Original article

The digital divide among caregivers of pediatric patients aged 0 to 12 years. Design and validation of a questionnaire

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ABSTRACT

Introduction. Health care strategies based on information and communication technologies (ICTs) may perpetuate health inequity, especially among vulnerable populations. In our setting, there are few validated tools to assess access to ICTs in pediatrics.

Objectives. To develop and validate a questionnaire to assess ICT access among caregivers of pediatric patients. To describe the characteristics of ICT access and assess whether there is a correlation among the three levels of the digital divide.

Population and methods. We developed and validated a questionnaire and then administered it to the caregivers of children aged 0–12 years. The outcome variables were the questions in the three levels of the digital divide. We also assessed sociodemographic variables.

Results. We administered the questionnaire to 344 caregivers. Among them, 93% had their own cell phone and 98.3% had Internet access via a data network; 99.1% communicated via WhatsApp messages; 28% had had a teleconsultation. The correlation among the questions was null or low.

Conclusion. The validated questionnaire allowed us to establish that the caregivers of pediatric patients aged 0–12 years mostly own a mobile phone, access the Internet via a data network, communicate mainly through WhatsApp, and obtain few benefits through ICTs. The correlation among the different components of ICT access was low.

Keywords: information technology; digital health; digital inclusion; pediatrics.

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INTRODUCTION

Information and communication technologies (ICTs) are tools used to improve access to health care; however, they may perpetuate health inequity.[1] The unequal distribution of access to ICTs among different social groups is called the digital divide.[2] The first level of the digital divide refers to access to technology; the second level, to digital use and skills; and the third level corresponds to the benefits and results that people obtain from the use of ICTs to improve their opportunities.[3]

The digital divide cuts across people's lives and limits the capacity of ICTs to have a positive impact on their quality of life. According to the digital inequality model proposed by van Deursen,[4] a lack of digital skills causes a limitation on the tasks performed online and this results in fewer offline opportunities for individuals. For this reason, the current trend is to analyze the levels of the digital divide with special emphasis on the third dimension. This analysis involves the search for methodologically valid tools that can measure the interrelationship between people and ICTs.[5] There are currently no validated tools to assess the characteristics of access to ICTs for health care among pediatric patients or their caregivers. Reported studies were conducted in other populations[5] or do not focus on health.[4]

ICT-based health care strategies are becoming increasingly common.[6] As previously mentioned, the use of ICTs as a strategy for access to health care could enhance existing social inequalities.[7–9] The lack of access to the Internet, a low income, older age, female sex, a low educational level, ethnic minority, and rural area of residence have been shown to be determinants of access to ICTs.[10–12] This information has gained relevance now because the COVID-19 pandemic has triggered and given a new boost to a large number of ICT-based health care strategies.[13–15]

Taking into account the inevitable progression of the digital revolution[16] and the absence of reliable tools, we set out to develop and validate a questionnaire to assess ICT access among caregivers of pediatric patients aged 0–12 years, describe the characteristics of access to ICTs using the validated questionnaire, and assess whether there is a correlation among the components of the three levels of the digital divide.

POPULATION AND METHODS

This study was conducted at Hospital General de Niños Pedro de Elizalde (HGNPE) between October 1st, 2021 and September 30th, 2022. The caregivers of patients aged 0–12 years who attended the hospital as companions of pediatric patients in any type of outpatient visit were included. Patients' caregivers were asked to give their informed consent for participation in the study. The protocol was approved by the Research Ethics Committee of HGNPE (registry no. 5289).

The study was divided into 2 stages; *Figure 1* describes the study procedure.

STAGE 1: Questionnaire development and validation

Through a review of the bibliography available in PubMed, MEDLINE, The Cochrane Library, SCOPUS, Google Scholar, LILACS, and Web of Science, variables were defined and the questions for the first version of the questionnaire were developed. A qualitative review of the first version of the questionnaire was conducted by 4 experts (1 expert in methodology and 3 subject matter experts) to assess content validity. A pilot test was then carried out to assess the comprehension of the questionnaire using open-ended questions. Reliability was assessed by means of a test-retest 1 week apart, and the kappa coefficient was estimated for answers as a measure of agreement.[17] Finally, questions with a kappa coefficient of less than 0.6518 were removed and those with an agreement percentage of 100% were included. The development and validation of the questionnaire are described in the *Supplementary material*.

STAGE 2: Characteristics of access and correlation among the levels of the digital divide

The questions included in the final version of the validated questionnaire—available in the supplementary material—were used as the main study variables to describe the characteristics of access to ICTs. In addition, the sociodemographic characteristics of the caregivers were assessed using the variables from the Permanent Survey of Households:[19] biological sex, caregiver's age, patient's age, place of residence in the City of Buenos Aires, caregiver's level of education, exclusive public health insurance, critical overcrowding (more than 3 persons per room), and head of household with formal employment.

To estimate the sample size, the expected prevalence of the variable "Access to fixed broadband at home" was used because it accounts for a fundamental variable for access to

Figure 1. *Study procedure*
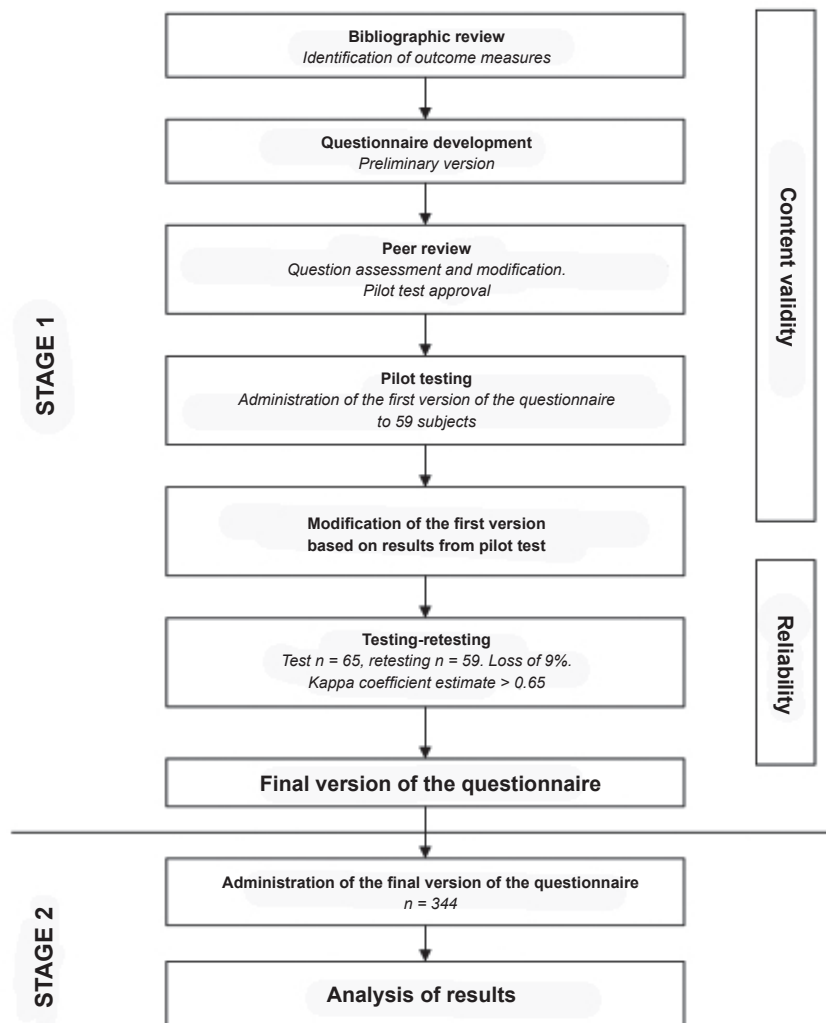
ICTs.[20] Expecting a prevalence of 68% (21) ± 5% and a confidence level of 95%, the sample size was estimated at 344 subjects. Quota sampling was used to prevent potential biases due to day and time of attendance.

Categorical variables were described with their absolute and relative frequencies as percentages and their corresponding 95% confidence intervals, while quantitative variables were expressed as mean and standard deviation or as median and range, depending on the observed distribution. Pearson's coefficient was used to assess the correlation among the different levels of digital divide. A value of $p < 0.05$ was considered significant in all cases. Microsoft Access® was used for database management and STATA MP 16 was used for statistical purposes.

RESULTS

The questionnaire was completed by 344 subjects. No subject refused to participate in the study. Among caregivers, 90.4% were females, 44.2% had completed secondary education, 20.9% lived in the City of Buenos Aires, 30.2% lived in critical overcrowding conditions, and 79.6% had exclusive public health insurance (*Table 1*).

Regarding the first level of the digital divide, 93% had their own cell phone and 98.3% used the Internet via a data network. Regarding the second level of the digital divide, 99.1% communicated via WhatsApp messages. In relation to the third level of the digital divide, 21.1% of caregivers received prescriptions via e-mail or WhatsApp, and 41.6% received lab test results (*Table 2*).

Table 3 describes the correlation matrix among the questions for all the levels of the digital divide. The correlation was generally null or low among them. In particular, Internet access via a WiFi network showed a positive correlation to the questions of the third digital divide, while Internet access via a data network did not show a positive correlation to any of the components of the third digital divide. In addition, a positive correlation was observed between using e-mail and the

TABLE 1. Sociodemographic characteristics (n = 344)

Caregiver's sex	
Female	311 (90.4%, 86.8–93.1)
Male	33 (9.6%, 6.9–13.2)
Caregiver's age in years	31.4 (26.5–36.6)
Patient's age in years	3.9 (2.0–6.7)
Place of residence in CABA	72 (20.9%, 16.9–25.5)
Caregiver's level of education	
No education	1 (0.3%, 0.1–1.6)
Incomplete primary education	16 (4.7%, 2.9–7.4)
Complete primary education	56 (16.3%, 12.8–20.6)
Incomplete secondary education	103 (29.9%, 25.4–34.9)
Complete secondary education	152 (44.2%, 39.0–49.5)
Complete tertiary education or higher	16 (4.7%, 2.9–7.4)
Exclusive public health insurance	275 (79.9%, 75.4–83.8)
Critical overcrowding	104 (30.2%, 25.6–35.3)
Head of household with formal employment	121 (35.2%, 30.3–40.4)

CABA: City of Buenos Aires.
For categorical variables, absolute and relative frequencies are described as percentages with their corresponding 95% confidence intervals. For continuous variables, median and interquartile range were used, based on their observed distribution.

TABLE 2. Questionnaire results (n = 344)

1. Do you have a desktop computer or laptop at home?	113 (32.9%, 28.1–37.9)
2. Do you have a functioning tablet?	63 (18.3%, 14.5–22.7)
3. Do you have your own mobile phone?	320 (93.0%, 89.8–95.3)
4. Do you have Internet access at home?	277 (80.5%, 76.0–84.4)
5. Do you have Internet access with your own WiFi network at home?	216 (62.8%, 57.6–67.7)
6. Do you have Internet access via a data network?	338 (98.3%, 96.2–99.2)
7. Have you sent or received e-mails in the past 15 days?	280 (81.4%, 76.9–85.1)
8. Have you used social media (Facebook, Instagram, TikTok, or Twitter) in the past 15 days?	306 (88.9%, 85.2–91.9)
9. Have you used messaging services (Facebook Messenger, WhatsApp) to communicate in the past 15 days?	341 (99.1%, 97.4–99.7)
10. Did you manage, without the help of other people, to create an e-mail account by following the online instructions?	209 (60.8%, 55.5–65.8)
11. Did you manage, without the help of others, to create long or complex passwords on your Internet accounts by following the online instructions?	211 (61.3%, 56.1–66.3)
12. Did you manage, without the help of others, to install or uninstall software or apps in your computer or mobile phone by following the online instructions?	213 (61.9%, 56.7–66.9)
13. Have you ever consulted about any medication?	193 (56.1%, 50.8–61.2)
14. Have you ever had a telephone or video call consultation with a health care provider?	98 (28.5%, 23.9–33.5)
15. Have you ever made an appointment for a medical consultation through a web site?	105 (30.5%, 25.9–35.6)
16. Have you ever received prescriptions via e-mail/WhatsApp?	75 (21.2%, 17.8–26.5)
17. Have you ever received lab test results via e-mail/WhatsApp?	143 (41.6%, 36.5–46.8)

Absolute and relative frequencies are described as percentages with their corresponding 95% confidence intervals.

questions related to the second and third levels of the digital divide. In contrast, the use of social media or messaging services did not correlate to any other question.

DISCUSSION

In this study, a questionnaire was developed to assess access to ICTs for health care among the caregivers of pediatric patients aged 0–12 years using a robust methodology that ensures its validity and reliability. Despite the bibliographic review, no reports were identified of validated questionnaires in Spanish that included the 3 levels of the digital divide in relation to health care in the study population. Most of the existing studies were published in developed countries,[4,5] where the questionnaires assess the levels of the digital divide separately[22,23] and using different approaches to understanding the resulting health benefit.[24] The strength of this questionnaire is that it assesses the 3 levels of the digital divide in health care and provides a broad view of access to ICTs.

The population of this study was mostly female, with a median age of 31 years and a low level of education who lived outside the City of Buenos Aires, had exclusive public health insurance, and in whom significant levels of informal employment and critical overcrowding were observed. Many of these characteristics are markers of social vulnerability and function as barriers in access to ICTs. Reddick et al., described the difficulties in access among older people living in less urbanized areas;[10] Delfino et al., provided details of the digital divide by gender;[12] Ogbo et al., described the negative effect of a low socioeconomic level in a developing country;[24] and Scheerder et al., referred to the correlation between a low level of education and ICT skills.[25] No studies were found in the bibliography that analyzed access to ICTs in relation to health coverage and, therefore, this aspect cannot be compared with the results of our study.

Regarding the first level of the digital divide, we observed that a high percentage of caregivers had a mobile phone and a low rate of access to computers and tablets, similar to what was reported in Argentina, where 88/100 people

TABLE 3. Correlation matrix (n = 344)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Computer	1																
2. Tablet	0.10	1															
3. Mobile phone	0.09	0.04	1														
4. Internet access	0.25*	0.15*	0.18*	1													
5. WiFi network	0.29*	0.17*	0.19*	0.64*	1												
6. Data network	0.04	0.06	0.31*	0.21*	0.12*	1											
7. E-mail	0.11*	0.11*	0.22*	0.22*	0.15*	0.16*											
8. Social media	0.06	0.02	0.08	0.08	0.07	0.09	0.28*	1									
9. Messaging service	-0.06	0.04	0.09	0.03	0.05	-0.01	0.11*	0.17*	1								
10. Creating an e-mail account	0.11*	0.08	0.10*	0.13*	0.16*	0.12*	0.33*	0.21*	0.5	1							
11. Creating passwords	0.11*	0.08	0.11*	0.13*	0.15*	0.12*	0.34*	0.22*	0.5	0.99*	1						
12. Installing/uninstalling software	0.10	0.07	0.11*	0.14*	0.15*	0.12*	0.33*	0.22*	0.5	0.98*	0.99*	1					
13. Medications	0.12*	0.03	0.07	0.11*	0.19*	0.01	0.19*	0.14*	0.04	0.21*	0.20*	0.21*	1				
14. Teleconsultation	0.11*	0.15*	0.05	0.16	0.15*	0.03	0.12*	0.02	0.05	0.06	0.06	0.05	0.10	1			
15. Appointments	0.11*	0.18*	0.08	0.18*	0.14*	0.04	0.24*	0.07	-0.00	0.18*	0.18*	0.18*	0.16*	0.28*	1		
16. Prescriptions	0.16*	0.19*	0.08	0.14*	0.20*	0.07	0.16*	0.09	0.05	0.11*	0.12*	0.11*	0.08	0.28*	0.29*	1	
17. Lab test results	0.05	0.18*	-0.00	0.10	0.12*	-0.11*	0.15*	0.05	0.08	0.09	0.10	0.09	0.18*	0.24*	0.34*	0.34*	1

*p <0.05. The gray-shaded area shows the correlation between the questions in the first and second level of the digital divide. The blue-shaded area shows the correlation between the questions in the first and third level of the digital divide. The green-shaded area shows the correlation between the questions in the second and the third level of the digital divide. The higher color intensity indicates statistical significance.

use a mobile phone and 87/100 people use the Internet.[19] Such material access gap seems to be associated with the fact that mobile phones are less expensive, have relatively low maintenance fees, and that they have become a ubiquitous technology in daily communication.[26–28] In turn, the most frequent way of connecting to the Internet was via a data network. This may be due to the fact that mobile phones are the main device used. Accessing the Internet through a single type of device is associated with poorer Internet use and a lesser development of digital skills.[22,29–31]

In relation to the second digital divide, the use of social media and messaging services (WhatsApp) to communicate predominated. This may be related to the sociodemographic characteristics of our population, the quality of Internet access, and the informality of online communications for these users, similar to what has been reported in other studies.[28,30]

Regarding the third digital divide, less than 50% of respondents reported obtaining health benefits through ICTs. Specifically, less than 30% had ever made a teleconsultation despite the fact that these grew exponentially during the COVID-19 pandemic.[11,16,32] This fact highlights the lack of access to health care in the study population despite the implementation of digital health programs.[14,15] Thus, it is possible that the implementation of ICT-based strategies may perpetuate the inequity in access to health care.[5,24]

The correlation among the levels of the digital divide was generally null or weakly positive. This is consistent with the theoretical framework proposed by van Deursen.[4] People may have access to the Internet, but that does not indicate that they have the necessary skills to use it and to benefit from it. Our study population showed a high rate of connectivity (first level of the digital divide), but these results become poorer in terms of usage (second level of the digital divide) and in the benefits obtained from it (third level of the digital divide). Such drop in results highlights the fact that ensuring connectivity is not enough to guarantee access to ICTs. The use and benefits obtained also depend on other factors, such as socioeconomic level, education, and personal motivations described as determinants for interaction with online activities.[25,23,29]

We observed that Internet access via a WiFi network and e-mail use have a positive correlation to the components of the third digital divide. In contrast, Internet access via a data network and WhatsApp use did not show a correlation to the questions in the third level of the digital divide. The analysis suggests 2 user profiles: on the one side, a person with a WiFi connection, who uses e-mail and benefits from the use of ICTs and, on the other side, a person with fewer digital skills, who accesses the Internet via the data network and benefits little from its use. The fact that both users access the Internet, but only 1 obtains positive results, highlights the existence of the digital divide and its negative effect on people's lives.[23]

This study has limitations that should be taken into consideration. Only caregivers of patients aged 0–12 years were included. This decision took into account the fact that patients older than 12 years are considered to have progressive autonomy[33] and, in addition, display their own characteristics in terms of ICT use.[34] The average age of the caregivers was 31.4 years. Age is a factor related to ICT access and use,[12] so it is to be expected that the population in this study will only be comparable to a population of a similar age. In addition, the study population represents the most vulnerable sectors of society. Although this may be considered a bias, populations with such characteristics have the lowest levels of access to ICTs and, therefore, require further study and intervention. In this regard, this study provides a validated tool to assess access to ICTs in vulnerable populations in line with the interests of the National Ministry of Health of Argentina in relation to national digital health strategies.[35]

Finally, it is worth noting that the results of this study may be directly applied to the development of health care access strategies through ICTs. For these strategies to succeed, it is critical that health care access strategies based on ICTs respond to the health care needs and access conditions of each target population in which they are implemented.

CONCLUSION

A questionnaire was developed and validated in Spanish to assess access to ICTs for health care aimed at caregivers of pediatric patients aged 0 to 12 years. The study population was characterized by mostly owning a mobile phone, having Internet access via a data network, communicating mainly using WhatsApp, and infrequently obtaining benefits through ICTs. The correlation among the different levels of the digital divide was low. ∎

Supplementary material available at: https://www.sap.org.ar/docs/publicaciones/archivosarg/2023/2976_AO_Sbruzzi_Anexo.pdf

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