Digital inclusion and functional capacity of older adults living in Florianópolis, Santa Catarina, Brazil (EpiFloripa 2009-2010)

Inclusão digital e capacidade funcional de idosos residentes em Florianópolis, Santa Catarina, Brasil (EpiFloripa 2009-2010)

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Abstract

Objective: To study the relationship between digital inclusion, represented by the exchange of online messages, and functional capacity of older adults living in Florianópolis, Santa Catarina, Brazil. **Methods:** Data were from EpiFloripa Idoso, a cross-sectional household-based survey conducted between 2009 and 2010 with older adults (60+ years). Functional capacity was represented by the inability / difficulty to perform basic / instrumental activities of daily living, and formed the outcome variable called functional dependence. The main independent variable was self-reported ability to send and receive online messages using the computer. Prevalence ratios (PR) and 95% confidence intervals (95%CI) were estimated with multivariable Poisson regression models. **Results:** The sample consisted of 1,656 older adults between 60 and 102 years old with a mean age of 70.39 years (SD = 7.79). Older adults who could send and receive online messages without difficulty demonstrated a significant lower prevalence of moderate / severe functional dependence (PR = 0.61; 95%CI: 0.40 - 0.94) after adjustment for demographic, socioeconomic, health and behavioral factors. **Conclusions:** The exchange of online messages has a strong association with functional independence. The causality of this association cannot be determined. Studies support the hypothesis that the exchange of online messages and functional independence have a bidirectional, additive and synergistic association. Longitudinal studies could elucidate the mechanisms involved in this association, in order to support digital inclusion policies for older adults, and to identify the profile of older adults who would benefit the most from digital inclusion.

Keywords: Elderly. Functional Capacity. Communication. Internet. E-mail.

Resumo

Objetivo: Estudar a relação entre inclusão digital, na forma de troca de mensagens pela Internet, e capacidade funcional de idosos residentes em Florianópolis, Santa Catarina, Brasil. **Métodos:** Utilizaram-se dados do EpiFloripa Idoso, um estudo transversal de base populacional com idosos (60+ anos) realizado entre 2009 e 2010. A capacidade funcional foi representada pela dificuldade ou incapacidade na realização de atividades básicas ou instrumentais da vida diária, e constituiu a variável dependente denominada dependência funcional. A variável independente principal foi a capacidade autorreferida de enviar e receber mensagens pela Internet usando um computador. Razões de prevalência (PR) e intervalos de confiança de 95% (IC95%) foram estimados em modelo multivariável por regressão de Poisson. **Resultados:** A amostra compreendeu 1.656 idosos entre 60 e 102 anos com idade média de 70,39 anos (DP = 7,79). Os idosos que conseguiam enviar e receber mensagens pela Internet sem dificuldade apresentaram prevalência significativamente menor de dependência funcional moderada/grave (RP = 0,61; IC95%: 0,40 - 0,94) após ajuste para fatores demográficos, socioeconômicos, de saúde e comportamentais. **Conclusões:** A troca de mensagens pela Internet possui forte associação com independência funcional. Não é possível inferir a relação de causalidade dessa associação. Estudos alicerçam a hipótese de que a troca de mensagens pela Internet e a independência funcional tenham uma associação bidirecional, aditiva e sinérgica. Estudos longitudinais poderiam investigar os mecanismos envolvidos nessa associação, para fundamentar políticas de inclusão digital de idosos e para identificar qual o perfil de idosos que mais se beneficiaria com essa inclusão.

Palavras-chave: Idoso. Capacidade Funcional. Comunicação. Internet. E-mail.

Introduction

The elderly population is the fastest growing segment in Brazil[1] – in that country, one is considered an elder once they are 60+ years old.[2] With the world's population ageing, the concept of functional capacity has emerged as the most efficient proxy for health access among the elderly.[3, 4] Functional capacity is the multidimensional interaction between physical and mental health, independence in daily life, social integration, and family and economic support.[3] It is measured in terms of activities of daily living, and will characterize an independent and autonomous older adult in a community. Autonomy and independence are determinant factors of healthy ageing, not the mere absence of problems or morbidity in all dimensions.[3, 4]

Integrity in activities of daily living is a basic factor for physical and mental health and social well-being.[4] In practice, the core concept is based on the ability/inability to perform activities of daily living.[5] Functional dependence, thus, is defined by the inability or difficulty to perform activities of daily living.[5]

Assessing functional capacity by means of activities of daily living scores is a vital component for a comprehensive geriatric assessment, since functional dependence is an independent and modifiable predictor of mortality.[6] Therefore, it is very important to identify factors that lead to or protect from functional dependence, and how they interact. Factors conventionally associated to functional dependence in Brazilian and foreign studies include: old age; low education; retirement; cognitive impairment; poor self-rated health; depression and other chronic diseases; hospitalization in the last six months; and infrequent contact with friends.[5, 7, 8]

As contemporary as the general population ageing, the increase in use of digital tools – such as personal computers, self-service cash (ATM), mobiles, and internet – provides a revolutionary way to social integration, in a process called Digital Inclusion.

The use of these tools improves communication and enables access to information and services,[9, 10] representing a process of socio-cultural gain and empowerment, that can be compared to a "new skill".

As more people get "online", the social gap between them and those who are still digitally excluded widens. The major concern is that, in 2009, only 5% of Brazilian elders were internet users[9, 10] – a deepening exclusion process for this fast growing population. However, older internet users are increasingly using this medium to communicate. E-mail is the main internet activity for this age group in Brazil: 70% of them used e-mail in 2009, and 82% in 2010.[9, 10] E-mail use has the potential to improve communication with family and friends, enable the development of new friendships, and support stronger intergenerational links.[11] Moreover, other means of communication via internet are getting popular among Brazilian older adults, such as instant messages (like MSN®), social networking sites (like Facebook®, Orkut®), and internet telephony providers (like Skype®).[9, 10]

The use of these tools reflects the existence of a social network. To become digitally included is not a passive process, and calls for initiative, high cognitive skills, emotional control and continuous learning. In fact, cognitively stimulating activities are determinant to reduce incidence of cognitive decline and of dementia – and these processes, in turn, are directly related to functional loss.[12] So far, few studies have explored the relationship between functional dependence of older people and digital inclusion.

The present study aims to investigate the relationship between digital inclusion – represented by the exchange of online messages – and functional dependence of older adults residing in Florianópolis, Santa Catarina, Brazil, on the hypothesis that there is a positive association between digital inclusion and functional independence.

Methods

The data used in this study were obtained from "EpiFloripa Idoso", a household-based cross-sectional survey on health conditions of older people carried out in the city of Florianópolis, capital of Santa Catarina state, Brazil, between September 2009 and June 2010.

The city had an estimated population of 408.163 inhabitants on the year of 2009.[13] The age group studied – 60 years old or above – corresponded to 44.460 inhabitants (10.8%). In 2007, according to the Federation of Industries of the State of Rio de Janeiro (FIRJAN System), Florianópolis appeared as the Brazilian city with the 119th best FIRJAN Index of Municipal Development (IFDM)[14] – which assesses job/earnings, education and health in all the 5,564 cities of Brazil, and ranks them accordingly.

The sample size calculation was performed with the public domain Epi-Info software, version 6.04, using the formula of simple random sampling calculation for prevalence. The following criteria were chosen: population estimated in 44.460 older adults; outcome prevalence unknown (50%); confidence level of 95%; and sampling error of 4 percentage points. The calculation was multiplied by 2 (value relative to the outline effect estimated for the two-stage cluster sampling), and added by 20% of expected losses and 15% for the control of confounding factors in multivariable analysis. The minimum desirable sample size obtained, thus, was of at least 1.599 people.

A two-stage cluster sample selection procedure was performed. Firstly, 80 out of 420 census tracts were systematically selected, considering the mean monthly income of the family head (8 census tracts in each decile of monthly income). For the second stage, the average number of dwellers per household in the South region of Brazil was taken into consideration – which, according to the Brazilian Institute of Geography and Statistics (IBGE),[15] amounted to 3.1 in 2009. It was then estimated that 60 households would be selected in each census tract, in order to interview 20 subjects from each tract. The households were systematically

selected, and every person aged 60+ years old was invited to participate in the study.

The number of households was updated before data collection by the study supervisors, in keeping with standards by the IBGE. Census tracts with less than 150 households were joined together, and those with more than 500 households were separated, respecting the corresponding decile of monthly income, totalizing 83 sectors.

Older adults who could not be contacted after four visits (with at least one visit in the evening and another on weekend), and the ones that were impossible to access due to travels or short hospital stays were counted as losses; and the ones who voluntarily refused their participation were counted as refusals.

Data was collected through a standard questionnaire applied in face-to-face interviews – with the help of hand-held devices – by interviewers that had at least graduated from high school, fully trained on the survey procedures. A pilot-study was carried out with 99 older adults residing in areas not sampled for the survey. Weekly verification of data consistency and quality control were provided via telephone for 10% of random selected older adults. The reliability of the questions used in quality control was fairly satisfactory, with *kappa* values ranging between 0.6 and 0.9. Supervision of field work, as well as quality and data consistency control, were performed by postgraduate students.

The outcome variable was functional dependence, obtained from the scale of activities of daily living (ADL),[4] composed of 8 basic activities and 7 instrumental activities – adding up to 15 activities. The basic daily activities were: getting in and out of bed; eating; grooming; walking on a leveled surface; bathing or showering; dressing; using the toilet on time; and climbing one set of stairs. The instrumental daily activities included: taking medications on time; walking nearby home; shopping; preparing meals; cutting toe nails; taking buses or taxis; and cleaning up the house. The functional dependence was classified in values ranging between zero (able to perform all ADLs without inability/difficulty) and 15 (inability/difficulty in all ADLs), and was dichotomized into: no/mild functional dependence (inability/difficulty to perform 0-3 activities) and moderate/severe functional dependence (inability/difficulty to perform 4-15 activities).[5]

The main independent variable was the ability to exchange online messages, defined as self-reported ability to use a computer to send and receive messages over the internet using at least one of the following means of communication: e-mail, social networking sites, instant messages, or voice messages. The definition of "computer" covered desktop computers as well as laptops and netbooks portable computers. This variable was based on the question "Are you able to send or receive messages through the computer?", and the answers were split into two groups: able to send and receive online messages without difficulty; able to send and receive online messages with difficulty/unable. It is worth mentioning that this variable represents the conclusion of a process started with the help of an indirect input device (mouse), and the comprehension of the metaphors implied in the use of the machine (hypertext navigation). It is not a detached variable, but a kind of marker that this person – who sends and receives online messages – is fit for exchanging information and sharing services and activities on the internet. It represents the end of the learning cycle required to digital inclusion.

The variable ability to use the computer was also analyzed, with the following question, asked before the question related to exchange of online messages: "Are you able to use the computer?". However, using the computer incorporates several levels of skill – from beginners to advanced –, representing, thus, a quite heterogeneous population, and so this variable was dichotomized into: able to use the computer without difficulty; and able to use the computer with difficulty/unable. If the older adult was unable to use the computer, the ability to exchange online messages was automatically classified as

unable to send and receive online messages using a computer.

Control variables, such as demographic, socio-economic, health, behavioral and social factors, were included. These variables are listed in the tables. Some deserve detailed description: the family income *per capita* was grouped in quartiles (1st quartile: ≤ R$ 327.50; 2nd quartile: > R$ 327.50 and ≤ R$ 700.00; 3rd quartile: > R$ 700.00 and ≤ R$ 1,500.00; 4th quartile: > R$ 1,500.00); the cognitive status was categorized as no cognitive impairment and probable cognitive impairment, according to the Mini Mental State Examination, taking into consideration the educational level;[16] depression symptoms were assessed through the reduced version of the Geriatric Depression Scale with 15 questions, using a cutoff of 5/6 (not case/case), according to study suggestions involving the Brazilian scale translation and validation;[17] other non-contagious chronic diseases were self-reported; physical activity was dichotomized into physically active (more than 150 minutes per week of physical exercise during leisure time) or not physically active;[18] and the frequency of contact with friends and relatives was dichotomized into frequent (more than once a month) or infrequent (once a month or less).

To test the association between outcome and independent variables, crude and multivariable analysis were performed through Poisson regression, estimating crude and adjusted prevalence ratios. The respective 95% confidence intervals were estimated, with p-value calculated by the Wald test.[19]

The first variable included in the multiple model was the main independent variable; then, one at a time, by forward selection, the control variables that displayed p<0.20 values were also included in the crude analysis. The variables remained in the model if they reached the p<0.05 value and/or adjusted the model. The variable ability to use the computer was not tested in the multiple model, since it constitutes a link between the outcome and the variable ability to exchange online messages.

The Stata 11.0 software (Stata Corp., College Station, USA) was used as statistical analysis tool. The multivariable analysis considered the effect of sampling design with the Stata *svy* command, designed for the analysis of complex samples.

The EpiFloripa Idoso project was approved by the Ethics Research Committee of the Universidade Federal de Santa Catarina, registration No. 352/2008, dated December 23, 2008; and it was financed by the National Council for Scientific and Technological Development (CNPq) under process No. 569834/2008-2.

Results

In the households visited there were 1,911 eligible older adults. Of the total, there was an effective sample of 1,705 participants; and, therefore, a response rate of 89.2% (206 losses or refusals). A small portion of the elderly on the effective sample could not be directly interviewed due to severe cognitive impairment (n=49), in which case an informant living in the same residence was interviewed instead. For analysis purposes, this portion of older adults was excluded, leaving the final sample count at 1,656 older people.

The final sample comprised older adults from 60 to 102 years old, mean age of 70.39 years (SD=7.79; median=69.00). Among them, 70.4% showed no/mild functional dependence; 21.9% were able to use a computer without difficulty; and 20.7% were able to send and receive online messages without difficulty using a computer (Tables 1 and 2).

In the crude analysis (Tables 3 and 4), the variable ability to exchange online messages presented the second strongest association with the outcome variable: those who were able to send and receive online messages without difficulty showed a prevalence ratio 4 times lower for moderate/severe functional dependence (PR=0.26; 95%CI: 0.17-0.38). Self-reported health was the variable

that had the strongest association with moderate/severe functional dependence; and, thirdly, the variable ability to use the computer.

After adjustment in multivariable analysis using Poisson regression (Table 5), those who were able to send and receive online messages without difficulty remained with a significantly lower prevalence ratio for moderate/severe functional dependence (PR=0.61; 95%CI: 0.40-0.94). The variable which presented the strongest association with the outcome variable remained self-reported health. The variable age remained in second place; and the ability to exchange online messages, on third place. Other factors independently associated with higher prevalence of outcome included: 1 to 4 schooling years; cognitive impairment; depression; spinal conditions or diseases; arthritis/rheumatism; diabetes; cardiovascular disease other than hypertension; and stroke. Apart from the exchange of online messages, physical activity also presented independent association with lower outcome prevalence.

Table 1 - Prevalence of moderate/severe functional dependence, of ability to use the computer, and of ability to exchange online messages, according to demographic, socioeconomic and health factors in older adults (60 +). Florianópolis, Santa Catarina, Brazil, 2009-2010 (n = 1,656).

Tabela 1 – *Prevalência de dependência funcional moderada/grave, de capacidade de uso de computador, e de capacidade de troca de mensagens pela Internet, segundo fatores demográficos, socioeconômicos e de saúde em idosos (60 +). Florianópolis, Santa Catarina, Brasil, 2009-2010 (n = 1.656).*

Variable	n (%)	Prevalence of moderate/ severe functional dependence	Prevalence of exchange of online messages without difficulty	Prevalence of computer use without difficulty
		n (%)	n (%)	n (%)
Functional dependence				
None	458 (27.7)	-	156 (34.1)	166 (36.2)
Mild	707 (42.7)	-	160 (22.6)	162 (22.9)
Moderate/severe	491 (29.6)	-	27 (5.5)	34 (6.9)
Exchange of online messages				
Unable to send and receive messages	1.269 (76.7)	453 (35.7)	-	33 (2.6)
Able to send and receive messages with difficulty	43 (2.6)	10 (23.3)	-	10 (23.3)
Able to send and receive messages without difficulty	343 (20.7)	27 (7.9)	-	318 (92.7)
Computer				
Unable to use	1.211 (73.2)	440 (36.3)	-	-
Able to use with difficulty	82 (5.0)	17 (20.7)	25 (30.5)	-
Able to use without difficulty	362 (21.9)	34 (9.4)	318 (87.8)	-
Age group				
60 to 69 years old	846 (51.1)	165 (19.5)	252 (29.8)	269 (31.8)
70 to 79 years old	596 (36.0)	192 (32.2)	78 (13.1)	80 (13.4)
80 years old or above	214 (12.9)	134 (62.6)	13 (6.1)	13 (6.1)
Sex				
Male	598 (36.1)	138 (23.1)	162 (27.1)	174 (29.1)
Female	1.058 (63.9)	353 (33.4)	181 (17.1)	188 (17.8)
Marital status				
Married/with partner	974 (58.8)	257 (26.4)	227 (23.3)	245 (25.2)
Single	95 (5.7)	22 (23.2)	26 (27.4)	29 (30.5)
Divorced/separated	130 (7.9)	24 (18.5)	40 (30.8)	40 (30.8)
Widow(er)	457 (27.6)	188 (41.1)	50 (10.9)	48 (10.5)

Table 1 - Prevalence of moderate/severe functional dependence, of ability to use the computer, and of ability to exchange online messages, according to demographic, socioeconomic and health factors in older adults (60 +). Florianópolis, Santa Catarina, Brazil, 2009-2010 (n = 1,656). (continuation)

Tabela 1 – *Prevalência de dependência funcional moderada/grave, de capacidade de uso de computador, e de capacidade de troca de mensagens pela Internet, segundo fatores demográficos, socioeconômicos e de saúde em idosos (60 +). Florianópolis, Santa Catarina, Brasil, 2009-2010 (n = 1.656). (continuação)*

Variable	n (%)	Prevalence of moderate/ severe functional dependence	Prevalence of exchange of online messages without difficulty	Prevalence of computer use without difficulty
		n (%)	n (%)	n (%)
Self-reported race				
White	1.410 (85.3)	406 (28.8)	310 (22.0)	324 (23.0)
Brown	131 (7.9)	52 (39.7)	17 (13.0)	18 (13.7)
African descendent or black	84 (5.1)	25 (29.8)	12 (14.3)	16 (19.0)
Yellow	12 (0.7)	4 (33.3)	1 (8.3)	1 (8.3)
Indigenous	16 (1.0)	4 (25.0)	2 (12.5)	2 (12.5)
Schooling (years of formal education)				
12 years or more	386 (23.4)	51 (13.2)	224 (58.0)	226 (58.5)
9 to 11	231 (14.0)	64 (27.7)	63 (27.3)	74 (32.0)
5 to 8	315 (19.1)	87 (27.6)	39 (12.4)	42 (13.3)
0 to 4	716 (43.4)	285 (39.8)	16 (2.2)	19 (2.7)
Paid work				
No	1.429 (86.3)	460 (32.2)	256 (17.9)	271 (19.0)
Yes	227 (13.7)	31 (13.7)	87 (38.3)	91 (40.1)
Household earnings per capita (quartile)				
1st	414 (25.0)	137 (33.1)	41 (9.9)	45 (10.9)
2nd	418 (25.2)	168 (40.2)	41 (9.8)	47 (11.2)
3rd	414 (25.0)	104 (25.1)	84 (20.3)	92 (22.2)
4th	410 (24.8)	82 (20.0)	177 (43.2)	178 (43.4)
Cognitive impairment				
No	877 (53.2)	202 (23.0)	205 (23.4)	214 (24.4)
Yes	771 (46.8)	285 (37.0)	137 (17.8)	147 (19.1)
Depression				
No	1.227 (76.1)	250 (20.4)	312 (25.4)	321 (26.2)
Yes	386 (23.9)	225 (58.3)	26 (6.7)	34 (8.8)
Health insurance				
No	597 (36.1)	192 (32.2)	60 (10.1)	69 (11.6)
Yes	1.059 (63.9)	299 (28.2)	283 (26.7)	293 (27.7)
Visit to the doctor in the last 3 months				
No	473 (28.6)	107 (22.6)	111 (23.5)	114 (24.1)
Yes	1.183 (71.4)	384 (32.5)	232 (19.6)	248 (21.0)
Hospitalization in the last 6 months				
No	1.526 (92.1)	446 (29.2)	321 (21.0)	337 (22.1)
Yes	130 (7.9)	45 (34.6)	22 (16.9)	25 (19.2)
Self-rated health				
Very good/good	848 (51.2)	111 (13.1)	261 (30.8)	267 (31.5)
Fair	642 (38.8)	261 (40.7)	79 (12.3)	87 (13.6)
Poor/very poor	165 (10.0)	118 (71.5)	3 (1.8)	8 (4.8)

Table 2 - Prevalence of moderate/severe functional dependence, of ability to use the computer, and of ability to exchange online messages, according to chronic diseases, and behavioral and social factors in older adults (60 +). Florianópolis, Santa Catarina, Brazil, 2009-2010 (n = 1,656).

Tabela 2 – *Prevalência de dependência funcional moderada/grave, de capacidade de uso de computador, e de capacidade de troca de mensagens pela Internet, segundo doenças crônicas e fatores comportamentais e sociais em idosos (60 +). Florianópolis, Santa Catarina, Brasil, 2009-2010 (n = 1.656).*

Variable	n (%)	Prevalence of moderate/ severe functional dependence	Prevalence of exchange of online messages without difficulty	Prevalence of computer use without difficulty
		n (%)	n (%)	n (%)
Spinal conditions or diseases				
No	826 (49.9)	180 (21.8)	197 (23.8)	205 (24.8)
Yes	829 (50.1)	311 (37.5)	145 (17.5)	156 (18.8)
Arthritis/rheumatism				
No	1.089 (66.0)	253 (23.2)	255 (23.4)	271 (24.9)
Yes	562 (34.0)	236 (42.0)	88 (15.7)	91 (16.2)
Diabetes				
No	1.290 (77.9)	333 (25.8)	289 (22.4)	302 (23.4)
Yes	366 (22.1)	158 (43.2)	54 (14.8)	60 (16.4)
Bronchitis or asthma				
No	1.401 (84.6)	388 (27.7)	303 (21.6)	313 (22.3)
Yes	255 (15.4)	103 (40.4)	40 (15.7)	49 (19.2)
Hypertension				
No	683 (41.2)	142 (20.8)	182 (26.6)	186 (27.2)
Yes	973 (58.8)	349 (35.9)	161 (16.5)	176 (18.1)
Cardiovascular disease other than hypertension				
No	1.200 (72.5)	283 (23.6)	270 (22.5)	281 (23.4)
Yes	456 (27.5)	208 (45.6)	73 (16.0)	81 (17.8)
Tendinitis or tenosynovitis				
No	1.420 (86.1)	410 (28.9)	275 (19.4)	292 (20.6)
Yes	229 (13.9)	78 (34.1)	68 (29.7)	70 (30.6)
Stroke				
No	1.527 (92.2)	415 (27.2)	331 (21.7)	347 (22.7)
Yes	129 (7.8)	76 (58.9)	12 (9.3)	15 (11.6)
Stomach or duodenal ulcer				
No	1.455 (87.9)	411 (28.2)	302 (20.8)	313 (21.5)
Yes	201 (12.1)	80 (39.8)	41 (20.4)	49 (24.4)
Physical activity				
Inactive	1.165 (70.4)	406 (34.8)	189 (16.2)	208 (17.9)
Active	491 (29.6)	85 (17.3)	154 (31.4)	154 (31.4)
Alcohol				
< Once a month/does not drink	1.060 (64.1)	384 (36.2)	129 (12.2)	138 (13.0)
≥ Once a month	594 (35.9)	106 (17.8)	214 (36.0)	224 (37.7)
Cigarettes				
Never smoked	1.004 (60.6)	304 (30.3)	192 (19.1)	205 (20.4)
Ex-smoker	511 (30.9)	155 (30.3)	121 (23.7)	124 (24.3)
Smokes	141 (8.5)	32 (22.7)	30 (21.3)	33 (23.4)
Socializing or religious group				
Did not participate in the last year	941 (56.8)	299 (31.8)	196 (20.8)	211 (22.4)
Participated in the last year	715 (43.2)	192 (26.9)	147 (20.6)	151 (21.1)
Contact with friends				
Infrequent	280 (17.0)	121 (43.2)	44 (15.7)	49 (17.5)
Frequent	1.369 (83.0)	368 (26.9)	299 (21.8)	313 (22.9)
Contact with relatives				
Infrequent	185 (11.2)	58 (31.4)	35 (18.9)	34 (18.4)
Frequent	1.468 (88.8)	431 (29.4)	308 (21.0)	328 (22.3)

Table 3 - Crude prevalence ratios (PR) and confidence intervals (95%CI) for moderate/severe functional dependence, according to demographic, socioeconomic and health factors in older adults (60 +). Florianópolis, Santa Catarina, Brazil, 2009-2010 (n = 1,656).

Tabela 3 - *Razões de prevalência brutas (RP) e intervalos de confiança (IC95%) para dependência funcional moderada/grave, segundo fatores demográficos, socioeconômicos e de saúde em idosos (60 +). Florianópolis, Santa Catarina, Brasil, 2009-2010 (n = 1.656).*

Variable	PR	95%CI	p-value*
Exchange of online messages			
Able to send and receive messages with difficulty/unable	1.00	-	-
Able to send and receive messages without difficulty	0.26	0.17-0.38	< 0.001
Computer			
Able to use with difficulty/unable	1.00	-	-
Able to use without difficulty	0.28	0.19-0.41	< 0.001
Age group			
60 to 69 years old	1.00	-	-
70 to 79 years old	1.66	1.28-2.17	< 0.001
80 years old or above	3.09	2.36-4.04	< 0.001
Sex			
Male	1.00	-	-
Female	1.47	1.19-1.81	< 0.001
Marital status			
Married/with partner	1.00	-	-
Single	1.02	0.70-1.51	0.899
Divorced/separated	0.68	0.43-1.08	0.102
Widow(er)	1.65	1.39-1.96	< 0.001
Self-reported race			
White	1.00	-	-
Brown	1.26	0.96-1.66	0.091
African descendent or black	1.10	0.72-1.69	0.649
Yellow	0.97	0.44-2.15	0.950
Indigenous	0.75	0.27-2.06	0.571
Schooling (years of formal education)			
12 years or more	1.00	-	-
9 to 11	2.19	1.46-3.27	< 0.001
5 to 8	2.01	1.43-2.85	< 0.001
0 to 4	3.05	2.18-4.27	< 0.001
Paid work			
No	1.00	-	-
Yes	0.42	0.30-0.59	< 0.001
Household earnings per capita (quartile)			
1st	1.00	-	-
2nd	1.34	1.09-1.64	0.006
3rd	0.80	0.64-1.00	0.052
4th	0.64	0.49-0.84	0.002

Table 3 - Crude prevalence ratios (PR) and confidence intervals (95%CI) for moderate/severe functional dependence, according to demographic, socioeconomic and health factors in older adults (60 +). Florianópolis, Santa Catarina, Brazil, 2009-2010 (n = 1,656). (continuation)

Tabela 3 – *Razões de prevalência brutas (RP) e intervalos de confiança (IC95%) para dependência funcional moderada/grave, segundo fatores demográficos, socioeconômicos e de saúde em idosos (60 +). Florianópolis, Santa Catarina, Brasil, 2009-2010 (n = 1.656). (continuação)*

Variable	PR	95%CI	p-value*
Cognitive impairment			
No	1.00	-	-
Yes	1.58	1.33-1.87	< 0.001
Depression			
No	1.00	-	-
Yes	3.01	2.63-3.45	< 0.001
Health insurance			
No	1.00	-	-
Yes	0.83	0.70-0.99	0.041
Visit to the doctor in the last 3 months			
No	1.00	-	-
Yes	1.48	1.24-1.78	< 0.001
Hospitalization in the last 6 months			
No	1.00	-	-
Yes	1.59	1.26-2.00	< 0.001
Self-rated health			
Very good/good	1.00	-	-
Fair	3.51	2.75-4.49	< 0.001
Poor/very poor	6.19	4.91-7.79	< 0.001

* p-valor obtido pelo teste de Wald da regressão de Poisson. / *p-value obtained by the Wald test of Poisson regression.*

Discussion

The present work displayed a significant association between sending and receiving online messages without difficulty using a computer and lower prevalence of moderate/severe functional dependence in crude analysis, and this association was maintained after adjustments for the selected control variables. It is not possible, though, to infer this association to be causal due to the cross-section design of the study.

Several factors conventionally associated with functional dependence, in Brazilian and foreign studies,[5, 7, 8] were also significantly associated with moderate/severe functional dependence in crude and/or multivariable analysis in the present work. That proves the consistency between data in the present work and literature; and reinforces the association between the independent variable and the outcome in relation to confounding factors.

A hypothesis for the association found between ability to exchange online messages and functional independence in older adults in this study is that the exchange of online messages carries a protective effect on functional independence. Another possible and opposed hypothesis is that older adults with higher functional independence – and, therefore, enjoying a better socioeconomic and cultural level – have easier access and broader interest in exchanging online messages. A third hypothesis is that the exchange of online messages and the

Table 4 - Crude prevalence ratios (PR) and confidence intervals (95%CI) for moderate/severe functional dependence, according to chronic diseases, and to behavioral and social factors in older adults (60 +). Florianópolis, Santa Catarina, Brazil, 2009-2010 (n = 1,656).

Tabela 4 - *Razões de prevalência (RP) brutas e respectivos intervalos de confiança (IC95%) para dependência funcional moderada/grave, segundo doenças crônicas e fatores comportamentais e sociais em idosos (60 +). Florianópolis, Santa Catarina, Brasil, 2009-2010 (n = 1.656).*

Variável	RP	IC95%	p-valor*
Spinal conditions or diseases			
No	1.00	-	-
Yes	1.75	1.45-2.11	< 0.001
Arthritis/rheumatism			
No	1.00	-	-
Yes	1.87	1.57-2.22	< 0.001
Diabetes			
No	1.00	-	-
Yes	1.80	1.54-2.12	< 0.001
Bronchitis or asthma			
No	1.00	-	-
Yes	1.54	1.26-1.89	< 0.001
Hypertension			
No	1.00	-	-
Yes	1.85	1.63-2.11	< 0.001
Cardiovascular disease other than hypertension			
No	1.00	-	-
Yes	2.13	1.73-2.63	< 0.001
Tendinitis or tenosynovitis			
No	1.00	-	-
Yes	1.22	0.93-1.59	0.148
Stroke			
No	1.00	-	-
Yes	2.26	1.92-2.66	< 0.001
Stomach or duodenal ulcer			
No	1.00	-	-
Yes	1.32	1.05-1.64	0.016
Physical activity			
Inactive	1.00	-	-
Active	0.48	0.35-0.66	< 0.001
Alcohol			
< Once a month/does not drink	1.00	-	-
≥ Once a month	0.51	0.40-0.65	< 0.001
Cigarettes			
Never smoked	1.00	-	-
Ex-smoker	1.00	0.81-1.24	0.979
Smokes	0.78	0.51-1.19	0.248

Table 4 - Crude prevalence ratios (PR) and confidence intervals (95%CI) for moderate/severe functional dependence, according to chronic diseases, and to behavioral and social factors in older adults (60 +). Florianópolis, Santa Catarina, Brazil, 2009-2010 (n = 1,656). (continuation)

Tabela 4 - *Razões de prevalência (RP) brutas e respectivos intervalos de confiança (IC95%) para dependência funcional moderada/grave, segundo doenças crônicas e fatores comportamentais e sociais em idosos (60 +). Florianópolis, Santa Catarina, Brasil, 2009-2010 (n = 1.656). (continuação)*

Variável	RP	IC95%	p-valor*
Socializing or religious group			
Did not participate in the last year	1.00	-	-
Participated in the last year	0.86	0.69-1.06	0.161
Contact with friends			
Infrequent	1.00	-	-
Frequent	0.62	0.51-0.74	< 0.001
Contact with relatives			
Infrequent	1.00	-	-
Frequent	0.94	0.71-1.26	0.697

p-value obtained by the Wald test of Poisson regression / ** p-valor obtido pelo teste de Wald da regressão de Poisson.*

Table 5 - Adjusted prevalence ratios (PR) and confidence intervals (95%CI) for moderate/severe functional dependence in older adults (60 +). Florianópolis, Santa Catarina, Brazil, 2009-2010 (n = 1,656).

Tabela 5 - *Razões de prevalência (RP) ajustadas e intervalos de confiança (IC95%) para dependência funcional moderada/grave em idosos (60 +). Florianópolis, Santa Catarina, Brasil, 2009-2010 (n = 1.656).*

Variable	PR	95%CI	p-value*
Exchange of online messages			
Able to send and receive messages with difficulty/unable	1.00	-	-
Able to send and receive messages without difficulty	0.61	0.40-0.94	0.025
Age group			
60 to 69 years old	1.00	-	-
70 to 79 years old	1.22	0.98-1.52	0.067
80 years old or above	2.03	1.66-2.48	< 0.001
Sex			
Male	1.00	-	-
Female	1.08	0.89-1.31	0.429
Schooling (years of formal education)			
12 years or more	1.00	-	-
9 to 11	1.28	0.96-1.72	0.091
5 to 8	1.04	0.76-1.43	0.804
0 to 4	1.29	0.94-1.77	0.112
Cognitive impairment			
No	1.00	-	-
Yes	1.15	0.97-1.35	0.098
Depression			
No	1.00	-	-
Yes	1.50	1.27-1.76	< 0.001

Table 5 - Adjusted prevalence ratios (PR) and confidence intervals (95%CI) for moderate/severe functional dependence in older adults (60 +). Florianópolis, Santa Catarina, Brazil, 2009-2010 (n = 1,656). (continuation)
Tabela 5 - *Razões de prevalência (RP) ajustadas e intervalos de confiança (IC95%) para dependência funcional moderada/grave em idosos (60 +). Florianópolis, Santa Catarina, Brasil, 2009-2010 (n = 1.656). (continuação)*

Variable	PR	95%CI	p-value*
Self-rated health			
Very good/good	1.00	-	-
Fair	2.29	1.76-2.99	< 0.001
Poor/very poor	2.36	1.82-3.07	< 0.001
Spinal conditions or diseases			
No	1.00	-	-
Yes	1.27	1.08-1.48	0.003
Arthritis/rheumatism			
No	1.00	-	-
Yes	1.23	1.07-1.41	0.004
Diabetes			
No	1.00	-	-
Yes	1.19	1.04-1.35	0.009
Cardiovascular disease other than hypertension			
No	1.00	-	-
Yes	1.36	1.15-1.60	< 0.001
Stroke			
No	1.00	-	-
Yes	1.35	1.14-1.60	0.001
Physical activity			
Inactive	1.00	-	-
Active	0.76	0.58-0.99	0.047

* p-value obtained by the Wald test of Poisson regression / ** p-valor obtido pelo teste de Wald da regressão de Poisson.*

functional independence share an additive bidirectional association.

A study that supports the first hypothesis reported that the use of e-mail – the most used medium of communication by Brazilian older adults on the internet[9] – can bring greater social well-being and comfort to older adults. Sayago & Blat[20] conducted an ethnographic study about the use of e-mail with 388 Spanish older adults, and found the following benefits: closer interaction with friends and relatives; feeling of digital inclusion and broader integration into the modern society; feeling of accomplishment and higher self-esteem; and reinforcement of the traditional methods of communication.

Moreover, in a study with 42 people – 61-year-olds in average – Xavier et al[21] have concluded that training workshops on internet practices can stimulate continuous cooperation and solidarity among participants; help to build up self-esteem; and generate new perspectives of digital inclusion focused on "cooperative, synchronous and evolutionary groups", rather than on technology centered on isolated users. There was a strong tendency to relate the creation of an e-mail account and the perception of a new identity in the sense of citizenship: the machine (new tool) is now "accepting" an individual before digitally excluded and rejected.

Considering that the exchange of online messages has a direct response on older

adult's social well-being, the possibility that it can be a factor associated to functional independence is justified by the relationship, largely reported in literature, between social well-being and maintenance of functional independence in old age.[8] Furthermore, social well-being is closely associated with maintenance of cognitive capacity,[22] which, in turn, is closely associated with functional independence.[23]

The learning of computer and internet abilities by the elderly has the potential to both strengthen social ties and assist in maintaining the cognitive capacity[24]. This maintenance, as already mentioned, is clearly associated to functional independence in literature. Xavier et al[24] conducted a study with 173 Brazilians with a mean age of 70.1 years (±10.05), and verified that 71 participants who had undergone computer and internet training workshops obtained a statistically significant increase in the Mini Mental State Examination, in comparison to the 102 participants in the control group.

On the other hand, the hypothesis that the maintenance of a good functional independence leads to a greater ability in the exchange of online messages also finds validation in literature. Several factors related to higher prevalence of functional independence are also associated with higher prevalence of computer use – such as being younger, being married, having a higher educational level, better financial conditions, good cognitive capacity, and low morbidity.[25] Furthermore, older adults enjoying a better social well-being could have higher cognitive capacity or interest to use the internet as a means of communication. For example, a study[26] displayed that older adults with higher social connectivity and support, as well as positive attitudes concerning ageing, had a lower dropout rate in a internet training program. According to this line of thought, social support and well-being may have acted as confounders in the association reported in the present work, where the social support was represented by the variables contact with friends, contact with relatives and participation in socializing or religious groups. Among them, only the variable contact with friends presented a significant association with functional independence – repeating the results found in a Brazilian longitudinal study about the association between functional independence and contact with friends and relatives.[7] However, even if the variable contact with friends had obtained criteria to remain in the multivariable analysis of the present study, the possibility of occurrence of this confounding factor would be residual, since this variable falls short in measuring all the social support of the elderly.

Only one study that researched the use of computers or the internet in relation with functional dependence was found in literature. McConatha & McConatha[27] conducted a longitudinal study with 29 institutionalized North Americans over 50 years of age – 26 of them were over 70. After the training period in (and support to) use of computers and the internet – including the use of e-mail –, the functional dependence score of participants, according to the Katz scale, decreased in comparison to the control group. The comparison of the abovementioned study with the present study is threatened due to the different methods employed. Nevertheless, results from both studies corroborate the notion that there is a positive association between functional independence with the use of computers and the internet and with the exchange of online messages.

The frequency of exchange of online messages and of computer use was not surveyed in the present study. Due to this limitation, if an older adult used the computer or engaged in the exchange of online messages less frequently, the self-reported ability may not have reflected the real ability at the time of the interview. Notwithstanding that, 93% of Brazilian internet users of 60+ years of age accessed the internet at least once a month, in 2009, and 98%, in 2010.[9, 10] Assuming that such frequency is similar to the frequency of access to the internet by the older adults of the present study – whose

data collection was performed from 2009 to 2010 –, and also considering that 78% of Brazilian older internet users used it as a means of communication, in 2009, and 91%, in 2010,[9, 10] it is improbable that this factor has introduced bias on the study. Future research may also come to investigate a possible dose-response relationship between frequency of exchange of online messages and functional dependence.

The means of communication used by the older adults to exchange online messages were not listed – if by e-mail, social networking sites, instant messages, or voice messages –, but only the ability to send and receive messages by any of these means using a computer. Future studies could be based on an integrated approach to investigate the relationship between functional dependence, the different means of communication available for the exchange of online messages, and other means of communication – including the exchange of online messages through electronic devices other than computers. Besides, the way that the exchange of online messages or the use of computers alone affects functional independence should be better explained in future studies.

Computer use is an instrumental activity of daily living, such as shopping for groceries, using public or private transportation, and managing finances. These functions are also classified as executive functions. The International Neuropsychological Society dictionary[28] defines executive functions as the fundamental cognitive abilities required to perform complex goal-directed behaviors, including the capacity to adapt to a range of environmental changes and demands. In a neuropsychological assessment, executive functions are a translation of a broad variety of cognitive functions such as attention, concentration, stimulus selection, abstract thinking, planning, cognitive flexibility, self-control and operational memory.[29]

An adequate social functioning depends on the integrity of executive functions,[30] and a decline in executive functions has early association with functional dependence.[31] The exchange of online messages, therefore, demands an adequate social and executive functioning. The association between such activity and functional independence observed in the present work alights to the possibility that monitoring the functionality of the exchange of online messages could be a marker of functional capacity of digitally included older adults. Further longitudinal studies might also investigate the functionality of the exchange of online messages not only as a marker of functional capacity, but also of depression, in the psychosocial dimension, and of mild cognitive impairment, in the cognitive/executive dimension. This functionality monitoring could be done verbally and periodically by health professionals, or with the use of computer systems provided with artificial intelligence using pattern recognition. With the perspective of an ever-growing digitally included society,[9, 10] health planning policies for older people – maybe not so far ahead in time – could benefit from automated monitoring as a simple and low cost way of assess – in a integrative, simultaneous and broad ranged manner – the functional, social and cognitive dimensions of many older adults.

The lower prevalence of functional dependence among older adults that exchange online messages, observed in this work, might be justified by a possible protective effect of online communication on functional independence. Moreover, researches support that internet and computer learning may have beneficial effects on cognitive capacity, a distinctive predictor of functional loss. The contrary hypothesis is also plausible – older adults who are more functionally independent may get more interested in the internet and have more access to it. These two hypotheses are not mutually exclusive. We believe that those who are more functionally independent are more prone to exchange online messages; and that this activity, in turn, exerts a beneficial effect on cognitive capacity and social well-being. In fact, it is well established in literature that the maintenance of cognitive

capacity and of social well-being in old age provides the maintenance of functional independence. Therefore, the exchange of online messages might promote greater functional independence, and the functional independence might promote the exchange of online messages – a bidirectional, additive and synergistic feedback. The mechanisms involved in the association found in the present work deserve further longitudinal studies. Such studies are essential to support digital inclusion policies for older adults – badly digitally excluded in Brazil – and to identify the profile of older people who would benefit the most from this inclusion.

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Errata
Correction

Inclusão digital e capacidade funcional de idosos residentes em Florianópolis, Santa Catarina, Brasil (EpiFloripa 2009-2010)

Digital inclusion and functional capacity of older adults living in Florianópolis, Santa Catarina, Brazil (EpiFloripa 2009-2010)

Volume 15, number 1, march/2012, Page 107:

Where it reads:

- **difficulty in performing basic**

Replace by:

- **difficulty to perform basic**