports, government support benefit schedules, etc.).

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[1] Publicly subsidized rental housing

Novel contributions to scholarship concerned with issues of digital inequity, the consequences of precarious internet access in low-income households, and public policy intended to redress the "Digital Divide" is provided through the use of Social Systems Theory (SST) as a theoretical framework guiding the conceptual, methodological and analytical design of this study. Social Systems Theory conceptualizes human activity in domains of discursive and purposively organized activity, and that are contingent on resources which may or may not be shared with other systems (Bailey, 1994; Parsons, 1951; Seidl, 2004). By defining the households of TCHC residents as social systems, the SST framework employed in this study helps to resolve blind spots in topical literature where the infrastructural characteristics of the internet may be obscured; whether by reconciling internet need against discrete tasks (Fontur International Inc. & MDB Insight Inc., 2017; Public Policy Forum, 2018), or within quantitative analyses that fail to resolve heterogeneity between households (Haight et al., 2014). For the purposes of this research, understanding how TCHC residents use the internet to organize their domestic activities highlights how the technology has informed change and adaptation within their households, and illustrates the implications of precarious internet access for households that struggle to maintain stable internet services.

Data collected from TCHC residents suggests that household internet services inform the organization and efficiency of household routines by minimizing the labour and financial expenditures[2] associated with the household activities. Once normalized, productive activity within the household can become contingent on at-home internet services, and may be subsequently destabilized during periods of unanticipated internet service disruption. The data also suggests that the ongoing challenges faced by TCHC residents in maintaining productive levels of household activity are compounded during periods of long-term internet service disruption.

Rationale & Motivation

Scholars from a range of disciplines have contributed to a contemporary framework wherein digital inequity can be broadly understood as an experienced, observed, and enumerated differential in the abilities of individuals to access, maintain, and make use of digital technologies to better themselves. As a discursive concept, the problem of digital inequity is underscored by an inherent *unjustness* (Stratton, 2021), and evidenced in the unequal distribution of resources and capital necessary to benefit from normalized technology use. Scholarly efforts to understand the intractability of digital inequity demonstrate that the problem is much more than an urban/rural divide, or one of technology access alone. Research into the characteristics of digital inequity in urban centers has foregrounded persistent gaps in the availability and affordability of high quality broadband services, and broadened our understanding of the relationship between the urban digital divide and underlying socio-economic inequality (Eubanks, 2011; Gonzales, 2015; Warschauer, 2003). While barriers to physical connectivity (service quality and affordability) do persist in urban centers, a larger problem emerges in equity deserving communities who face barriers in utilizing their social, economic, and cultural capital to realize

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[2] All dollar values presented are in Canadian funds

the constructive outcomes associated with digital inclusion. Gonzales (2015) argues that barriers to community betterment owe more to entrenched and systemic inequalities than to technology divides alone, and that the inequitable distribution of digital resources compounds existing socio-economic deficits. This view is evidenced in more recent work confronting the myth of "disinterestedness" towards broadband use in low-income communities. Fernandez et al. (2020) describe how affordability barriers contribute to a dismissive attitude towards technology adoption in disconnected households. Contrastingly, low-income households with broadband access demonstrate a breadth of instrumental online activities including education and job seeking, and place a high value on remaining connected despite financial constraints. Similarly, Reisdorf et al. (2020) dismantle criticisms of low-income community members engaging in a limited breadth of online activities by demonstrating that the nature of activities performed online are more closely associated with the connection modality itself (mobile versus fixed, public versus at-home). Affordability barriers can press individuals into having to choose between one modality over another; subsequently limiting the breadth of online activities they can pursue.

Urban connectivity divides are most apparent in communities faced with poverty, precarious housing, and homelessness, and where internet service providers have few market based incentives to invest in upgrading legacy infrastructure (Anderson, 2021; Rajabiun & McKelvey, 2019). In these settings, connectivity gaps are typically filled by so called "third spaces" comprised of public libraries, community centres, outreach organizations, and a host of commercial WiFi networks (coffee shops etc.) (Dailey et al., 2010, p. 38; Graham & Marvin, 2001). These community intermediaries, both formal and informal, are instrumental in filling physical connectivity gaps, and in acting as proxies for local community technology interests. The latter role, arguably, is especially significant for communities characterized by unique needs such as new residents, older adults, and youth, and where trusted social bonds are a primary determinant of constructive technology outcomes (Erete, 2013). Despite the important role played by community intermediaries in bridging connectivity and literacy divides, they can nonetheless exclude populations who face mobility, language, or employment barriers. As such, a meaningful public policy intervention must consider multiple connectivity modalities (Rhinesmith et al., 2019), with provisions for at-home services as the locus.

The research presented below is motivated by a need to deepen our understanding of the role of broadband in supporting a range of basic activities of daily living. Building on recent scholarship highlighting how limited connectivity options in low-income urban communities has informed a dependency on mobile and public space access (Reisdorf et al., 2020; Rhinesmith et al., 2019), this study directs its attention to the internet supported domestic routines of social housing residents. This level of analysis illustrates how at-home broadband services are instrumental in helping residents maintain their households in the face of limited financial and labour resources, as well as the risks associated with dependency on a precarious household technology. Providing evidence-based rationale for framing broadband as an essential service has the potential to inform contemporaneous policy debates surrounding digital equity. For example, policymakers may wish to consider the long-term socio-economic benefits of providing secure and non-excludable connectivity in certain low-income households, such as elderly

residences and in households with children, instead of lower impact but politically popular public WiFi networks.

