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Digital health and cardiovascular healthcare professionals in Portugal: current status, expectations and barriers to implementation

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Digital Health and cardiovascular healthcare professionals: current status, expectations and barriers to implementation

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DEDICATÓRIA

Ao Professor Doutor Ricardo Ladeiras Lopes, um grande obrigado por me ter orientado na realização deste projeto. Foi muito gratificante ter tido a oportunidade de trabalhar consigo e levar a cabo este grande desafio, para o qual tanto me apoiou e incentivou.

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Pelo caminho mais bonito da minha vida...

...a todos,
o meu obrigado!

Brief description of the article's significance and/or interest:

Despite the increasingly important role of Digital Health in the daily routine of healthcare professionals and its promising contribution to the prevention and treatment of cardiovascular diseases, there is no solid data evaluating the position of Portuguese healthcare professionals (HCP) towards implementing DH in cardiovascular medicine. Therefore, this national cross-sectional study aims to provide a snapshot of DH's implementation in the Portuguese cardiovascular HCP routine and identify both expectations and barriers to its adoption.

Declaration of originality:

We declare that the manuscript is our own work and does not contain plagiarism as a whole or in parts. We also acknowledge that the manuscript has not been previously published, nor is it under review or consideration for book chapter or journal publication elsewhere. We also declare that all authors have read and approved the manuscript and that there are no conflicts of interest to declare. This manuscript is being submitted as an Original Investigation.

Digital health and cardiovascular healthcare professionals in Portugal: current status, expectations and barriers to implementation

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Abstract

Introduction and objectives:

Digital health (DH) is a broad concept, bringing together technology and healthcare, that is playing an increasingly important role in the daily routine of healthcare professionals and promising to contribute to the prevention and treatment of cardiovascular diseases. There is no solid data evaluating the position of Portuguese healthcare professionals (HCP) towards the implementation of DH in cardiovascular medicine. Therefore, this national cross-sectional study aims to provide a snapshot of DH's implementation in the Portuguese cardiovascular HCP routine and identify both expectations and barriers to its adoption.

Methods:

An 18-question survey was created for the specific needs of this study and distributed to 1174 potential receivers of the Portuguese Society of Cardiology mailing list.

Results:

We collected 117 valid responses (survey response rate of 10%). Almost all participants had smartphones and laptops, and two-thirds had tablets. Electronic medical information systems were the most used DH tool (84% of respondents) and were considered the most relevant in improving cardiovascular care. Implantable technologies (sensors or devices), telemedicine and social media were also used by more than 2 out of 3 respondents and considered "very relevant" or "totally relevant" by most of them.

Most participants showed positive expectations regarding the impact of DH in cardiovascular medicine: 78% agreed that DH might improve health outcomes, 64% that it promotes health literacy and 63% that it may decrease healthcare costs. The top-rated barriers were patients' inability to use smartphones, limited access to electronic devices, and lack of legal regulation of DH.

Conclusion:

Most Portuguese cardiovascular HCP had at least three electronic devices (primarily smartphones, laptops and tablets) and showed positive expectations regarding DH's current and future impact on cardiovascular medicine. Patient DH literacy, technology adoption, and DH regulation were identified as the most important blockers to increasing the adoption of DH tools in cardiovascular medicine.

Key words Digital health | Implementation | Cardiovascular medicine | Cardiovascular research | Cardiovascular healthcare professionals | COVID-19 | Cross-sectional survey

Saúde Digital e profissionais de saúde cardiovascular em Portugal: situação atual, expectativas e barreira à implementação

Resumo

Introdução e objetivos
A saúde digital é um conceito amplo, que junta a tecnologia aos cuidados de saúde, desempenhando um papel cada vez mais importante na prática clínica diária dos profissionais de saúde e promissor na prevenção e tratamento de doenças cardiovasculares. Não existem dados consistentes que avaliem a posição dos profissionais de saúde portugueses em relação à implementação da saúde digital na medicina cardiovascular. Por conseguinte, este estudo nacional transversal visa compreender o panorama geral da implementação da saúde digital na rotina diária dos profissionais de saúde cardiovascular em Portugal e identificar tanto as expectativas como os obstáculos à sua adoção.

Métodos
Um inquérito de 18 perguntas foi construído para as necessidades específicas deste estudo e distribuído a 1174 potenciais respondedores da *mailing list* da Sociedade Portuguesa de Cardiologia.

Resultados
Foram obtidas 117 respostas válidas (taxa de resposta ao inquérito de 10%). Quase todos os respondedores tinham um *smartphone* e um computador portátil e dois terços tinham um *tablet*. Os sistemas eletrónicos de informação médica foram a ferramenta mais utilizada (84% dos inquiridos) e considerada a mais relevante para melhorar os cuidados de saúde cardiovasculares. Mais de 2 em 3 dos inquiridos relataram utilizar tecnologias implantáveis (sensores ou dispositivos), telemedicina e as redes sociais e todas estas ferramentas foram consideradas "muito relevantes" ou "totalmente relevantes" pela maioria.

A maior parte dos respondedores demonstrou expectativas positivas relativamente ao impacto da saúde digital na medicina cardiovascular: 78% concordaram que esta pode melhorar os *outcomes* em saúde, 64% que promove a literacia em saúde e 63% que pode diminuir os custos dos cuidados de saúde. A incapacidade dos pacientes em utilizar *smartphones*, o acesso limitado a dispositivos eletrónicos e a falta de regulamentação legal da saúde digital foram as barreiras mais cotadas.

Conclusão
Globalmente, a maioria dos profissionais de saúde cardiovascular em Portugal tinham pelo menos três dispositivos eletrónicos (principalmente *smartphones*, computadores portáteis e *tablet*) e mostraram expectativas positivas relativamente ao impacto atual e futuro da saúde digital na medicina cardiovascular. A literacia e a adoção de tecnologia relacionada com a saúde digital pelos pacientes, bem como a falta regulamentação jurídica, foram identificados como os obstáculos mais importantes para aumentar a adoção de ferramentas de saúde digital na medicina cardiovascular.

Palavras-chave
Saúde digital | Implementação | Medicina cardiovascular | Investigação cardiovascular | Profissionais de saúde cardiovascular | COVID-19 | Inquérito transversal

Introduction and objectives

Digital health (DH) is a recent concept that emerged in the 21st century during Internet expansion, which opened an account of new possibilities in the healthcare area (1). The European Commission defines DH as the tools and services that use information and communication technologies (ICTs) to improve prevention, diagnosis, treatment, monitoring and management of health-related issues and to monitor and manage lifestyle habits that impact health (2).

The World Health Organization (WHO) states that DH can help make health systems more efficient and sustainable, enabling them to deliver good quality, affordable and equitable care (3). Furthermore, several studies published in the last years have demonstrated the efficacy of health information technologies in improving practitioner performance outcomes and reducing the costs of healthcare (4, 5).

DH is essential in cardiovascular medicine, as it can help promote cardiovascular health and treat cardiovascular disease, one of the leading causes of death worldwide. Tools such as mobile applications, text messaging and monitoring sensors for self-tracking, and online behavioural counselling, can improve lifestyle through positive behaviour change theory against poor diet, smoking, and lack of physical activity (6).

Despite this, several barriers to the widespread implementation of DH have been identified, some of them being the lack of awareness and confidence in DH, legal clarity inadequacy, and limited access to electronic medical devices, among others (7).

Health professionals play a crucial role in deploying DH in routine clinical care. Recent studies have aimed to assess the systematic integration of DH in cardiovascular disease management and the healthcare professionals' attitude towards this topic (8-11). However, information about these issues focusing on Portuguese cardiovascular healthcare professionals (CVHCP) is unavailable.

This study aimed to provide a snapshot of the implementation of DH tools in the routine of CVHCP in Portugal and identify both expectations and barriers to implementing those tools in clinical practice.

Methods

A digital survey consisting of 18 questions was released in November 2022. The complete survey is available in Appendix A. It was developed and published in Portuguese for this national cross-sectional study, inspired by other questionnaires with similar objectives (8, 9), following the guidelines for designing questionnaires and Checklist for Reporting Results of Internet E-Surveys (CHERRIES) guidelines (12).

The first part aimed to characterise the profile of each respondent: gender, professional group, institution and region of work. Furthermore, respondents' age category was registered as <30, 30–39, 40–49, 50–59, 60-69 or +70 years. Successively, questions were asked regarding the following topics: i) personal possession of smartphones, smartwatches, tablets and portable computers; ii) self-knowledge about DH and involvement in projects related to this topic; iii) current use of DH and evaluation (in a scale of 1-5) of its relevance in the clinical practice, considering smartwatches, teleconsultations, remote monitoring devices, electronic medic information systems, digital apps

related to Health, social media, among other tools; iv) the impact of COVID-19 pandemics in the acceleration of the DH implementation; v) expectations towards DH, subdivided into six statements about possible benefits or drawbacks, to which respondents could totally agree, partially agree, be neutral, partially disagree and fully disagree and vi) perceived barriers to implementation of DH, to which respondents could indicate the level of importance (1, not at all relevant to 5, totally relevant).

The Digital Health Study Group of the Portuguese Society of Cardiology (SPC) approved the questionnaire. The first page of the questionnaire provided informed consent. Following its approval, the questionnaire was transferred to a Google Forms webpage and sent, by e-mail, to the mailing list of the SPC. The mailing list of the SPC had 1174 potential recipients, including doctors, nurses, technicians, and researchers. The questionnaire was available online for two consecutive weeks, and answers were collected anonymously and voluntarily. No financial compensation was provided for answering it. Not every item of the questionnaire needed to be answered. