Using Information and Communication Technologies to Promote Healthy Aging in Costa Rica: Challenges and Opportunities

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Abstract. Several authors have suggested that ICTs have the potential to promote healthy ageing by supporting social inclusion, access to products and services and learning. However, older people often do not use ICT and information about patterns of usage is scarce. Data from the Costa Rica Census 2011 and two questionnaires showed that older people between 65 and 74 years old, living in urban areas, with more education and higher socioeconomic status are the most active ICT users. They presented a tendency to mobility and connectivity when using ICTs, reported positive perceptions of technology and were favorably disposed to learning about and using ICT. Based on the analysis of data we conclude that opportunities to promote healthy aging through use of ICT include use of public infrastructure and community-based learning services to increase the number of ICT users and facilitate progression from social networking activities to activities supporting the maximization of functional status such as instrumental activities and learning for personal development.

Keywords: Older adults · ICT literacy · Healthy/Active aging · ICT and active aging

1 Introduction

This paper is part of a project about using Information and Communication Technology (ICT) to promote healthy aging among older Costa Ricans in order to prevent cognitive impairment. This is the first analysis of data relating to how older Costa Ricans are currently using ICT.

Models of active and successful ageing suggest that it is possible to remain functional, independent, and autonomous and have good quality of life during old age [1–4]. According to the WHO [3], active aging is a multifactorial process which is dependent on population and individual factors. At population level active aging requires that individuals have opportunities to realize their potential for physical, social and mental wellbeing throughout their lifespan, and that they are able to participate in society

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irrespective of illness and disabilities. At individual level the most important factors in successful ageing include the maintenance of autonomy and independence.

Powerful individual-level predictors of active ageing include psychological factors such as intelligence and cognitive ability, e.g. capacity for solving problems and adapting to changes and losses produced by aging, and social engagement, defined as productive interaction with society, with one's community and with a social network [1, 2, 4, 5].

Technology can play an important role in work, leisure and healthcare provision. Specifically, ICT can increase opportunities for social learning and create new ways to access information and services [6]. ICTs have the potential to promote healthy aging by supporting social inclusion, increasing access to products and services, supporting learning for pleasure and fulfillment as well as being used for specific cognitive training [6–10].

Despite the potential of ICT to improve many aspects of daily life including learning processes and cognitive activities, older people often do not use ICT. In 2014 just 29 % of people aged between 65 and 74 years living in the 28 countries of the European Union were using the Internet frequently (every day or almost every day); this produces an age-based digital divide [11]. In 2011 just 14 % of people in this age group in Costa Rica were using the Internet according to the National Census [12].

There is some information available about ICT usage among older people living in European countries and in the United States of America [9–12], but there is not much detailed information about when and how are they using ICT. In general, information about this topic tends to be even scarcer in developing countries.

In the light of the aging of the population, the low usage of ICT by older people and the lack of information about this topic in Latin American developing countries, we decided to investigate patterns of ICT usage, interest in ICT and motivation to use ICT among older Costa Ricans. Knowing how older people are using ICT, what obstacles and barriers they face, and what their needs and expectations are would enable the development of tailored interventions using ICT to promote successful or healthy aging.

2 Methodology

We analyzed data from the last National Census 2011 to enable us to describe the patterns of ICT access and usage among older Costa Rican people and how ICT usage was related to socio-demographic characteristics. We also administered two questionnaires to 59 older Costa Ricans participating in educational programs offered by governmental and non-governmental institutions. Recruitment was a two-stage process. First we put out a general call through governmental and non-governmental organizations and then we screened potential participants for cognitive impairments using the Mini Mental State Examination (MMSE) [13]. All participants were older than 60 years. We used this criterion as it is the criterion used by the United Nations to define "older" people [3].

One of the questionnaires included socio-demographic questions so that we could compare our participants to the general population; the questionnaire also included questions about access to, and experiences with technologies, as well as questions about interest in ICT, expectations of ICT and barriers to learning about and using ICT.

Participants also completed the Survey of Technology Use (SOTU), which explores experiences with technologies and socio-personal characteristics [14]. Descriptive statistics were calculated using SPSS 22.

Because there was little variance in MMSE scores it was not possible to calculate reliability measures. Nevertheless it is important to note that we used the MMSE as a screening tool and not as a diagnosis tool. The SOTU was translated and adapted using the back-translation procedure and two cognitive interviews. On the basis of the cognitive interviews we made some final modifications to the translated versions of the instrument.

3 Results

3.1 Description of Older People in the General Population and the Study Participants

Table 1 describes the general population and participants in the research project. Women made up just over half the general population (53.4 %) and 78 % of study participants, the average age of study participants was 67.46 years (SD = 5.31) and the mean score in the MMSE was 28.63 (SD = 1.29).

About half the study participants (48.8 %) had university level education and 20.3 % were high school graduates, whereas the most frequent educational level among

Table 1. Demographics

	National census N = 311,712	Participants n = 59
Age group (%)		
60–64	–	32,2
65–74	58	61
75–84	21	5,1
85 and more	11	1,7
Marital status (%)		
Married/civil union	53,4	57,6
Separated/divorced	9,8	20,3
Widowed	24,6	11,9
Single/never married	12,2	10,2
Education level (%)		
Without any degree	13,6	0
Some primary school	36,7	3,4
Primary school	23,8	10,2
Some high school	7,4	15,3
High school	4,8	20,3
Technical high school	0,9	1,7
1–3 years of college	1,5	3,4
University	11,2	45,8

the general population was some primary school education (36.7 %) followed by completed primary school (23.8 %). Most study participants (71.2 %) received a pension from some kind of public institution, which indicates that they had a medium or high income. In contrast just over a quarter of the general population (27 %) did not have health insurance or had state-provided social health insurance, which is an indicator of low income. These data indicate that study participants were of medium or high socioeconomic status; later we report our analysis of the impact of socio-demographic variables on the ICT usage patterns among older Costa Ricans.

3.2 ICT Access and Usage Among Costa Rican Older Adults

According to the 2011 Census 24 % of older Costa Ricans had a desktop computer at home, 19 % had a laptop, 25 % had Internet access and 69.3 % had a mobile phone. The majority (56.1 %) of study participants had a desktop computer, 76.3 % had a laptop, 91.5 % had Internet access at home and 100 % had a mobile phone. This shows that our sample had better access to ICT devices than the general population, and that the ICT device most commonly available to older people is the mobile phone.

Of the 24 % of the general population who had a computer at home, just 11.3 % were using it, a similar pattern was observed with respect to availability and use of the Internet and mobile phones; just 50 % of 69,3 % of people with access were using them. (See Table 2).

Table 2. Older people using computer, internet and mobile phone

Have you used (item) in the last three months?	National census N = 311,712		Study participants n = 59	
	Yes (%)	No (%)	Yes (%)	No (%)
Computer	11.3	88.5	78	22
Internet	10.5	89.5	83,1	16,9
Mobile phone	32	68	100	0

A larger proportion of study participants were using the devices and services to which they had access. In both groups the most commonly used ICT device was the mobile phone.

Analysis of the relationship between socio-demographic characteristics and ICT usage showed that people living in urban areas were more likely to have access to ICT than people living in rural area (30 % and 8 % respectively). Analysis of ICT usage by sex, showed that more men than women were using ICT, but the difference was non-significant. The majority of users were from the 65–74 years age group. In the population as a whole the number of users decreases by around 50 % for each extra decade of age e.g. 42 % of people in the 65–74 years age group were using a mobile phone; but this figure decrease to 22 % in the 75–84 years group and to 10 % in the 85 years and older group. As most of the study participants were in the 65–74 years age group we could not detect this pattern in our sample.

ICT usage varied with educational level. Most ICT users had some university education, whereas most of the people who were not educated above primary school level were non-users (See Fig. 1).

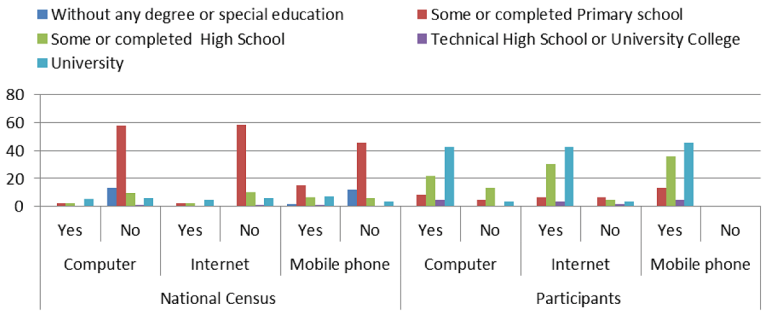

Fig. 1. ICT usage by educational level

The majority of the study participants, who had some university education or had graduated from high school, were active users.

The relationships between ICT usage and employment and disabilities were also investigated. The 39 % of users in the general population and 71.2 % of users in the study participants) were pensioners, employees or independent workers, and thus had a medium or high income. ICT users in the general population (14 % of computers users, 7 % of Internet users and 38 % of mobile phone users) reported no disability, whereas around 90 % of people reporting a disability were non-users. In comparison around 30 % of study participants reporting a disability were non-users. Mobile phones were used by 23 % of people in the general population with a sensory impairment, 19 % of people with a motor impairment and 9 % with an intellectual impairment. All the study participants with some kind of impairment were using a mobile phone.

To summarize, at national level only around 11 % of older people were using computers and the Internet, although 32 % were using a mobile phone. People from urban areas have better access to ICT than those in rural areas. ICT usage is most common in the 65–74 years age group. Although the most frequent educational level categories for the general population were some primary school education and completed primary school, most ICT users had some university education; they also tended to have a medium or high income level and to be without disability. This information suggests that as well as being age-based, the digital divide is also related to socioeconomic status. The majority of our participants represented the active users from the national level. The composition of our sample allowed us to gain a better understanding of usage patterns among older Costa Ricans users.

3.3 ICT Access and Usage Among Study Participants

In an attempt to explain the gap between access and usage we asked our participants what ICT devices were available to them personally. The majority (76.9 %) had access to, and were using, a smartphone, 59.3 % were using the Internet and 54.2 % were

Table 3. Devices for personal use and knowledge of public spaces with free access to computers and internet

Devices	n (%)	Places	n (%)
Smartphone	45 (76,3)	Cafe internet	28 (47,5)
Internet	35 (59,3)	Public universities	16 (27,1)
Laptop	32 (54,2)	Libraries	9 (15,3)
Mobile phone	31 (52,5)	Municipalities	7 (11,9)
Desktop	21 (35,6)	NGO	7 (11,9)
Tablet	21 (35,6)	None of the above	16 (27,1)

using a laptop. The least commonly used ICT devices (35.6 %) were the desktop computer and the tablets (See Table 3).

We wanted to distinguish between mobile phones with basic functionality only (voice calls and SMS) and smartphones (touchscreen interface, operating system and Internet access). Although we explained the difference to participants some were confused and the answers in this item about mobile phone could not be very accurate, in another item we clarified this issue when asked about the type of mobile phone they were using, results are presented in the section about mobile phone and internet usage.

Mobile devices and the Internet were the devices that participants most willingly use. Although tablets are a relatively new category of mobile device a significant number of participants were using them, reinforcing the idea of that older people are interested and willing to adopt new mobile devices and take advantage of their connectivity. We also asked participants if they knew of any public institutions and organizations offering access to computers and the Internet. Internet cafés were the most frequently mentioned public-access option, only 27.1 % knew that public universities offered this service and fewer than 20 % mentioned other options; 27.1 % did not have information about public options.

Mobile Phone and Internet Usage Among Study Participants. Most study participants were using smartphones. The most frequent use for mobile phones and smartphones was voice calling, followed by texting and instant messaging; Internet searching was less common (See Table 4).