Social Systems Theory

As a general descriptor, a Systems Theory can be described as an interdisciplinary approach to understanding complex biological, mechanical, or chemical relationships. The systems perspective argues that we are not able to fully comprehend a social system by breaking down its constituent components for individual analysis; we must instead investigate a system in its functioning state (Capra & Luisi, 2014). While systems based approaches are not unique in the field of community-technology studies, they tend to be focused at intermediate and macro levels of analysis (i.e. between neighbourhoods and cities) rather than in the domain of highly localized, day-to-day domestic activities (Heeks & Ospina, 2014).

The most general and fundamental property of a social system is the purposeful and non-random arrangement of the human and technical constituents of the system. Understanding the purpose of these arrangements is what lends SST its unique characteristics as a framework for investigating how the capabilities of social systems are contingent on the ways in which its human and material constituents are organized to acquire and process necessary resources. A Social System's ability to resist *disorganization* constitutes the fundamental principle of organization between its human and material components (Bailey, 1994; Bogdanov, 1912; Schwaninger & Scheef, 2016). The threshold at which disorganization begins to compromise the social system can be operationalized as a minimum level of productive activity (Goldspink & Kay, 2009). Below this threshold, SST suggests, a social system will no longer be able to maintain its normal state.

Demands for labour, information, and financial resources constitute extractive forces that continually act upon the social system (Bailey, 1994). The relationship between resource availability and the resources extracted from a social system highlights two key characteristics that are important to the discussion presented below. First, that a social system maintains itself *variably* at or above a minimum level of productive activity; a threshold which itself is constituted by external demands for resources that, in low-income households, typically exceed the resources available to the system itself. Fluctuations in a social system's level of productive activity are informed by changes in its ability to extract and utilize available resources. And though these fundamental processes are shared by all social systems, this explanatory model highlights differences between the capabilities of social systems of varying means. Unlike higher income households, low-income households tend to operate in a fixed and ongoing state of resource deficit (Canada Without Poverty, 2011; Laurie, 2018). The second characteristic concerns the implications, or consequences for social systems unable to maintain the minimum levels of productive activity. Productive activities are those whose primary purpose are to reconcile the resource demands of the system, and subsequently prevent disruption that would otherwise alter or change the normal conditions of the system. Disruption in the availability of resources does not indicate that a social system will collapse, rather, it suggests that the system will be unable to maintain its activities at a nominal level, and over a period commensurate with the scope and permanency of the disruption. The question posed by this application of SST is the

extent to which adaptation in the face of short or long-term disruption to household broadband service may be untenable for the people who comprise the social system.

The normalization of household activities, evidenced in routines, allows for a degree of predictability and replicability necessary to perform the activities of daily living (Taylor & Swan, 2005). It is at this juncture that SST provides a rationale for explicating how these activity patterns change in relation to the use of broadband within the household.

The experiences of TCHC residents presented below demonstrate two novel contributions to our understanding of the interdependency that can emerge between household stability and broadband access. First, as evidenced through the experiences of late adopters (elderly residents), broadband is adopted in order to help sustain aging-in-place (Ivan et al., 2020; Rogers et al., 2020), without ready access to connectivity outside the home, and absent many of the mobility, financial, and social supports available to higher income retirees. The distinct practice areas that motivate broadband adoption amongst late adopters provides a clearer means of operationalizing change in the organization of activity within these households. Second, the incorporation of broadband into the household activities of late adopters (families) implicates the well-being of all members of the household. There is a corresponding increase in demand for devices and costs associated with broadband services in these households. Broadband is utilized by primary caregivers to help manage their own labour in provisioning for the household, supporting the needs of dependents, and in many cases, to supplement household income, The consequences of this interdependency become apparent when the financial burden of maintaining connectivity exceed the household's ability to pay; with periods of service termination (temporary and long-term) resulting in significant shock and disruption to household stability, and extraordinary measures undertaken to compensate for the shortfall.

Research Sites & Recruitment Process

The Toronto Community Housing Corporation (TCHC) is the second largest social housing provider in North America, currently housing twelve percent of the City of Toronto's rental population and six percent of its total population. The TCHC owns and manages more than 2,000 individual facilities located in some of Toronto's lowest income communities, predominantly occupied by fixed income families, and whose resident populations are exposed to higher rates of social and economic marginalization including; seniors, non-traditional families, refuges and new immigrants, and persons with disabilities (Social Development Finance & Administration, 2010; Toronto Community Housing Corporation, 2014).

