



Survey of User Needs for ICT – Community Living by People with Disabilities

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Abstract

This report summarizes data from the Survey of User Needs for Information and Communication Technology (SUN-ICT) conducted by the Rehabilitation Engineering Research Center for Community Living, Health and Function (LiveWell RERC). This survey is part of the authors' long-standing research program to track the use, usability and user needs of people with disabilities for mainstream consumer information and communication technologies. This survey is also the cornerstone of a larger research undertaking based on the Concerns Report Method (CRM), which assesses the relative importance of functional activities by people across disabilities (Fawcett et al. 1987). The CRM has been used extensively with different consumer groups to identify strengths and specific needs in various community contexts. We present two related lines of analysis: 1) an inventory of current technology used by people with disabilities; and 2) an exploration of the types of daily activities that people with disabilities would like to engage in, but experience some difficulty. This analysis provides: 1) a snapshot of where people with disabilities are in terms of ICT adoption, and 2) the challenges to independence and community participation they continue to face which ICT may be able to ameliorate.

Keywords

Information and communication technology, smartphones, tablets, wearable technology, disability, survey research.

Introduction

Assessment and identification of the technology needs of consumers with disabilities trails behind innovation in information and communication technology (ICT). The accelerating development and proliferation of ICT devices in a variety of form factors (mobile phone handsets, tablets, wearable devices and home automation and control), the emerging Internet of Things (IoT), and the ubiquity of the “cloud,” means that people with disabilities might be at even greater risk of having their needs overlooked than ever before.

The challenge for rehabilitation researchers is to identify and articulate to technology developers in an actionable way the priority needs and access issues of disabled ICT users. ICT industry professionals and researchers alike acknowledge the importance of engaging customers with disabilities, but find this difficult within the constraints of time, budget, and intense competition. This problem is exacerbated by the rapidly accelerating pace of technology development, which poses continuing challenges to ensure that hard-won accessibility gains are not lost in new generations of technology.

The current era’s emerging technology ecosystems of wearable technology and home automation and control (wearables and smart homes) is like preceding eras when cellphones and later smartphones were first proliferating in the marketplace. Then as now, mainstream consumers were the original target users of the new platforms and associated peripheral gear, apps, etc. These platforms and technologies hold enormous promise to facilitate independence and community participation by people with disabilities. But, uncertainty remains about how readily individuals will adapt to these technologies due to concerns regarding privacy, ease of use, reliability, accuracy and impact on people’s lives.

People with disabilities and the general population report similar rates of adoption of mature platforms, including cellphones, smartphones and tablets (Morris 2016, 2014). But, historically adoption rates by people with disabilities has lagged those of the general population. Furthermore, there has been a continuing challenge of ensuring access and leveraging the underlying capabilities of consumer ICT to serve the needs and interests of people with disabilities. Hard won gains in accessibility can be and are often undone by the release of new versions and new generations of consumer technology (Wentz and Lazar 2016); (Schroeder and Burton 2010).

At the same time, the proliferation of these technologies almost requires that people have access to them or risk being left out of the conversation, literally and figuratively. Disconnecting may not be an option (Rainie and Anderson 2017). Access and use of consumer information and communications technology by all members of society is both imperative and uncertain.

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We present two related lines of analysis: 1) an inventory of current technology use by people with disabilities; and 2) an exploration of the types of daily activities that people with disabilities would like to engage in, but experience some difficulty. This analysis provides: 1) a snapshot of where people with disabilities are in terms of ICT adoption, and 2) the challenges to independence and community participation they continue to face which ICT may be able to ameliorate.

Discussion

The survey questionnaire comprises 5 sections listed below. Part 3 is an inventory of ICT device ownership, providing the data to understand where people with disabilities are currently in terms of technology use. Part 5 comprises paired questions on the importance and satisfaction with the ability to engage in 75 distinct activities grouped in 8 domains of daily living.

Part 1 – About you (demographics)

Part 2 – About your abilities

Part 3 – About your use of ICT devices

Part 4 – Problems or issues using ICT

Part 5 – Activities that might benefit from use of ICT

Data for the survey reported here were collected from November 2016 through August 2017 using convenience sampling. The total number of respondents who reported a disability is 265. The mean age of respondents with a disability was 56.6 with a standard deviation of 15.1 years. Females constituted 60.8 percent of respondents and non-whites were 13.8 percent of respondents (Table 1). Two-thirds of the sample had a college degree and slightly more than half (58.5%) reported annual household incomes below \$50,000. The median household income in the United States in 2016 was \$57,617 (Guzman 2017).

Table 1. Demographics: All respondents with disability

Demographic variable	Percent
Female	60.8
Non-White/Caucasian	13.8
Bachelor degree or higher	67.8
Annual household income below \$50,000	58.5

Respondents were asked to identify whether they had difficulties in any of 11 general functional categories (Table 2). Respondents were asked to indicate all that apply, and as such reported having on average 2 functional limitations or difficulties, the most common being difficulty hearing and difficulty walking, standing or climbing stairs. The rest of the survey questionnaire comprises several sections, including an inventory of respondent technology profiles – ownership and use of cellphones, tablets, wearable technology, home automation, etc.

Table 2. Functional difficulties of respondents

(percentage of respondents with each type of disability)

Disability Type	Percent
Difficulty concentrating, remembering, or making decisions	14.2
Frequent worrying, nervousness, or anxiety	18.9
Difficulty seeing - Low vision/Blind	25.6
Difficulty hearing - Hard of hearing/ Deaf	47.6
Difficulty speaking so people can understand you	10.2
Difficulty using your arms	17.3
Difficulty using your hands and fingers	26.8
Difficulty walking, standing or climbing stairs	45.7
Difficulty with fatigue/limited stamina	28.0

What ICT devices people with disabilities currently have

Regarding ownership of ICT devices and other technology (Table 3), the most commonly owned devices were smartphones (81.5% of respondents), laptop computers (68.9%), tablets (64.2%) and desktop computers (57.5%). Rates of ownership of all other devices were far lower, ranging from 4.3% for sleep monitors and home activity sensors, to 18.1% for home security systems. Notably, respondents reported owning fitness trackers - the most common of the newer generation of consumer ICT devices – at a relatively low rate of 13.4%. Smartwatches (many of which include fitness tracking functionality) were owned by 11.4% of respondents. Fewer than 10% of respondents reported owning home automation devices.

Table 3. Ownership of information and communication technology devices
(percentage of all respondents with a disability)

Information and Communication Technology Devices	Percent
Smartphone	81.5
Laptop computer	68.9
Tablet computer (iPad, Kindle Fire, Galaxy Tab, Microsoft Surface)	64.2
Desktop computer	57.5
Home security system	18.1
Fitness tracker or sensor (Fitbit, Garmin)	13.4
Smartwatch (Apple Watch, LG Watch)	11.4
Basic mobile phone	9.4
Specialized assistive technology	9.1
Home automation or control system	8.7
Other wearable technology (rings, pendants, glasses)	5.1
Home activity sensor system	4.3
Sleep monitor	4.3

Ownership of ICT devices is not uniform in the sample of people with disabilities. Demographic characteristics, including age and income are variably associated with device ownership. Generally, the effects of age and income are less for established technology devices like smartphones and tablets (Tables 4 and 6), and greater for emerging platforms such as fitness trackers, smartwatches and home automation (Tables 5 and 7). Table 4 shows relatively consistent ownership rates of smartphones across the first 5 age groups spanning 18 to 70 years, with rates ranging from 79% to 91%. Only for the over-70 age group does ownership drop to 61%. Tablet ownership rates are more consistent across the 6 age groups.

Table 4. Ownership of information and communication technology devices
(percentage of all respondents with a disability)

Age	Basic cellphone	Smartphone	Tablet
18-30 (n=12)	17%	83%	67%
31-40 (n=34)	6%	91%	74%
41-50 (n=34)	18%	79%	74%
51-60 (n=65)	12%	85%	52%
61-70 (n=71)	4%	85%	69%
Over 70 years old (n=36)	8%	61%	61%

Age-ownership patterns are also evident for other emerging platforms/devices.. For fitness tracker, which are generally lower cost and offer simpler functionality than smartwatches, ownership rates rise steadily from the youngest age group (18-30) to the third youngest group (41-50) and then decline for the oldest 3 age groups. For smartwatches and home automation, a more distinct negative linear relationship between age and ownership rate is evident. These results are consistent with expectations of technology adoption by which younger people tend to be earlier adopters of new technology.

Table 5. Ownership of information and communication technology devices
(percentage of all respondents with a disability)

Age	Fitness tracker	Smartwatch	Home automation
18-30 (n=12)	8%	25%	33%
31-40 (n=34)	15%	18%	18%
41-50 (n=34)	21%	15%	15%
51-60 (n=65)	17%	11%	5%
61-70 (n=71)	11%	7%	3%
Over 70 years old (n=36)	6%	8%	6%

Annual household income also affects ownership of both established and emerging technologies, although in variable ways. For basic cellphones (“feature phones”, in industry parlance) there is a strong inverse relationship between income and ownership rates – higher income individuals with disabilities own these less expensive mobile phones at lower rates than lower income individuals. However, for smartphones, tablets and fitness trackers the relationship is reversed: as household income rises, ownership rates also rise. A slightly different pattern is evident for smartwatches and home automation: ownership rates generally rise with household income, except that those in the lowest income groups have slightly higher ownership rates than those in the middle-income groups.

Table 6. Ownership of information and communication technology devices
(percentage of all respondents with a disability)

Annual household income	Basic cellphone	Smartphone	Tablet
Less than \$10,000 (n=22)	18%	68%	64%
\$10,000-\$14,999 (n=19)	21%	74%	53%
\$15,000-\$24,999 (n=37)	14%	76%	54%
\$25,000-\$34,999 (n=25)	12%	80%	56%
\$35,000-\$49,999 (n=34)	6%	74%	65%
\$50,000-\$74,999 (n=37)	8%	84%	65%
\$75,000-\$99,999 (n=21)	5%	86%	81%
\$100,000 or more (n=39)	3%	97%	85%

Table 7. Ownership of information and communication technology devices
(percentage of all respondents with a disability)

Annual household income	Fitness tracker	Smartwatch	Home automation
Less than \$10,000 (n=22)	5%	14%	9%
\$10,000-\$14,999 (n=19)	5%	11%	5%
\$15,000-\$24,999 (n=37)	3%	5%	5%
\$25,000-\$34,999 (n=25)	8%	4%	0%
\$35,000-\$49,999 (n=34)	15%	9%	9%
\$50,000-\$74,999 (n=37)	19%	14%	11%
\$75,000-\$99,999 (n=21)	33%	14%	10%
\$100,000 or more (n=39)	23%	26%	21%

What people with disabilities want to do

Review of response data on ICT device ownership helps to document where people with disabilities currently are in terms of technology access and use. The second part of our analysis

provides an initial description of where people with disabilities wish to be in terms of independent living and community participation.

For this part of the research we used the Concerns Report Method (CRM) to ask respondents to rate issues of concern in their community. Issues were selected from a larger pool of items by a panel of consumers and advocates with specific knowledge of their community. Using a five-point Likert-type rating scale, survey respondents rated each issue on two dimensions: Importance and Satisfaction. For example, a survey item may pertain to the availability of affordable and accessible housing. The respondent would rate how important it is to him or her that there is accessible and affordable housing available in the community and how satisfied he or she is with the availability of accessible/affordable housing in the community. We asked survey respondents to rate the importance to them of specific activities, and then asked them to rate their satisfaction with their ability to perform those activities, both on a 1-5 scale. The aim of this approach is: 1) to identify the things (in this case, common activities) that are most important, and 2) to identify the important activities with the lowest satisfaction. Results will help structure further inquiry with the objective of identifying and building use-cases for technology designers and developers to address the unmet needs of people with disabilities.

The 1-5 rating scales range from not important/not satisfied to very important/very satisfied. In analyzing survey responses, issues rated high in both importance and satisfaction are considered strengths. Issues rated high in importance but low in satisfaction are considered concerns or needs. The list of functional activities to be rated for importance and satisfaction in the SUN-ICT was developed by the research team in collaboration with our stakeholder group of people with disabilities. This Research Partners Panel includes people with vision, mobility, dexterity, cognitive and speech limitations.

The section in the survey questionnaire that uses the CRM methodology includes 8 sets of questions relating to domains of activity related to independent living and community participation. These domains are listed below.

1. Getting and using information
2. Communicating and networking
3. Leisure and social activities
4. Thinking and remembering
5. Community mobility and travel
6. Managing and controlling your environment
7. Managing money and finances
8. Maintaining health, wellness, and safety

Respondents provided importance-satisfaction ratings for 75 specific activities across the eight domains. Of the 75 specific activities listed in the questionnaire, 19 (or 25%) were given an average rating of at least 3.80 on the 5.00 scale, which used as the threshold for activities of high importance. Differences between importance and satisfaction for 19 activities were calculated. Activities with a difference of 0.40 or greater were identified as “concerns”, while the others were treated as “strengths”, or at least less concerning. This analysis identified 10 concerns (Table 8) and 9 strengths (Table 9).

The list of “concerns” in Table 8 offers important insights into the needs of people with disabilities. The activities with the greatest difference between importance and satisfaction were in the Managing money and finances domain – shopping, comparing prices and goods, and using credit/debit cards. Other domains of high concern were community mobility and travel (finding safe routes and recognizing traffic conditions) and thinking and remembering (remembering

people, managing time, and recording notes and reminders). Respondents also indicated a need to be better able to communicate using voice calling and email.

Table 8. Activities with HIGH IMPORTANCE and LOWER SATISFACTION,
all respondents with a disability

Domain	Activity	Importance	Satisfaction	Difference
Managing money/finances	Shopping for goods or services (comparing, purchasing)	4.33	3.78	0.55
Managing money/finances	Using credit or debit cards	4.50	3.95	0.54
Community mobility/travel	Recognizing traffic conditions	4.06	3.56	0.50
Getting/using information	Getting information on the internet (news, sports)	4.41	3.92	0.49
Communicating and networking	Voice Calling	3.96	3.47	0.49
Thinking and remembering	Remembering names of people, places, things	3.97	3.50	0.47
Communicating and networking	Sending and receiving emails	4.74	4.28	0.46
Community mobility/travel	Planning a safe and easy route	4.14	3.68	0.46
Thinking and remembering	Recording notes, reminders, and to-do lists	4.07	3.61	0.46
Thinking and remembering	Managing time (calendars, alarms, alerts)	4.30	3.86	0.44

Activities of greatest strength (those that have high importance but relatively high satisfaction) include social networking, getting weather updates, managing medications, budgeting/tracking expenses, and getting public safety alerts (Table 9).

Table 9. Activities with HIGH IMPORTANCE and HIGH SATISFACTION,
all respondents with a disability

Domain	Activity	Importance	Satisfaction	Difference
Communicating and networking	Text messaging and instant messaging	4.41	4.05	0.37
Getting/using information	Getting directions and instructions (YouTube videos, recipes, tutorials)	4.13	3.76	0.37
Community mobility/travel	Knowing your community layout (location of stores, houses)	4.11	3.78	0.33
Managing money/finances	Using online banking (transfers, deposits, checking balance)	4.38	4.08	0.30
Getting/using information	Getting public safety alerts (emergency alerts, amber alerts)	3.97	3.72	0.26
Managing money/finances	Budgeting, tracking expenses, managing receipts	3.87	3.61	0.26
Health/wellness/safety	Managing medications	3.98	3.74	0.25
Getting/using information	Getting weather updates	4.13	3.97	0.16
Leisure and social activities	Social networking (Facebook, LinkedIn, Snapchat, Instagram)	3.80	3.67	0.12

Conclusions

These survey research results provide key insights into the current ICT device ownership profile of people with disabilities and the lifestyle activities that are most salient to them. They show that the pattern of ownership of established ICT devices like smart phones and tablets and ownership of emerging ICT devices is generally similar for both people with disabilities and the general population. Rates of smartphone and tablet ownership are high, while fitness trackers, smartwatches and home automation systems are low.

Smartphone and tablet ownership rates by people with disabilities matches or even exceeds those of the general population. The Pew Research Center tracking survey measured smartphone and tablet ownership by the general population in 2016 at 77% and 51%, respectively (2017). This compares to 81.5% and 64.2%, respectively, for the SUN-ICT survey results reported here. For fitness trackers, ownership rates are much lower for people with disabilities than the general population: 13.4% versus 12% for the general population according to Gartner (2016). Gartner's data for smartwatch ownership shows a similar rate (12 percent) as the SUN-ICT data for people with disabilities (11.4%).

More research and analysis is needed to track technology adoption trends by people with disabilities. Generally, it is expected that technology adoption rates of people with disabilities taken all together (i.e., all disability types) tend to lag the general population. This is likely the result of accessibility issues needing time to be resolved and the underdeveloped capabilities (and consequently, the use cases) insufficiently developed in early generations of new technology devices.

The survey results also point to a list of key activities in which people with disabilities want to participate, but for which they have substantially less satisfaction in their ability to engage. At the top of the list are activities related to managing money and finances, specifically 1) shopping for goods/services and 2) using credit/debit cards. Activities related to community mobility and travel (recognizing traffic conditions and planning a safe and easy route) also rank high on the list of “concerns”. Taking these results together can help researchers, designers and engineers prioritize the types of solutions they undertake. Activities related to thinking and remembering was also prominent on the list of concerns.

The analysis presented here represents an initial review of the data. Further analysis by disability type might provide sharper relief to patterns of device ownership and priority needs of people with specific functional limitations. For instance, people with cognitive difficulties might assign even higher importance and lower satisfaction scores to activities related to thinking and remembering than the rest of the sample. Limitations of this study include the need to analyze the data according to disability type and the relatively small sample size for doing so. Segmenting the sample by disability type will produce smaller subsample sizes that might further limit analytical reliability.

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