The most commonly used applications were those related to social interaction (mobile messaging, social networking and email) followed by leisure application (video sharing and online games) and finally functional applications (reminders, weather, Internet browsers and banking). Smartphones were used for social interaction and, to a certain extent, in support of instrumental activities of daily life. Increasing knowledge and use of such applications for instrumental tasks represents an opportunity to use ICT to support independence and autonomy in daily life.

The majority of participants (47) were using the Internet on several devices, most (61 %) were going online several times a day and spent four or more hours a week using the Internet (See Table 5).

We asked participants if the number of hours they had spent online in the last week was typical; 67.8 % confirmed that it was whilst 10.2 % reported that it had been an atypical week.

Table 4. Type of mobile phone, uses and applications

Mobile phone	N (%)	Mobile phone applications	Count [a]
Type:		Mobile messaging (Whatsapp, Messenger, Line, Viber)	56
Smartphone	48 (81,4)	Social networking (Facebook Twitter)	27
Mobile phone	11 (18,6)	Email	16
Uses:		Video-sharing website (Youtube)	9
Voice calling	58 (98,3)	Video chat and voice call (Skype, Line, Viber)/Reminders (notes, agendas, reminders)	7
Texting (SMS)	48 (81,4)	Online games/Picture editing	6
Mobile messaging	42 (71,2)	Weather/Traffic and navigation/Mapping	4
Internet searching	35 (59,3)	Bowsers (Chrome, Safari, Firefox)/Internet banking	3

[a] n = 48, but the answer reflects how many applications participants were using e.g. if a participant was using messenger and line then both applications were counted.

Table 5. Start Internet use, frequency and hours per week using Internet

Starting	n (%)	Frequency	n = 47 (%)	Hours per week	n = 47 (%)
More than 1 year	39 (66,1)	More than once a day	36 (61,0)	More than 5	20 (33,9)
1 year	7 (11,9)	Once or twice a week	5 (8,5)	4 or 5	11 (18,6)
6 months	4 (6,8)	Once a day	4 (6,8)	2 or 3	9 (15,3)
N/A	9 (15,3)	Twice monthly	2 (3,4)	1 or less	7 (11,9)
		N/A	12 (20,3)	N/A	12 (20,3)

We found that eight of the Internet non-users in our sample had some primary school education or some high school education. Internet non-users also reported low monthly incomes (between 370 and 750 USD). Five of them did not have access to the Internet at home and had mobile phones with basic functionality; only two knew about public spaces offering free access to the Internet. This profile corresponds to that of non-users in the general population. It highlights the fact that people with limited access to ICT have little information about opportunities to use ICT devices free of charge. Finally, we found that four of the non-users were people who had a technical or university education; these non-users did have access to the Internet at home.

We asked Internet users about their performance of 26 ICT-based activities and ranked these activities according to percentage of participants who reported performing them (see Table 6).

Between 50–83 % of participants reported performing the top ten activities. Most participants sent or read emails. The next most common activities were related to social interaction (staying in touch with distant friends, using social networking and instant messaging, in that order). The second most important category of the top activities was accessing health and wellness information. The middle positions in the top ten were occupied by other activities related to social interaction and the lower top ten positions were occupied by activities related to leisure and instrumental activities. Turning to the ten least commonly performed activities, the bottom positions were occupied by social

Table 6. Most and least commonly performed ICT-based activities (n = 47)

Top performed ICT based activities	n (%)	Lowest performed ICT based activities	n (%)
Send or read e-mail	39 (83,0)	Do any banking online	13 (27,7)
Staying in touch with distant friends	36 (76,6)	Participate in informal educational processes	12 (25,5)
Using social networking sites	34 (72,3)	Buy or make a reservation for a travel service, like an airline ticket, hotel room	11 (23,4)
Send "instant messages" to someone who´s online at the same time	32 (68,1)	Play a game online	11 (23,4)
Look for health and wellness information	32(68,1)	Buy a product online, such as books, music, toys or clothing	9 (19,1)
Staying in touch with local friends	31 (66,0)	Exchange personal stories	6 (12,8)
Make a phone call online, using the internet	27 (57,4)	Participate in formal educational processes	6 (12,8)
Look for information about movies, music, books	26 (55,3)	Reading or participating in blogs	3 (6,4)
Look for products and services	25 (53,2)	Participating in forums	0
Explore personal educational needs or interests	24 (51,1)	Participating in an online virtual world	0

participation activities such as having a personal say, taking an active role in producing or exchanging information and participating in formal learning. Playing online games occupied a middle position; whilst this is a leisure activity it requires players to take an active role. The highest positions were occupied by instrumental activities (online banking; online shopping) and informal educational activities. It is important to note that although ICT has the potential to facilitate learning few older people were using ICT for formal or informal learning. Internet users took advantage of ICT to enhance their social interaction, but they tended to be passive consumers of information from the Internet and did not take advantage of its interactivity to produce and share information; this reduces its potential to promote social inclusion.

3.4 Older People's Needs, Motivations and Barriers to Using ICT

The two most frequently cited motivations for using ICT did not correspond with the most commonly performed activities; they were in fact related to instrumental activities: "I realize that they are useful in daily life" and "I think it is important to be up to date and know about new technologies (both cited by 50.8 %). The third most frequently given reason was "To communicate with family members" (33.9 %). Less frequently cited motivations were "Job/working motivations" (18.6 %) and "I knew about ICT courses for older people" (8.55 %).

Table 7. Barriers to learning about and using ICT (n = 50)

Barrier	n	%
Memory problems, or difficulty to understand the information	20	40
It is not easy to understand information in different devices (amount, size and disposition on information in different software)	17	34
The teaching and learning processes are not adequate for older people	17	34
There are not enough opportunities to learn how to use ICT	11	22
Access to devices and applications	7	14
Psychomotor disabilities (problems with specific movements on hands)	3	6
Disabilities in vision or hearing	2	4
Other	19	38

The most common method of learning to use ICT among our 54 users was by participating in special courses for older people (42.6 %), followed by with the help of a young person (37 %) and by oneself (20.4 %). Participants reported that their biggest difficulties in learning and using ICT related to their cognitive performance (declining memory and attention), followed by courses are not appropriate/suitable courses for older people and lack of learning opportunities. Sensory and psychomotor impairments were not important barriers for them (see Table 7).

Most of the barriers in mentioned in the "Other" category were individual factors such as "fear" or "shame". Participants reported that memory or attention problems meant that during tuition they frequently forgot the instructions and information; they felt that the people who were teaching them did not have enough patience and such situations made them feel ashamed and anxious. They also reported being afraid of making a mistake that would damage equipment or result in loss of information. Other barriers to learning about and using ICT were lack of practice at learning things and that devices and software display information in a language in which participants are not fluent (sometimes most of the available information is in English).

The overwhelming majority of participants (93.2 %) reported that they had the capacity to use ICT devices and applications without discomfort, stress, or fatigue, so physical factors were not a barrier to usage. Only 2 participants responded negatively to this question about physical capacity. To gain more insight into the relationship between ICT usage and psychophysical factors we analyzed associations between ICT usage in the last three months and items in the Experiences with current technology subscale from the SOTU (See Table 8).

The majority of users described their current experiences with technologies in positive terms (being satisfying, adding to their creativity, encouraging and bringing them closer to people). However some users were neutral to negative in their responses. More specifically, some participants reported that although ICT brought them closer to distant family or friends, it sometimes separated them from people in the interactions of daily life.

When emotions related to technology at different stage of life were evaluated in the SOTU "use and perspective subscale" user's responses were positive. But, most participants had not had access to technology at school (95 %) or during childhood

Table 8. People using ICT in the last three months by use and experience with current technologies from SOTU

	Frustrating	Neutral	Satisfying
Computer users [a]	3	1	42
Internet users [b]	2	1	46
Mobile phone users[c]	4	2	53
	Interferes with creativity	Neutral	Help creativity
Computer users	0	4	42
Internet users	0	4	45
Mobile phone users	0	5	54
	Separates me from people	Neutral	Brings me together with people
Computer users	6	5	34
Internet users	6	5	37
Mobile phone users	8	7	43
	Discouraging	Neutral	Encouraging
Computer users	1	3	42
Internet users	0	3	46
Mobile phone users	2	3	54
	Lowers my opinion of self	Neutral	Raises my opinion of self
Computer users	2	5	39
Internet users	1	5	43
Mobile phone users	2	6	51

[a] n = 46 computers users.
[b] n = 49 Internet users.
[c] n = 59 mobile phone users.

(86 %). Users were favorably disposed to using technology, and in the "personal and social characteristics" subscale the majority of users described themselves in positive terms, reporting characteristics such as being calm, positive, persevering, physically and emotionally independent.

4 Discussion and Conclusions

We found that few older people were using ICT in the general population (11 % were using computers and the Internet; 32 % were using mobile phones). Most of the active ICT users were between 64 and 75 years old, living in urban areas, and were high

school graduates or had some university education; they also tended to have a medium or high income and to be without disability. In contrast most of the non-users were people who had not been educated beyond primary school and had a low income; this indicates that the digital divide is not just age-based but is also related to socio-economic factors. There is an association between socio-economic factors and the social and cultural background which is necessary to a willingness to learn and use technology and this factor would help to account for the gap between access and usage. Most participants were active ICT users and fitted the profile of ICT users in the population; non-users in our sample also shared the same profile as non-users in the general population.

The most commonly used ICTs were mobile devices and the Internet, indicating that mobility and connectivity were important drivers of usage. In the population and in our sample the mobile phone was the most commonly used ICT, suggesting that it has potential as a gateway device for promoting ICT literacy. Examining use of smartphone applications and online activities we found that the most frequently performed activities were related to social interaction and leisure, whilst the least frequently performed were related to learning, social participation and instrumental activities.

Online activities reflect ICT usage to maintain a social "engaged life" one of the most powerful predictor of successful aging [4]. But increasing the use of ICT for instrumental activities, social participation and learning would promote better functional status and more independence and autonomy among older people. Use of ICT for learning should be promoted, as learning activities and other forms of cognitive stimulation may counteract cognitive decline [2, 15–19]. Despite the potential of ICT to facilitate the development of flexible learning models, combining self-managed and organized education, which would give older people the additional time they sometimes need for processing and reflection on new information [6], the analyses suggest that the low usage of ICT for learning were due to perceived non-availability of relevant learning options and programs.

Users in our sample had positive perceptions of technology, and they were favorably disposed towards using it and self-reported positive personal and social characteristics; a similar user profile was reported by Vroman et al. [10]. The most frequently cited barriers to learning about and using ICT were external barriers such as lack of learning opportunities and inadequate learning environments.

According to the Information and Communication Technology Social Networking Motivational model proposed for older adults by Vroman et al. [10], our participants were in the first level of ICT adoption, i.e. they used ICT mainly to support personal relationships and for social networking with family and friends. They were also using ICT to access information, an activity associated with the second level of the model; the other component of this second level is "performing instrumental tasks online". The final level is "sharing through online groups and communities".

In conclusion the main challenges in the promotion of healthy aging among older Costa Ricans are: ensuring that most older people benefit from ICT, promoting the "higher" levels of ICT adoption [10] and promoting learning as an activity, which includes learning for personal development [6]. Nevertheless, older people largely have positive perceptions of ICT and are favorably disposed towards using it, thus, the existence of a public ICT infrastructure and the creation of community-based learning

services present opportunities to overcome the digital divide and promote healthy aging. However services must be tailored to the needs and characteristics of older people and it is important to ensure that information about services reaches the target audience.

Limitations. Since the call for participants was made in institutions providing educational opportunities and social activities for older adults, our sample contained a high proportion of older adults who were already using ICT and were interested in improving their knowledge and skills. These sample characteristics limit the conclusions we can draw from our data and the generalizability of the findings. There is a need to reach older adults who are non-users of ICT, particularly older adults with disabilities and those living in rural areas.

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