Residential facilities were identified and selected in consultation with a TCHC research liaison whose role was to ensure appropriate protocols were followed throughout participant recruitment and data collection. These protocols included ensuring confidentiality in data collection, and that no data would be published that might compromise TCHC operations (proprietary and sensitive data). The following criteria were developed for site selection:

1. TCHC facilities with subsidized tenant populations exceeding 75%;

2. A facility whose tenant populations was comprised of elderly residents (65 years and over);

3. A facility with a majority of family households.

Recruitment posters were prominently displayed in the common areas of residential facilities (lobbies, laundry rooms, social spaces), The posters described the nature and purpose of the study, expected time commitment, nature of the interview questions and visualization activities, information about compensation, and the protocols for protection of participant privacy. Key characteristics of the three residential facilities and participants included in the study:

55 Rankin Cres.
A 16-story building and one of 83 facilities dedicated to housing elderly residents. The building is located in the Emerson-Wallace neighbourhood with a Low-income Cut Off score (LICO) at the city average of 17%. Acquired by the TCHC in 2005, 98% of the building is occupied by subsidized tenants.

- Sixteen participants were recruited from 55 Rankin Cres. The average length of residency of participants is 7 years, only two of the participant households have more than one occupant.

50 Regent Park Blvd.
An 18-story building located in the Regent Park neighbourhood, this is one of the most recent additions to the TCHC's portfolio. The development is an example of the TCHC's efforts to procure new housing assets through private partnerships, and under the city's "Mixed-Use" planning model intended to combine subsidized with market valued rental properties. Seventy-five percent of the building is occupied by subsidized residents, and the Regent Park neighbourhood itself has a LICO score that is 18% below the city average.

- Six participants were recruited from 50 Regent Park Blvd. Average length of residency is 2 years, three of the participant households are occupied by adult families, the remaining households are single occupancy.

2739 Victoria Park Ave
Comprised of three 18-story buildings located in the Pleasant View neighbourhood. Some of the older buildings in the TCHC portfolio, these properties were acquired in 1990 and are slated for demolition in 2024. Ninety-five percent of the buildings at 2739 Victoria Park are occupied by subsidized residents, and the Pleasant View neighbourhood has a LICO score that is 2% below the city average.

- Seven participants were recruited from 2739 Victoria Park Ave. Average length of residency is 5 years, six of the participant households are comprised of families with school age children (K-12), one household reported private vehicle ownership.

Data Collection Methods

Theoretical concepts derived from Social Systems Theory were employed to operationalize the primary indicators of the household social system (Bailey, 1994; Parsons, 1951), these include; household composition, organization of basic needs activities (type, frequency, duration), resources (material, human, financial), and expenditures (labour and financial).

Questions about the routines associated with provisioning for basic needs constituted the entry point for data collection, and in establishing the normal operating state of the household. The basic needs activity areas which were operationalized in the study (education, health, nutrition, finances, and childcare) were derived from the Social Determinants of Health (Mikkonen & Raphael, 2010), a framework widely utilized in Public Health research to ascertain the social, economic and environmental conditions within which physical health can be improved or impaired. This framework describes poverty and low-income as mutually constituted conditions, and inequitable wealth distribution identified as a primary determinant of material deprivation. Poverty, subsequently, is understood as a conditional state wherein resource barriers can foreclose on the capabilities of individuals to meet their basic needs (Laurie, 2018; Raphael, 2011).

Semi-structured interviews were undertaken with participants in private rooms reserved at the participant's home facility. A mean interview length of 122 minutes (SD 15.9) resulted from the twenty-nine interviews conducted. Participants were asked to describe the ordering of tasks that comprise the activity, the frequency of activities, the amount of time expended, any direct costs incurred (public transit, delivery services, etc.), and to identify the primary technical resources employed. All interview questions were open ended, written and spoken in plain language, and complimented with an interview guide (Appendix 1).

Activity visualization exercises, conducted during the second half of the interview session, were undertaken in order to expound upon the patterns of household activity and to illustrate any changes to routines informed by internet service use or disruption (Figure 1). These exercises were facilitated with the use of a whiteboard provided by the researcher. Participants were given the opportunity to illustrate task processes in single or multiple visualizations, and photos were recorded of each attempt. A mean average of 4 (SD 1.5) visualizations per participant were produced from the twenty-nine interview sessions. All interview sessions were audio recorded with typewritten notes taken throughout.

Figure 1: Activity Visualization Exercises

Labour and financial resources constitute superordinate constraints on household activities. Operationalized as expenditures over the course of data collection, participants were asked to explicate, to the best of their ability, these expenditures in terms of actual time and financial costs. Expenditures associated with basic needs undertakings are calculated by reconciling the time expenditures (labour-time) and the financial expenditures reported by participants. Tables 1 and 2 illustrate the coding of expenditures associated with the performance of a healthcare related activity (prescription refill) by a participant from the elderly housing facility at 55 Rankin Cres. Performing this bimonthly activity online requires less than one out of a reported total twenty labour-time hours committed to household maintenance per month, with a financial cost of $100.00 per month (prescription and delivery cost) (Table 1). Prior to adopting at-home internet services, the same activity required six out of a reported total twenty-six labour-time hours committed to basic household activities per month, and a financial cost slightly less than $100.00 per month (Table 2).

Table 1: Household Activity Labour & Financial Expenditures – *Internet Supported*

Tasks	Financial Cost	Total Labour-time	Monthly Frequency	Total Monthly
Access pharmacy website Initiate delivery request	Prescription cost = 45 Delivery service cost = 10	< .5 hour	2	Labour: < 1 hours Financial: > $100

Table 2 - Household Activity Labour & Financial Expenditures – *No Internet Support*

Tasks	Financial Cost	Total Labour-time	Monthly Frequency	Total Monthly
Telephone pharmacy Transit to pharmacy Pick-up prescription Transit from pharmacy	n/a Transit fare = 3 Prescription cost = 45 Transit fare = 3	3 hours	2	Labour: 6 hours Financial: > $100

Experimental design methods were not employed in this research. The validity of income and financial expenditure data collected from participants was assessed against secondary sources including schedules published by The Ministry of Children, Community and Social Services (2019), Service Canada (2019), and the TCHC (2019). For example, the benefit schedule for the Ontario Disability Support Program (ODSP) indicates a payment of $2,030 per month for a single parent household with three dependent children in a two-bedroom unit. The TCHC's subsidy schedule indicates that this rental unit would be provisioned to this family at a cost of $780 per month, resulting in a net household income of $1,250 per month.

Data Analysis

All of the TCHC households who participated in the study describe employing the internet as a technical resource in the course of their basic needs activities. Two primary participant cohorts emerged through the data collection phase. Late adopters, localized to the elderly care facility at 55 Rankin Cres., characterize themselves as having recently adopted internet-based technologies coinciding with their term of residency at the facility. Early adopters, localized to the facilities at 50 Regent Park Blvd. and 2739 Victoria Park Ave., describe longer-term and normalized experiences with internet-based technologies, and having incorporated internet use into their household activities prior to their residency at the TCHC.

Late Adopter Households

Late adopter households were localized to the cohort of elderly residents at 55 Rankin Cres. Participants described remote access to health and financial services, as well as mobility constraints compromising their abilities to access in-person services as primary motivations for adopting at-home internet services. Routines associated with basic needs provisioning constituted the lion's share of activities supported by household internet use, with all but two of the households from this cohort subsisting on fixed government and pension-based income sources. The online activities described by these residents were largely characterized as non-intensive. Not surprisingly, fourteen of the sixteen participant households subscribe to low cost internet service plans with moderate upload/download speeds (50/10 Mbps) provisioned by Rogers Telecommunications at a fixed rate of $10.00 per month. For these participants, routine stability was described as necessary in terms of maintaining their physical and psychological well-being, and in contributing towards their overall sense of independence:

> When you get old keeping things predictable becomes very important, and also much harder (laughing). That's really why I got hooked on the internet, the reminders, I get emails from my bank and my doctor. It's just part of my routine every day now - go on the computer and check all my bookmarks with the websites I need, check my calendar. I don't need a care attendant, yet, but I'm hoping I can delay that and remain self-sufficient as long as possible.

A deliberate and motivated approach to internet adoption was apparent amongst the residents of 55 Rankin Cres, with several describing increased efficiencies in the context of specific outcomes (e.g. saving time in banking and refilling prescriptions), and qualifying the benefits they perceive as being associated with changes to their domestic routines. Compared to participants from the early adopter cohort, these residents do not describe using or accessing the internet through community intermediaries, such as libraries or coffee shops, nor do they perceive internet access as a "taken for granted" technology. At-home internet services constitute the sole means of accessing the internet for these residents. As such, several noted a fear of disruption to their domestic routines should they lose access to the internet. Appreciation for the convenience and independence afforded by their use of the internet was tempered by an

awareness of how precarious those routines are having been made contingent on internet access:

> I'm always afraid it will go out, not like losing the power during a storm or something like that, but just go out for good. I don't know what I'd do, do you know who runs it? I always thought the government made sure it was on, like water. Anyway, I got along for 60 years without the internet but things were different, I wasn't on my own like I am now, had a car and a job. Now I keep most things organized online with my bills, appointments, and other stuff.

The mean length of occupancy for the participants from 55 Rankin Cres. is seven years, and thirteen of the sixteen participants from this cohort indicate that they adopted household internet services during their tenure at the facility. 55 Rankin Cres. was notable for the strength of social ties between residents. Social engagement between residents emerged as a key indicator of the ways in which social ties within close-knit communities can inform technology adoption (Mattie et al., 2018). Several participants from this cohort describe their preliminary introduction to the internet emerging from observations of the internet activities of their fellow residents and neighbours:

> [Name omitted] one floor down from me goes to the same clinic that I do, and he's been on the internet for years. He was always talking about how he gets all his medication online, gets the newsletter from Second Harvest, has his supplies delivered from the internet and all that stuff. I never used it myself, but I know a lot of people who have been on it for a long time. I wouldn't say that's the only reason I got the internet myself, but it did make me ask the doctor and nurses at the clinic if they thought it would be helpful for me. They thought it would be a good idea, and told me they could email me important stuff about appointments and medication. I ended up getting a donated computer, and when I got the internet installed in my unit some of my friends helped teach me how to do the basic stuff.

