Journal of Geriatric Cardiology | JGC
RESEARCH ARTICLE
J Geriatr Cardiol 2021; 18(9): 739–747

Digital literacy as a potential barrier to implementation of cardiology tele-visits after COVID-19 pandemic: the INFO-COVID survey

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https://doi.org/10.11909/j.issn.1671-5411.2021.09.003

ABSTRACT

BACKGROUND During the COVID-19 pandemic, the implementation of telemedicine has represented a new potential option for outpatient care. The aim of our study was to evaluate digital literacy among cardiology outpatients.

METHODS From March to June 2020, a survey on telehealth among cardiology outpatients was performed. Digital literacy was investigated through six main domains: age; sex; educational level; internet access; availability of internet sources; knowledge and use of teleconference software programs.

RESULTS The study included 1 067 patients, median age 70 years, 41.3% females. The majority of the patients (58.0%) had a secondary school degree, but among patients aged ≥ 75 years old the most represented educational level was primary school or none. Overall, for internet access, there was a splitting between "never" (42.1%) and "every day" (41.0%), while only 2.7% answered "at least 1/month" and 14.2% "at least 1/week". In the total population, the most used devices for internet access were smartphones (59.0%), and WhatsApp represented the most used app (57.3%). Internet users were younger compared to non-internet users (63 *vs.* 78 years old, respectively) and with a higher educational level. Age and educational level were associated with non-use of internet (age-per 10-year increase odds ratio (OR) = 3.07, 95% CI: 2.54–3.71, secondary school OR = 0.18, 95% CI: 0.12–0.26, university OR = 0.05, 95% CI: 0.02–0.10).

CONCLUSIONS Telemedicine represents an appealing option to implement medical practice, and for its development it is important to address the gaps in patients' digital skills, with age and educational level being key factors in this setting.

Since the beginning of 2020, COVID-19 has been declared a pandemic by World Health Organization (WHO) and it has rapidly spread across the whole world, affecting all of the society layers, and in particular Health Care Systems.[1] Worldwide, policymakers have promoted a series of measures to limit the diffusion of SARS-Covid 19 with the adoption of lockdown periods including isolation, social distancing, and quarantine. This has had a profound impact on people's lives and the Health Care Systems organization.[2–6]

The follow-up of patients affected by chronic cardiac diseases is traditionally based on periodic ambulatory visits, done in coordination with general practitioners, in order to verify the implementation of guidelines-adherent preventive measures and treatments, to intercept any major change in patient's clinical status, as well as to support a good patient-doctor relationship, which is fundamental for reaching therapeutic goals.[7,8]

The lockdown period had a profound impact on the management of cardiovascular conditions, with a decrease in the number of hospital admissions for acute coronary syndromes, and a parallel increase in the rate of out-of-hospital cardiac arrests, possibly related to the fact that people were more likely to stay home and delay their access to the hospital.[9–11]

A reduced referral to the hospital for medical care was also reported for arrhythmias, atrial fibrillation, and heart failure with potentially negative implications on patients' outcomes.[5,12,13] As people were asked to stay home, national health agencies and health care providers have searched for new strategies to best provide for their patients' needs and tried at the same time to limit contagions and redirect resources to the treatment of patients with COVID-19 disease. In this perspective, while reducing ambulatory visits and planned procedures, the implementation of telehealth systems has represented a new potential option for outpatient care.[14–19]

Thus, the degree of digital literacy, in terms of the ability of individual patients to access various digital platforms through computers, laptops or mobile devices, has become a topic of great interest for a fast implementation of the "telemedicine opportunity" in our daily practice.

The aim of our study was to take a picture of digital literacy among cardiology patients attending our outpatient clinic, through a survey performed during COVID-19 pandemic, in order to assess the possibilities to extend telemedicine, by using currently available technology, as a way to reach patients and their families at home.

METHODS

Study Design and Population

The InterNet For Outpatients during COVID-19 pandemic (INFO-COVID) survey was performed from March to June 2020 collecting data that involved unselected patients attending the outpatient clinic of our Cardiology Unit. Participants were at least 18 years old and provided informed consent, after detailed information about the reasons for the survey and subsequent analysis of anonymous data. All the patients who have been invited to participate in our survey, accepted to respond to the questionnaire. The questionnaire recorded patients' answers on six main topics: age and sex; educational level (none, primary school, secondary school, University); internet access (never, at least once a month, at least once a week, every day); availability of internet sources (Wi-Fi at home, smartphones, tablet, personal computers (PC) with webcam); knowledge and use of teleconference software programs (WhatsApp, Skype, Google Meet, Zoom, Facebook, Instagram, Telegram). The study protocol and data analysis were approved by the local Ethics Committee.

Statistical Analysis

Continuous variables were expressed as median and interquartile [IQ] range. Among-group comparisons were made using a non-parametric test (Kruskal–Wallis test). Categorical variables were reported as number of patients and percentages. Among-group comparisons were made using a χ^2 test or Fisher's exact test (if any expected cell count was less than five). Univariate logistic regression analysis was performed to identify factors associated with internet non-use. All the variables with $P < 0.10$ in the univariate analysis were used in the multivariate model to identify independent predictors of non-internet use. A two-sided P-value <0.05 was considered statistically significant. All analyses were performed using SPSS statistical software (SPSS v.27).

RESULTS

A total of 1 067 patients were included in the study, of which 441 were females (41.3%). Median age of participants was 70 [60–79] years. The overall patients' characteristics and survey results are shown in Table 1.

We divided our population into five age subgroups, corresponding to the youngest patients (20 to 40 years old), middle-aged patients (41 to 64 years old), and three categories of elderly patients, such as "young-old" (65–74 years old), "middle-old" (75–84 years old) and "oldest-old" (≥ 85 years old). The majority of patients had a secondary school degree (n = 603, 58.0%), but among the patients aged ≥ 75 years old the most represented educational level

Table 1 Characteristics of the patient population and results of the survey.

	Total population (*n* = 1 067)	Age 20–40 (*n* = 56)	Age 41–64 (*n* = 314)	Age 65–74 (*n* = 316)	Age 75–84 (*n* = 284)	Age ≥ 85 (*n* = 97)	*P*-value
Female	441/1 067 (41.3%)	24/56 (42.9%)	121/314 (38.5%)	122/316 (38.6%)	127/284 (44.7%)	47/97 (48.5%)	0.24
Educational level							< 0.001
Primary school or none	329/1 040 (31.6%)	6/56 (10.7%)	19/310 (6.1%)	89/309 (28.8%)	149/275 (54.2%)	66/90 (73.3%)	
Secondary school	603/1 040 (58.0%)	32/56 (57.1%)	248/310 (80.0%)	190/309 (61.5%)	110/275 (40.0%)	23/90 (25.6%)	
University	108/1 040 (10.4%)	18/56 (32.1%)	43/310 (13.9%)	30/309 (9.7%)	16/275 (5.8%)	1/90 (1.1%)	
Internet access							< 0.001
Never	447/1 061 (42.1%)	1/55 (1.8%)	34/313 (10.9%)	125/316 (39.6%)	208/281 (74.0%)	79/96 (82.3%)	
At least 1/month	29/1 061 (2.7%)	0/55 (0.0%)	13/313 (4.2%)	8/316 (2.5%)	7/281 (2.5%)	1/96 (1.0%)	
At least 1/week	151/1 061 (14.2%)	3/55 (5.5%)	57/313 (18.2%)	59/316 (18.7%)	24/281 (8.5%)	8/96 (8.3%)	
Everyday	434/1 061 (41.0%)	51/55 (92.7%)	209/313 (66.8%)	124/316 (39.2%)	42/281 (14.9%)	8/96 (8.3%)	
Wi-Fi at home	516/1 059 (48.7%)	48/56 (85.7%)	222/313 (70.9%)	157/314 (50.0%)	71/281 (25.3%)	18/95 (18.9%)	< 0.001
Smartphone	617/1 046 (59.0%)	53/56 (94.6%)	272/312 (87.2%)	198/315 (62.9%)	78/273 (28.6%)	16/90 (17.8%)	< 0.001
Tablet	243/1 043 (23.3%)	32/56 (57.1%)	119/313 (38.0%)	61/314 (19.4%)	25/271 (9.2%)	6/89 (6.7%)	< 0.001
PC with webcam	404/1 043 (38.7%)	42/56 (75.0%)	185/313 (59.1%)	117/313 (37.4%)	47/272 (17.3%)	13/89 (14.6%)	< 0.001
WhatsApp	606/1 057 (57.3%)	53/56 (94.6%)	270/314 (86.0%)	195/316 (61.7%)	72/280 (25.7%)	16/91 (17.6%)	< 0.001
Skype	209/1 051 (19.9%)	29/56 (51.8%)	96/312 (30.8%)	54/316 (17.1%)	25/277 (9.0%)	5/90 (5.6%)	< 0.001
Google meet	127/1 049 (12.1%)	26/56 (46.4%)	61/312 (19.6%)	27/315 (8.6%)	10/276 (3.6%)	3/90 (3.3%)	< 0.001
Zoom	114/1 050 (10.9%)	17/56 (30.4%)	57/312 (18.3%)	28/315 (8.9%)	8/277 (2.9%)	4/90 (4.4%)	< 0.001
Facebook	353/1 051 (33.6%)	42/56 (75.0%)	179/313 (57.2%)	94/316 (29.7%)	32/277 (11.6%)	6/89 (6.7%)	< 0.001
Instagram	182/1 051 (17.3%)	36/56 (64.3%)	93/313 (29.7%)	36/315 (11.4%)	15/277 (5.4%)	2/90 (2.2%)	< 0.001
Telegram	60/919 (6.5%)	12/50 (24.0%)	27/273 (9.9%)	11/270 (4.1%)	9/251 (3.6%)	1/75 (1.3%)	< 0.001

