Survey on e-health knowledge and usage in general cardiology of the Council of Cardiology Practice and the Digital Health Committee
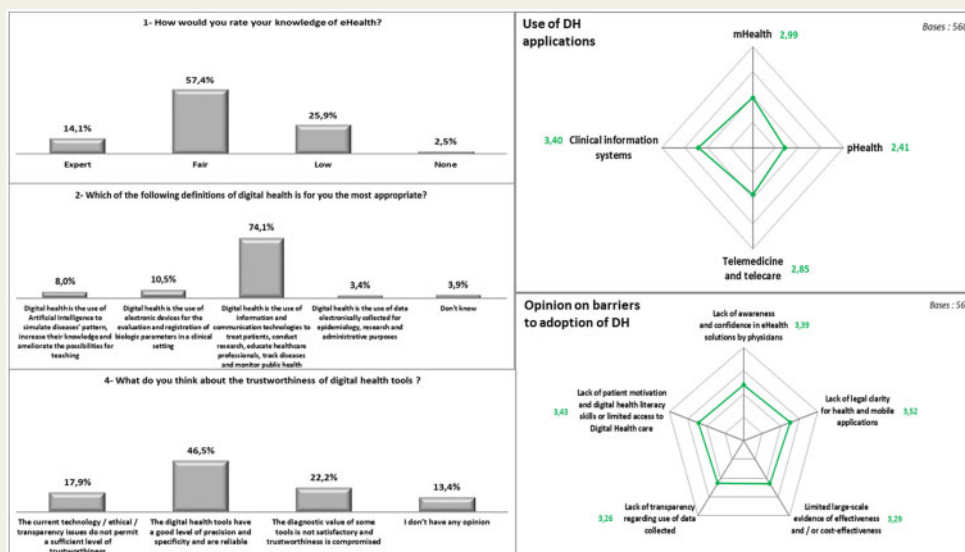
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The Council for Cardiology Practice of the European Society of Cardiology (ESC), in collaboration with the Digital Health Committee (DHC), undertook an electronic survey with 15 question multiple-choice questionnaire sent to 32 461 members of the ESC with the aim to assess the knowledge and usage of digital health (DH) technologies (DHTs) by office-based cardiologists. Of 559 respondents, 57% graded their knowledge about DH as 'fair' and three quarters identified the correct definition of DH. Clinical information systems, mHealth Apps, and telemedicine were the most frequently used DHTs, but 41% of respondents had concerns about their ethical and data transparency. Lack of legal clarity, low patient motivation, limited DH literacy, and poor access to DH were perceived as the main barriers to the adoption of DH. Seventy percent of the respondents were aware of the DH pages on the ESC website and 76% of the educational sessions in the DH area during the ESC Congress 2019. Only 16% had not read articles on DH. Eight-eight percent of responders declared that they would 'probably' or definitely attend future educational initiatives on DHT.

Graphical Abstract

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Introduction

World Health Organization defines digital health (DH) as the use of information and communication technologies to treat patients, conduct research, educate healthcare professionals, track diseases, and monitor public health.[1] Digital health domains include (i) mobile applications (m-Health) wireless technologies for health information, data registration, and patients screening, (ii) telemedicine with invasive or non-invasive sensors and wearables tools, integrated with m-Health, measuring biological signals, and collecting transmissible or recordable data; (iii) electronic health records (EHRs) information systems for decision support and monitoring of clinical and institutional practice; (iv) artificial intelligence applications like big data, machine learning, or automatic clinical analysis.

Previously published surveys about DH among healthcare professionals were performed on specific topics, such as mental health, DH education, DH applications, or were limited to national settings. A US survey showed that although 63% of general practitioners believed EHRs improved care, 74% considered their workload increased, and 68% reported that EHRs reduced time for patient care.[2]

Our survey comes after the publication in 2020 of five articles about DH topics in the e-*Journal of Cardiology Practice*.[3–7]

Its aims were to ascertain (i) the knowledge of digital health technology (DHT), (ii) the use of DH tools, and (iii) the interest in education about DH among general cardiologists.