Banking, healthcare, transportation and nutrition emerged as the primary areas where participants from this cohort reported using the Internet to support their basic needs (Table 3). Online banking activities, in particular, suggest the development of fundamental digital skills, and have been observed as an indicator of general financial health (Crocker & Williams, 2021). Late adopters, in particular, were able to provide concrete descriptions of changes to their activities and routines after adopting the internet, illustrating how the technology has elevated productive activity within their households. Participants were asked to describe the organization of their routines in key basic needs activity areas (healthcare, finance, nutrition, etc.) with an emphasis on identifying labour-time differences between the two states. Comparing monthly labour-time expenditures reported by residents across banking, nutrition, and healthcare activity areas prior to and after the adoption of household internet services evidences a decrease of 32% in the overall hours expended on these activities across the participant cohort (Table 4). Prior to the

adoption of household internet, the majority of labour-time expenditures associated with healthcare, finance, and nutrition activities involved transiting outside of the home:

> Most of us are in here because we can't afford assisted living, so you have to be able to be independent, and that's hard because a lot of us can't get around very easily. I used to spend half of my day just going here and there, to the bank, supermarket, you know, just normal stuff, but with my health it took a lot for me. I do most all of that stuff on my computer now, so I really just go out when it suits me, to the park, down to the common room, there's a lot less stress worrying about just getting around.

Incorporating internet-based technologies into these activities allows participants to forgo transit time (e.g. using online prescription refill and delivery services), to incorporate new activities into existing practice domains (e.g. medical calendaring, emailing practitioners), and to increase the amount of surplus time available for social activities (exercises, group meals). These personal care and social activities, in particular, were noted by participants as critical to their general sense of well-being and happiness.

The operationalization of expenditures associated with basic needs activities lends a unique perspective to our understanding of the ways in which internet services are employed to support productive activities within TCHC households. The value of using the internet for these activities is observed in the savings of labour-time which can then be redistributed to other areas of household activity. This subsequently informs a nominal level of predictability and efficiency in the labour-time expectations associated with household activities. This also suggests that disruption to internet services are likely to result in household resources (labour and financial) being diverted to make up for the shortfall in efficiency informed by loss of the internet.

Table 3: Distribution of Labour Hours at 55 Rankin Cres.

Basic Needs Activity Area	Monthly Hours	% of Total Reported Hours
Banking	63	24.8
Healthcare	90	35.4
Transportation	64	25.2
Nutrition	37	14.6

Table 4: Reported Monthly Labour Hours per Household at 55 Rankin Cres.

																	Cohort Total	$\bar{x}$ per Household
No Internet Support	25	22	26	n/a	25	n/a	24	25	20	20	26	24	n/a	28	20	20	305	23.46
Internet Supported	12	15	18	15	20	12	18	16	15	16	20	18	15	18	12	14	254	15.87
% Change																	-16.72	-32.35

In discussing the ways in which internet access has informed changes in their own household routines these participants also frequently described the apparent challenges faced by facility residents who do not maintain household internet services of their own. When pressed to elaborate, participants employed two framing devices to support their perceptions of the challenges faced by these residents; the apparent time and labour expended in the performance of basic needs activities, and the frequency with which they have provided support to these residents using their own online resources:

> I know when I was without internet my neighbor would invite me over to use her computer and she showed me how to set up my Facebook account so I could keep in touch with my kids and grandkids. That was pretty simple, but eventually I started to see how she used the computer for her prescriptions and to get money from her relatives. When I got my own computer with internet I started doing the same things, but I also use it for a bunch of other stuff I hadn't known about, like cooking and ordering clothes, there's a lot of cheap clothes on eBay. I know there's a lot of residents here that aren't on the internet, but they're also the ones who are usually asking "where did you get that?" or "how do you get the groceries delivered?" I can't say if they're better off without it, all I know is that it's made my life a bit easier.

Focused discussions regarding internal adaptation on the part of internet enabled households as well as the perceived constraints in non-internet households produced two salient observations with regard to the normalization of productive activity constituted by at-home internet services, as well as the implications of internet use for the distinctive health, well-being, and security needs of elderly communities. Non-internet enabled households, or those disinterested in adopting internet-based technologies, may indeed maintain themselves absent the technology, but should not be situated as a standard for comparison when assessing the merits of universal internet provisioning, from either an economic or public interest perspective. And while internet service

disruptions are less likely to result from affordability barriers amongst this cohort, the performance of critical self-care activities that intersect with online delivery of healthcare, government, and transportation services highlights the non-commercial characteristics of basic needs activities that rely on internet access; illustrating the affordances that may accompany broadening access to the internet within elderly communities.

Early Adopter Households

Early adopter households localized at 50 Regent Park Blvd. and 2739 Victoria Park Ave. similarly describe the organization of household routines around internet access. Internet access was largely perceived as a normal and routine affordance amongst this cohort of residents. The economic imperatives associated with internet supported activities was more concretely described in early adopter households, with basic needs activities explicitly tied to the need to secure income and manage expenses. Periods of internet disruption were likewise framed in terms of the constraints on a household's financial stability:

> Tuition, banking, submitting my invoices so I can get paid, it's all online, I don't really think about how I could earn money and pay my expenses any other way, who does? You asked me about how much labour goes into all this online stuff, well I guess I never really saw it that way, but when we've lost the internet at home I had to make time for it out of the house, so I guess it saves time yeah, but definitely I got less done overall.

Periods of long-term internet service disruption were most prominent in early adopter households, and though long-term internet service disruptions were not reported as regular occurrences, when they do occur, the resulting constraints illustrate a heightened level precarity that exists within family households. Residents from single occupant households describe few service disruptions, and noted the ease with which they were able to adapt their internet activities outside of the home, and with relatively few compromises to their household routines:

> I had no service once for a week when I first moved in, it sucked overall but gave me a chance to get out and explore the neighbourhood. There's coffee shops nearby that are open late so I just plopped myself there until they closed to get my work done. I did manage to sort through all my stuff, clean and paint the apartment when I was at home that week though.

Service disruptions related to financial constraints and affordability barriers were indicated by the family households located at 2739 Victoria Park Ave. Higher cost internet service plans, necessitated by the demands of multiple family members and a wider range of internet enabled devices, place strains on income resources that are already liminal to the poverty threshold. Participants from these households described the organization of household routines over the course of a standard work week (five days). As such, long-term internet service disruption was operationalized as a disruption lasting five days or more, with a total of seven periods of long-term disruption reported by participants from this cohort during their residency at 2739 Victoria Park Ave (Table 5). The longest period of service disruption was reported at 45

days. Where long-term service disruptions were reported, participants were guided in describing and visualizing the reorganization of household activities in-lieu of internet access, as well as any labour, task completion time, or financial constraints associated with the period of disruption.

Table 5: Reported Long-term Internet Service Disruptions at 2739 Victoria Park Ave.

	HH 1	HH 2	HH 3	HH 4	HH 5	HH 6	HH 7	
Periods of Long-term Internet Service Disruption (days) *HH = Household*	n/a	7, 10	14	30	5	14	45	$\bar{x}$ **17.85**

Daily activity patterns in family households were reported to be highly contingent on internet access, particularly in households with residents in caregiver roles. Labour-time expenditures by caregivers was understood for its economic value (income maintenance) and for its social value (provisioning for children).   Focused discussions with these participants highlighted the ways in which these periods of disruption have compromised their abilities to maintain household routines, including those associated with the care of child dependents:

> That month was HORRIBLE [participant emphasis]. We lost internet at home and on our mobiles. Everything got turned upside down, you can't load the kid's Presto card by phone so I had to take the bus to the station to use the machines, I don't have a laptop so I had to go to the library to send emails to my case worker, I guess I could have done all the banking and TTC stuff there too, but the passwords are all saved on the browser, I didn't feel safe putting all that stuff into a public computer. Let's see what else, I missed my email reminders for my prescriptions, missed my deadline to send my income statements to ODSP so my payment was late the next month, kids couldn't do their homework at the house so I had to get them to the library and stay there because I don't like them taking the bus alone late at night, so there goes any work I can do in the evening when they're usually on the computer. I managed to get it back on but I had to borrow money from my sister to do it. It was out for two weeks but felt like eternity.

The detail these participants provided in describing adaptations to household routines was instructive in assessing the labour and financial implications associated with periods of long-term internet service disruption. Monthly household income was operationalized as income after fixed housing costs. Housing costs at the TCHC are assessed at a fixed percentage of total

household income (30%), and constitute the single largest resource demand faced by TCHC households. Financial costs associated with increased labour-time expenditures during periods of long-term internet service disruption, indicated as income to labour value, was assessed by dividing the monthly household incomes of the affected households by the labour-time hours reported in both normal and internet disrupted conditions.

Average government support income (less subsidized rent) for the family households who participated in the study is $1,238 per month (Table 6). Under normal internet supported conditions, a mean average of twelve labour-time hours per week associated with performing basic needs tasks and activities was described by participants, this yields an income to labour value of $24.32/hour for this cohort (Table 7). Of the two households who reported periods of internet service disruption lasting 30 days or more, monthly household labour-time hours increased by 30% to sixty-eight hours per month, lowering the income to labour value by 23.5% from $19.19/hour to $14.66/hour (Table 8). Residents from these households describe lowered overall levels of productive activity during these periods, as well as a "triaging" of household resources (labour and financial) by primary caregivers in an effort to mitigate the loss of a key household resource.

Table 6: Composition & Net Monthly Income of Family Households at 2739 Victoria Park Ave.

	HH 1	HH 2	HH 3	HH 4	HH 5	HH 6	HH 7	$\bar{x}$
Household Composition	1 Adult 2 Children	2 Adults 3 Children	1 Adult 3 Children	1 Adult 1 Child	3 Adults 2 Children	1 Adult 3 Children	1 Adult 2 Children	
Net Monthly Income	1100	1370	1250	900	1700	1250	1100	1238

Table 7: Reported Household Labour Hours at 2739 Victoria Park Ave.