was primary school or none. Population characteristics and results of the survey according to educational level are shown in Table S1 in the Supplementary Material.

Overall, concerning internet access, we observed a splitting between the categories referred to as "never" (42.1%) and "every day" (41.0%), while only 2.7% and 14.2% answered they accessed the internet at least once a month and at least once a week, respectively. This separation reflects the opposite tendency among the extreme ages of our study population, since 92.7% of patients aged 20 to 40 years old reported they have access to the Internet every day, while 82.3% of those aged ≥ 85 years reported they never use the Internet.

The availability and knowledge of devices that may be used for web connections and potentially for tele-visits tended to decrease from younger to older ages. Among the available devices, smartphones appeared to be the most used for Internet access, available for 59.0% of patients in our population, and WhatsApp represented the most used app for telecommunication, being known and used by 57.3% of the whole population. Figure 1 shows the availability and use of specific Internet access supplies and telecommunication software in different age groups and the constant decline in use when categories of increasing age are considered.

Internet users appeared to be younger compared to non-Internet users (63.0 versus 78 years old, respectively) and with a higher educational level, as shown in Table 2 and Figure 2. The factors associated with internet non-use were evaluated at univariate analyses and then at multivariate analyses (Table 3). As shown in Table 3 and Figure 3, age and educational level were independently associated with internet non-use (age-per 10-year increase odds ratio [OR] = 3.07, 95% CI: 2.54–3.71, secondary school OR = 0.18, 95% CI: 0.12–0.26, university OR = 0.05, 95% CI: 0.02–0.10). Conversely, female sex was not associated with internet non-use. Age and educational level were also independ-

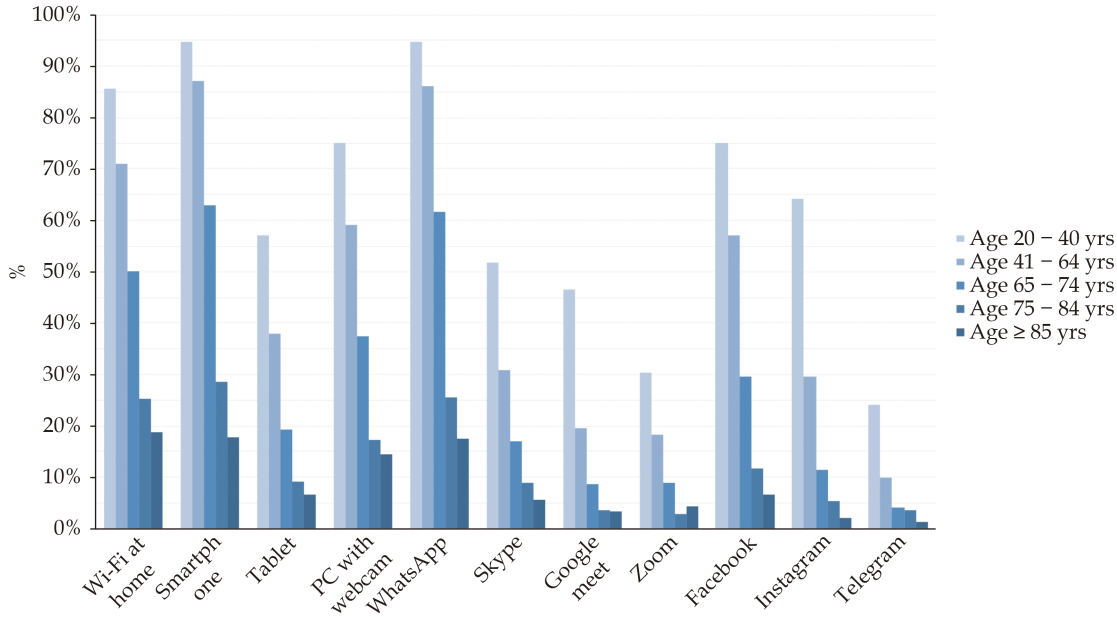

Figure 1 Disposal and use of teleconference devices and software in different age classes.

Table 2 Characteristics of internet users and non-internet users.

	Internet users (*n* = 614)	Non-internet users (*n* = 447)	*P*-value
Female	238/614 (38.8%)	199/447 (44.5%)	0.06
Age, median (IQR)	63.0 (53.0–71.0)	78 (72.0–83.0)	< 0.001
Age classes, yrs			< 0.001
20–40	54/614 (8.8%)	1/447 (0.2%)	
41–64	279/614 (45.4%)	34/447 (7.6%)	
65–74	191/614 (31.1%)	125/447 (28.0%)	
75–84	73/614 (11.9%)	208/447 (46.5%)	
≥ 85	17/614 (2.8%)	79/447 (17.7%)	
Educational level			< 0.001
Primary school or none	63/603 (10.4%)	264/432 (61.1%)	
Secondary school	441/603 (73.1%)	159/432 (36.8%)	
University	99/603 (16.4%)	9/432 (2.1%)	

ently associated with the use of WhatsApp, the most used mobile app in our cohort (Table S2).

DISCUSSION

One of the major challenges in COVID-19 pandemic is to continue to ensure the best possible care, either in terms of diagnosis, treatment, or follow-up, avoiding focusing only on COVID-19. Indeed, the COVID-19 pandemic carries the risk of worsening care for non-COVID-19 diseases, as a consequence of delayed access to health care systems by patients and late detection of clinical instability by healthcare professionals, thus leading to worse outcomes for chronic conditions.

Our survey investigated the possibility to implement telemedicine in the COVID-19 era through simple non-dedicated devices, testing the knowledge and the confidence with the use of social media and platforms for web communication, tele-contacts and tele-conferences in unselected patients attending our outpatient clinic. Digital tools have a great potential both during and after the COVID-19 pandemic and digital health care models have been proposed.[20] However, our survey shows that a digital divide still exists, with a substantial propor-

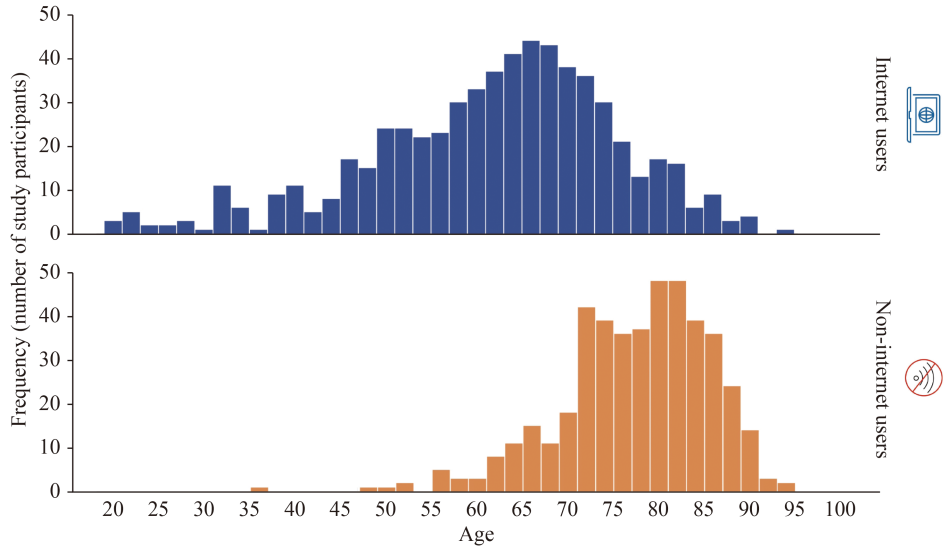

Figure 2 Age distribution of internet users (top panel) and non-Internet users (bottom panel)

Table 3 Factors associated with internet non-use (never accessed the internet).

	Univariate analysis			Multivariate analysis		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Age (per 10-year increase)	3.99	3.34–4.77	< 0.001	3.07	2.54–3.71	< 0.001
Female sex	1.26	0.99–1.62	0.06	1.07	0.76–1.51	0.68
Educational level						
None or primary school (ref)	–	–	–	–	–	–
Secondary School	0.08	0.06–0.12	< 0.001	0.18	0.12–0.26	< 0.001
University	0.02	0.01–0.04	< 0.001	0.05	0.02–0.10	< 0.001
Age classes, yrs						
65–74 (ref)	–	–	–			
20–40	0.02	0.004–0.20	< 0.001			
41–64	0.18	0.12–0.28	< 0.001			
75–84	4.35	3.07–6.17	< 0.001			
≥ 85	7.10	4.01–12.56	< 0.001			

CI: confidence interval; OR: odds ratio; ref: reference.

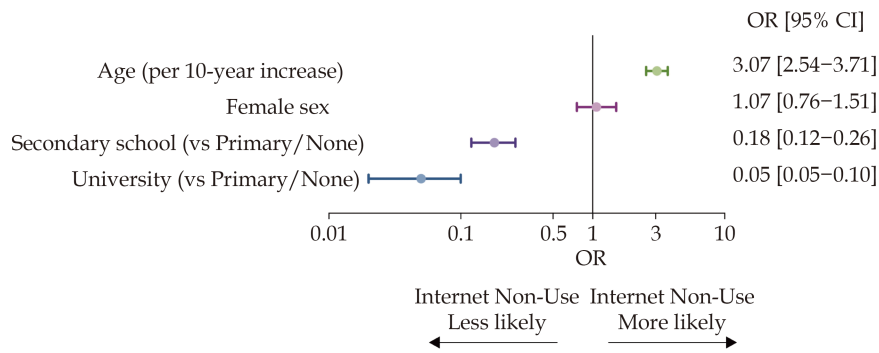

Figure 3 Factors associated with internet non-use.

tion of cardiology patients with a lack of confidence in digital solutions, as highlighted by 42.1% of patients overall who reported no access to the Internet. Age and educational level are clearly the determinants of non-internet use even if nowadays a series of user-friendly tools can be available.

Telemedicine has been defined as "the remote delivery of healthcare services and clinical information using telecommunications technology".[21] Even before the COVID-19 pandemic, positive data on the use of telemedicine had been published, both in cardiology and non-cardiology settings, with reports indicating a positive impact on disease management and hospitalizations.[22–26]

The pressure exerted on the health care system by the COVID-19 pandemic, with its direct and indirect effects,[6,27,28] promoted the implementation of telemedicine, which can have an important role not only in primary care,[29,30] but also in specialties such as cardiology dealing with chronic diseases (e.g. heart failure, atrial fibrillation, hypertension and chronic coronary syndromes) as well as patients with cardiac implanted devices.[31–40]

As a matter of fact, COVID-19 encouraged to move beyond traditional place-based and in-person based arrangements for patient monitoring and for provision of care, with a strong pressure on employing electronic and mobile health resources, including internet and related tools.[41] For providers, the implementation of digital systems to contact patients remotely requires to fulfil a series of policy and legal requirements for ensuring safety in data management after patient consent. With this regard it has been reported that COVID-19 induced a relaxation of regulatory and licensure barriers that characterized in many settings the implementation of telemedicine in its various forms, from the simplest to those more complex with dedicated hardware and software.[42] However, from the perspective of patients and caregivers, the lack of digital literacy represents an important barrier in moving from traditional models of contact, surveillance and monitoring to newer and even simpler ones based on easy digital tools able to offer a more detailed assessment, both vocal and visual, as compared to a simple phone call.

The simplest approach to contact patients during and after COVID-19 pandemic could include videocalls, or asynchronous platforms, using e-mails, apps, texts, etc., with the advantage of relatively simple technical requirements.[43] Traditionally, telehealth systems have been focused on selected groups of patients, monitored using dedicated tools or even with implanted devices. Nowadays, the implementation of remote care systems on a large scale is necessary, going beyond technical issues, but with the obvious requirement of a minimum level of patients' digital literacy.

Our results indicate that there is still the need to fill the skill gap in digital and e-Health literacy among chronic patients and that both age and education level are key factors, with no negative implications of sex. In a recent experience female sex negatively affected the possibility to have a video visit during ambulatory checks via telemedicine interactive communications systems during the COVID-19 pandemic in the United States and it is noteworthy that the possibility to have a complete telemedicine visit, with or without video, already declined at an age of 55 or above as compared to younger patients.[44]

In another study, based on a telephone survey and performed in Israel, the group characterized by a lower level of e-Health literacy was significantly older and with lower socioeconomic status (as measured by education) than the group with a higher level of e-Health literacy.[45]

According to the results of our study, implementation of telemedicine in our daily cardiology practice may start from the consistent percentage of patients that have Internet access and disposal of teleconference devices and software programs, but at present a substantial proportion of older patients would not be involved and would not be able to take advantage from telehealth platforms. In our analysis, we purposely divided old patients into three subgroups, highlighting that a good proportion of young-old patients actively access the Internet either every day or at least once a week, thus not only young patients can be reached by telehealth systems. Moreover, an average around 25% of "middle-old" people have some access to the Internet, thus creating the opportunity to reach them with video calls, e-mails, texts and other tools they are familiar with.

During the COVID 19 pandemic a growing interest in telemedicine has spread,[46] both from

health care providers and patients, and reports have been produced suggesting satisfaction after using it.[47] The challenge for the next future will be to find solutions for closing the gap that still prevents from using digital solutions as a standard component of health care provision in cardiology, thus limiting in-office checks to those that absolutely require an in-person check (e.g., for performing an echocardiogram). From the side of physicians it appears crucial to provide an appropriate organization of the care process including tele-visits and tele-contacts as a recognized step of the care process, also with reimbursement implications and appropriate measures to ensure the safety of collected data, that could also fuel "big data" analysis.[48] Collection of prospective data will allow a better assessment of the value of digital health implementation, in line with the "virtual circle" of health technology assessment.[49]

Limitations

We performed a single-center study, focusing the attention on cardiology patients. In order to address the telemedicine field more comprehensively, it would be desirable to involve a large panel of experts from multiple sectors and areas of interest (technology, communication, infrastructures, financial and privacy policy, etc.). Nevertheless, the aim of our investigation was centred on assessing if telemedicine could be feasible in a real-world cardiology population, with a rather simple approach and limited investments, as reasonable in the emergency of COVID-19 pandemic.

In our study, we did not assess the reasons why patients did not make access to the Internet, but it can be speculated that their social and educational background does not enable them to do it.[44] However, it has also been underlined that affordability plays an important role in people's access to the Internet so that, from a patient's perspective, this is an important factor that should be assessed in order to extend the use of telemedicine.[50]

In our survey, we did not include the household income. However, it is noteworthy to consider that according to the literature a direct correlation exists between the level of education and personal earnings.[51,52] Additionally, we did not consider patients' urban or rural location since no significant related differences in access to the internet exists in our Region. Finally, despite our questionnaire had simple pre-defined answers, our survey may be limited by the self-reporting of the requested information.

Conclusions

Among unselected real-world patients attending a tertiary cardiology outpatient clinic, a digital divide still exists, with a substantial proportion of patients with a lack of confidence in digital solutions. Telemedicine represents an appealing option to overcome the difficulties that COVID-19 pandemic created for daily medical practice and to maintain a patient-centred approach. For the implementation of telemedicine in the population affected by cardiac diseases it is important to address the gaps in patients' digital skills, with age and educational level being, at present, the key factors that condition digital literacy.

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Please cite this article as: Boriani G, Maisano A, Bonini N, Albini A, Imberti JF, Venturelli A, Menozzi M, Ziveri V, Morgante V, Camaioni G, Passiatore M, De Mitri G, Nanni G, Girolami D, Fontanesi R, Siena V, Sgreccia D, Malavasi VL, Valenti AC, Vitolo M. Digital literacy as a potential barrier to implementation of cardiology tele-visits after COVID-19 pandemic: the INFO-COVID survey. *J Geriatr Cardiol* 2021; 18(9): 739–747. DOI: 10.11909/j.issn.1671-5411.2021.09.003