Methods and results

A cross-sectional, anonymous, electronic survey was developed by the Council for Cardiology Practice (CCP) of the ESC using a free web-based tool (Survey Monkey[TM]) with 15 multiple-choice questions: 10 to assess the knowledge about DH (Q1–10), formulated by consensus of experts, and 5 about respondents' demographics (Q11–15).

A web link to the survey was distributed using emails to 32 461 physicians, engaged in activities of the ESC with an interest in general cardiology and DH or through an announcement in the September and October issues of the e-*Journal of Cardiology Practice*, with a reminder after 1 month.

Data were collected within the constraints of the EU General Data Protection Regulations.

Descriptive data are presented as proportions. For questions 3, 5, and 6 (ordinal items), a weighted mean was calculated (from 5 scores). Four sub-groups analysis were carried out stratifying respondents according to age, sex, practice place of work, and geographical region.

All pair-wise comparisons across groups were performed using a χ^2 test. Statistical significance was considered with a *P*-value <0.05. No corrections were made for multiple testing.

Raw data about demographic features, knowledge about DH, use of DHT, opinions about DH, educations about DH are shown in *Table 1*. Complete data on subgroup analyses are available in Supplementary material online.

Five hundred and fifty-nine responders (1.7% of those who were e-mailed the survey) answered questions 1–15 in full: 70% were male and half worked in Europe. Three quarters worked in hospital practice. Most respondents rated their knowledge of e-health to be 'fair' (57%), with 74% correctly identifying the most appropriate definition of DH. Only 18–20% had never used m-health or telemedicine/telecare, with almost 90% having used clinical information systems (electronic medical records or decision support). Thirty-four percent had never used wearable technologies or implantable technologies for decision making or therapy management. Approximately half of respondents thought that lack of awareness and confidence in e-health solutions by physicians (and lack of evidence on clinical or cost effectiveness) was an important or major issue, and a similar proportion was concerned about the lack of legal clarity for health and mobile applications. Concern was lower about the lack of transparency in the use of data collected, or about patient motivation and digital literacy. The majority (79%) thought that the COVID-19 pandemic would have a major impact on the adoption of e-health. Seventy percent or more visited the ESC DH webpages and had visited the DH area or sessions at the ESC Congress in 2019. More than 80% read scientific articles on DH trials, and 97% were planning on attending future educational events on DH.

A greater percentage of respondents aged <45 years had used wearable or implantable technologies with sensors, telemedicine and telecare, and clinical information systems. There was less concern among older respondents about lack of legal clarity for health and mobile applications. They were also less likely to visit the ESC DH webpages or read articles regularly on DH but were just as likely to be planning on attending future educational initiatives on DH. There were no major differences between the sexes. European respondents were less likely to have used telemedicine or telecare than respondents from other geographies, and more likely to believe that there was a lack of awareness and confidence in e-health solutions by physicians, but less likely to believe that low patient motivation or DH literacy limited access to DHTs. They were more likely to read scientific articles on DH trials. 'General' cardiologists were much less likely to use clinical information systems or telemedicine/telecare regularly compared with hospital-based cardiologists, rated themselves less expert in e-health, and were less likely to believe that the COVID-19 pandemic would impact e-health adoption. They were also somewhat less likely to be planning on attending future educational initiatives about DH (Supplementary material online).

Discussion

This survey had a low response rate (1.7% of those who were contacted by email), but similar to previous surveys of the CCP of the

Table I **Questionnaire and results**

Your knowledge about eHealth

| 1. How would you rate your knowledge of eHealth? | A. Expert
B. Fair
C. Low
D. None |

Expert 14.1% | Fair 57.4% | Low 25.9% | None 2.5%

| 2. Which of the following definitions of DH is for you the most appropriate? | A. DH is the use of artificial intelligence to simulate diseases' pattern, increase their knowledge, and ameliorate the possibilities for teaching
B. DH is the use of electronic devices for the evaluation and registration of biologic parameters in a clinical setting
C. DH is the use of information and communication technologies to treat patients, conduct research, educate healthcare professionals, track diseases and monitor public health
D. DH is the use of data electronically collected for epidemiology, research, and administrative purposes
E. Do not know |

A 8.0% | B 10.5% | C 74.1% | D 3.4% | E 3.9%

| 3. How frequently are you using each of the following DH applications? (please rate every application from 1 = never to 5 = commonly) | A. mHealth (mobile applications delivering health information, screening patients, monitoring physiological signs, providing direct care, and patient education) ☐☐☐☐☐
B. pHealth (wearable or implantable technologies with sensors and/or therapy delivery devices for decision making and therapy management). ☐☐☐☐☐
C. Telemedicine and telecare (disease management services, remote patient monitoring, teleconsultations, and homecare) ☐☐☐☐☐
D. Clinical information systems (electronic medical records, decision support, and monitoring of clinical and institutional practice) ☐☐☐☐☐ |

mHealth 2.99 | pHealth 2.41 | Telemedicine and telecare 2.85 | Clinical information systems 3.40

mHealth: 17.1% / 22.7% / 19.5% / 23.2% / 17.5%
pHealth: 8.4% / 15.0% / 19.6% / 23.2% / 33.8%
Telemedicine and telecare: 14.3% / 20.0% / 22.5% / 22.9% / 20.4%
Clinical information systems: 28.0% / 23.9% / 19.8% / 16.3% / 12.0%

| 4. What do you think about DH tools trustworthiness? | A. The current technology/ethical/transparency issues do not permit a sufficient trustworthiness
B. They have a good sensibility and specificity and a very good trustworthiness
C. The diagnostic value of some tools is not satisfactory and trustworthiness is compromised
D. I do not have any opinion |

A 17.9% | B 46.5% | C 22.2% | D 13.4%
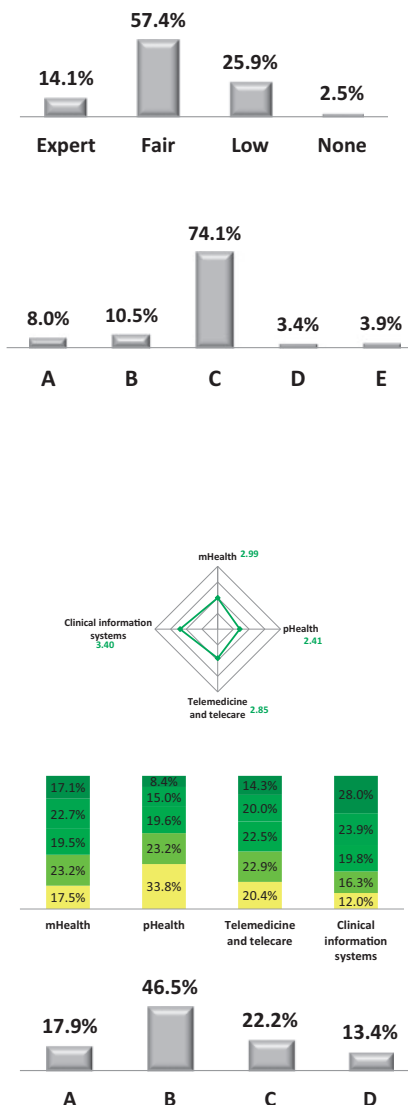
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ESC (from 1.3 to 4.7%)[8,9] and typical for voluntary email-based similar surveys (from 0.2 to 6.3%).[10,11]

The respondents, who are likely to be more interested or knowledgeable about DH than non-responders, had a good knowledge of eHealth and most of them indicated the most appropriate definition of DH. Almost all had used clinical information systems, and only a small proportion had not used m-health Apps, although experience of using wearable or implantable technologies was more limited. Concern was centred around lack of awareness of DH among physicians, the lack of evidence for clinical (and cost-) effectiveness, and lack of legal clarity around the use of DHT. Most thought the COVID-19 pandemic would accelerate the use of DHTs. Awareness of the ESC DH webpages, and its DH area and sessions was high, and most read scientific articles on DH trials. Importantly, experience of and knowledge about DH and DHTs were lower in 'general' cardiologists compared with hospital-based cardiologists, and they were also less likely to be planning on attending future educational initiatives. This trend was also observed in older respondents.

A recent paper[12] discussed barriers for physicians using DHT, including increased workload and responsibilities, unreliable technologies, and/or lack of evidence supporting their use, lack of integration with the EHRs, financial concerns, and data privacy and security issues. The most frequent facilitators for DHT were identified as regulatory approval, institutional support, reimbursement, and technologies that improved workflow efficiency, or

Table 1 *Continued*

Your knowledge about eHealth		

5. Grade from 1 = very few to 5 = very much your opinion about the most important barriers to adoption of e-Health

A. Lack of awareness and confidence in e-health solutions by physicians ☐☐☐☐☐

B. Lack of legal clarity for health and mobile applications ☐☐☐☐☐

C. Limited large-scale evidence of effectiveness and/or cost-effectiveness ☐☐☐☐☐

D. Lack of transparency regarding utilization of data collected ☐☐☐☐☐

E. Lack of patient motivation and digital health literacy skills or limited access to DH care ☐☐☐☐☐
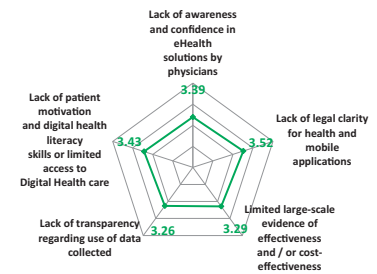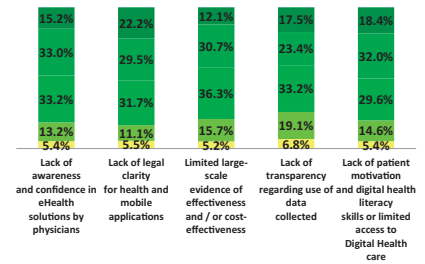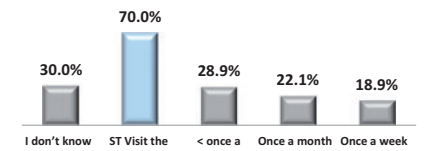

6. Grade from A = minimal impact to E = maximal impact, how do you think the recent COVID-19 pandemic will change eHealth use

A. B. C. D. E.
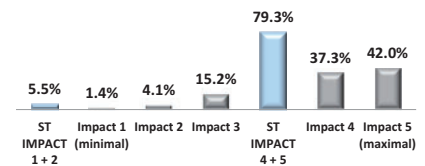
7. How frequently are you watching the ESC Digital Health (DH) page on the ESC Website?

A. I do not know this Webpage

B. I'm watching it less than once a month

C. I'm watching it once a month

D. I'm watching it at least once a week


8. Did you visit the DH Area or attend the Digital Health sessions during the ESC Congress 2019?

A. I do not know these sessions

B. I saw the DH Area but I did not attend any session

C. I was attending one/two session of the DH programme

D. I visited the DH with attention and I attended almost all DH sessions
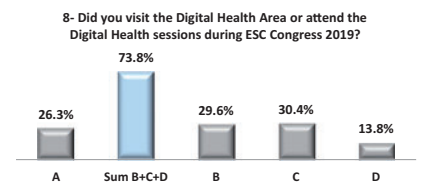
9. Did you ever read scientific articles on DH Trials?

A. I do not know any article on this topic

B. I know that some articles on DH trials have been published but I don't know the contents

C. I read one/two articles about DH trials

D. I'm regularly reading articles about this topic
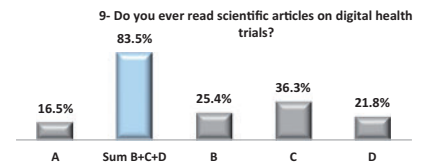
10. Are you planning to attend education initiatives about DH?

A. Yes, for sure

B. Yes, probably

C. No, for sure

D. It depends on the kind of tool used
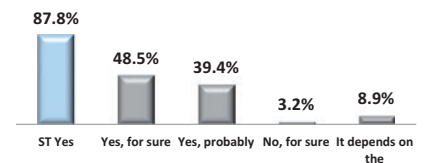
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Table 1 *Continued*

Your knowledge about eHealth		
Your profile		
11. Age (years)	A. Under 30	
	B. 30–44	
	C. 45–60	
	D. Over 60	
12. Gender	A. Female	
	B. Male	
13. In which country do you live?	…………………………………	
14. What is your geographic area?	A. Europe	
	B. North America	
	C. Central and South America	
	D. Africa	
	E. Asia and Oceania	
15. Where are you working?	A. Academic university hospital	
	B. Community public hospital	
	C. Private hospital	
	D. Cardiology practice	
	E. Other	
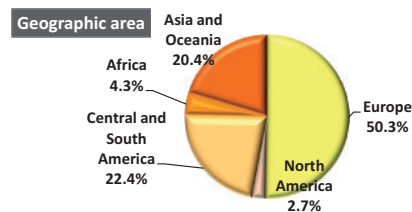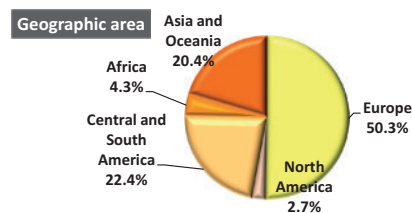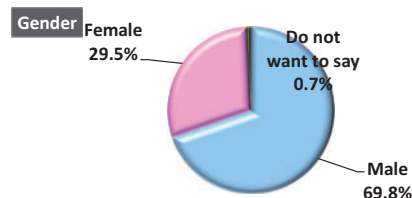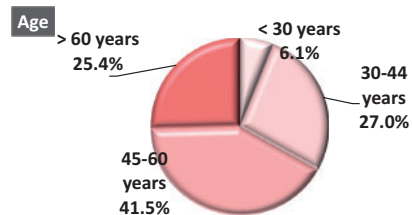
communication between patients and clinicians. Our survey supports these findings.

Although awareness about ESC DH activities was high among respondents, there is room for further improvement and support for cardiologists, particularly those who are less familiar with DH and DHTs, including those who work in more general cardiology. The Digital Health Committee will continue to work closely with the ESC Committees, Associations, Councils, and Working Groups of the ESC: (i) to support the education and training of cardiovascular healthcare professionals in DH (ii) to advocate for the better co-design and assessment of DH tools, with appropriate privacy and security standards, (iii) to advocate for the development of clearer regulation and transparency around legal issues, and (iv) to support appropriate reimbursement of DH. The ESC and its members are important stakeholders in the appropriate development and integration of DH as a tool to achieve its ambition of reducing the burden of cardiovascular disease.

Supplementary material

Supplementary material is available at *European Heart Journal – Digital Health* online.

Conflict of interest: none declared.

Data availability

The data underlying this article are available at https://orcid.org/0000-0002-2273-7228

Lead author biography

Riccardo Asteggiano is an adjunct professor at University of Insubria (Varese, Italy) School of Medicine. He was former Chair of the Council for Cardiology Practice and of the Council of Cardio-Oncology of the European Society of Cardiology. Actually, is Liaison Officer for the Councils of the Digital Health Committee, Consulting Editor of the EHJ Digital Health, and Member of the Committee for the Practice Guidelines and of Advocacy Committee. He developed in past years similar surveys for the CCP about Atrial

Fibrillation anticoagulation management, Peripheral Artery Diseases, TAVI, Syncope, published in relative articles on the EHJ family.

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