	HH 1	HH 2	HH 3	HH 4	HH 5	HH 6	HH 7	Hours Per Household ($\overline{x}$)		Income to Labour Value (monthly income / hours)
Internet Supported (Weekly)	10	12	15	12	16	10	14	12.7/week	50.9/month	24.32/hour

Table 8: Change in Household Labour Hours During Long-term Internet Service Disruption

	HH 4	HH 7	$\overline{x}$
Labour Hours - *Internet Supported*	12	14	13/week, 52/month
Income to Labour Value - *Internet Supported*	18.75	19.64	19.19/hour
Labour Hours - *During Internet Disruption*	16	18	17/week, 68/month
Income to Labour Value - *During Internet Disruption*	14.06	15.27	14.66/hour
% Change in Labour Hours	+33.3	+28.57	+30.93
% Change in Income to Labour Value	-25	-22	-23.5

The primary tactics employed to offset the constraints associated with the loss of household internet services include the elimination of discretionary activities and expenses, followed by a reorganization of primary household activities. Residents report a near doubling of average transit time outside of the home, as well as increases in debt incurred (borrowing, credit, etc.) in order to reestablish their household internet services:

> My ex-husband wasn't any help so I did what I had to do to manage, you know? My part-time work is online but I can't do that at the library, they have a time limit you know, so when my son was at school I spent what time I had at the library looking for another job. I borrowed my mom's laptop for him, so I'd pick him up from school and take him to Starbucks so he could finish his school work. I did what I could on my phone. Our car needed work but that wasn't going to happen so I actually posted an ad to sell it. Applied for another credit card but didn't get approved. First thing I did when we got the service back was take

away his PlayStation, that's what put us in the hole with Rogers to begin with. He's still mad at me about that.

Limited labour resources constrained by incomes that are liminal to the poverty threshold within these households are further strained by the increase in labour-time expenditures and household debt associated with periods of long-term internet service disruptions. The adaptations to household routines necessitated by the loss of household internet services were described by residents as untenable and requiring support from outside of the household in order to maintain primary needs (e.g. after school care for children, and borrowing from extended family). These losses, both in productivity and finances, were deemed unrecoverable. Household conditions described by residents during periods of long-term internet service disruption highlight their struggles to maintain the minimum levels of productive activity characteristic of normal household conditions.

Discussion

TCHC households are constrained by labour and income resources that are liminal to the poverty threshold (Toronto Community Housing Corporation, 2016), are insufficient to reconcile the resource demands they face, and constitute an ongoing material resource deficit (Mikkonen & Raphael, 2010; Toronto Community Housing Corporation, 2019). Ascertaining the role of household internet services in helping TCHC residents to maintain minimum levels of productive activity constituted the primary focus of this research. In this way, at-home internet services are framed as a technical resource whose role is to support the organization of productive activities within the household social system.

The data collected in this study suggests that the benefits associated with household internet use, as well as the precarity that results from struggling to maintain household broadband, is most apparent in households that are susceptible to disruption (elderly and family households). This also suggests that TCHC households with the highest stakes in obtaining and maintaining stable household internet services struggle in both respects. Although common tasks and activities were evidenced across TCHC households (paying the rent, grocery shopping, etc.), the heterogeneity of individual households is reflected through the agency of residents in organizing household routines. No two households are the same despite performing similar activities. It is through the organization and normalization of productive household activities where the necessity of at-home internet services becomes apparent, and must be considered in the context of the increasingly digitalized service environments in which basic needs activities are undertaken.

The primary affordances of the internet as a household resource can be observed in the economic and social value derived from the labour of residents employing the technology to sustain their households. The consequence is that the technology enables this by "squeezing" more labour out of residents over shorter periods of time, and normalizing a level of household productivity that is contingent on maintaining access to the internet. Online service provisioning in key basic needs activity areas, such as health, education, public transit, government, and retail

services, compounds the necessity of household internet services for TCHC residents. Though community intermediaries, such as public libraries and local coffee shops, play an important role in filling connectivity gaps for communities faced with precarious access to the internet, this support is both temporary, excludable, and primarily utilized for short-term access needs and discrete internet tasks (Reisdorf et al., 2020; Rhinesmith et al., 2019).

Internet adoption in older adult households was characterized by residents as a necessary response to the constraints faced by older adults in social housing, and who have fewer options to age-in-place. This cohort constitutes an under studied cross section of the urban digital divide, facing unique barriers, and without ready access to community connectivity supports typically accessible to younger residents. Decreases in the labour-time expenditures of these residents was reported after household internet adoption.

Family households demonstrate similar outcomes in their use of the internet to manage household activities. Responsibility for maintaining minimum levels of productivity was shouldered by residents charged with caring for dependent family members. Even under "normal" internet enabled conditions, higher deficits between household resources and demands for resources were apparent in family households. Internet use by caregivers was described as increasing task efficiency by limiting the time spent in transit outside of the home for many activities. Conversely, disruption to household internet services results in significant "shock" to the household social system, with long-term disruptions compromising the household's ability to maintain its fundamental activities, and pushing it closer to minimum levels of productive activity. These periods are characterized by constraints on caregiver activities and a loss of overall task efficiency associated with labour being diverted to securing internet access outside of the home. Of all the family households who participated in the study, primary responsibility for executing and performing basic needs activities tended to be shouldered by individual caregivers (in both single and multiparent households).

Conclusion

Combining the observations and data obtained over the course of this study with the broader portrait of poverty illustrates the dividends that could be realized through efforts to universally provision non-excludable internet services in low-income households. The annual provincial dollar cost associated with poverty average $11.75 billion dollars [6.05% Provincial GDP], distributed at a cost of $2,597 per provincial household. The provincial healthcare system absorbs an average of $2.9 billion dollars per year in costs associated with poverty remediating services (Laurie, 2018). Moving low-income households up an average of one income quintile is projected to generate between $1.0 and $1.5 billion dollars (Canadian Centre for Economic Analysis, 2019; Laurie, 2018), further suggestive of the importance of policy mechanisms and public service provisions to stabilize low-income households, the latter of which, at present, do not include fixed at-home internet services.

Scholarship in the field of Geron-Technology studies has highlighted relationships between long-term technology adoption, generational cohorts (Ivan et al., 2020) and social

network strength (Mattie et al., 2018). While instructive for scholarship concerned with bridging digital connectivity divides amongst older adult populations, these research efforts have primarily assessed the use of digital technologies in the domains of popular and social media consumption, rather than as a technology employed to support the primary and basic needs of older adults. The data collected over the course of this study present a compelling rationale for inductive research into the hypothesized increase in task efficiency and household productivity associated with internet adoption by older adults living in publicly subsidized housing facilities. Constructive changes to the organization and performance of household activities appear to yield long-term benefits in older adult households where broadband use is normalized, and where financial and social supports are limited. Employing a combination of standardized scales, such as the *Enhanced Activities of Daily Living* (EADL) scale (Rogers et al., 2020) and the *Technology Acceptance Model* (TAM) scale (Davis & Venkatesh, 1996; Hoffman et al., 2004), future research efforts could be directed towards assessing changes to the characteristics of household activities and routines amongst older adults prior to, and over the course of household internet adoption. Primary indicators of change to household routines may include time expended in the performance of basic needs activities, changes in financial costs associated with these activities, as well as changes in surplus time made available within the household.

Should the outcomes of the COVID-19 pandemic not result in significant momentum towards a universal service framework, one inclusive of provisions to protect low-income households from service exclusion, it will represent a fundamental policy failure. The crisis has situated government itself as a primary stakeholder in the enfolding digital service ecosystem with access to critical health information, emergency financial aid, assistance for immigrants and refugees, education, municipal services, court services, pharmaceutical and mental health support, all facilitated through the internet (Canada Revenue Agency, 2020; Innovation Science and Economic Development Canada, 2020; Lee-Shanok, 2020; Office of the Premier, 2020; Service Ontario, 2020). Under these circumstances, it is incumbent upon policymakers to consider broadband service delivery models that do not rely on the support of competitive service providers alone, but that also allow room for delivery models that are more closely aligned with the provisioning of common or public goods (Anderson, 2021; Lane, 2017). As this research has demonstrated, even prior to the onset of the COVID-19 pandemic, there is no justifiable reason to compel low-income households to find 'workarounds' to digital exclusion.

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Appendix

Appendix 1 – Resident Interview Guide

Interview Guide - Resident

There are 7 areas related to what I'm calling your basic needs activities that I want to explore with you.

I'd like to start by first identifying which of these areas are actually relevant to you. For example, if you don't have children and don't go to school, then we won't be looking at those areas. For social services, this can include any type of government service you use aside from healthcare and education. For example, CPP or CTB.

- Now let's organize these areas by how frequent your activities are in each area
- Do you have internet service at home? Mobile plan?

Employment/income
- Do you work outside the home?
- Primary income source?
- Are your work hours static? Do you work outside of those hours? From home?
- Salary payment
- Managing taxes

Education
- School schedule
- Commuting to school
- Resources used to support education
- Payment mechanisms
- Children use of internet?

Health
- Frequency of medical activities
- Transportation needs
- Health information activities
- Social activities
- Family activities & connections
- Civic participation/engagement

Food/Nutrition
- Frequency of grocery shopping
- Informational activities
- Online ordering
- Payment mechanisms

Childcare
- Family composition?
- Transportation

- Informational activities
- Payment mechanisms
- Education resources

Housing
- Rent payment mechanisms
- Size of your unit?
- Amenities use
- Housing search
- Clothing
- Utility/bill payments
- ISP provider
- TCHC contacts

Social Services
- Service access
- Reporting mechanisms
- Social Income Benefits
- Informational activities
- immigration

Where ATTI is identified
- How activity was performed prior to ATTI
- Favoured applications or online resources?
- Public wifi use?
- How was literacy developed?
- What alternatives to ATTI does participant use?
  - Identifying one significant activity, what would it look like if you could not use the internet?
- Has disruption been experienced?
  - What were the consequences?
  - How did you work around the disruption?
- What are the primary barriers to your maintaining/obtaining ATTI?
- What do you value the most about having ATTI?

Visualization Exercise (60 mins)

With your assistance, I'd like us to now visualize the routines we've discussed. To help with this we will be using this whiteboard. You can decide whether you'd like to draw the exercise or if you'd prefer I do so. We will start with any activity area you'd like. The objective is to help us get a deeper sense of how your tasks and activities connect together, how much time you spend on them, how much occurs inside and outside of the home, and where you may us the internet to help you get things done.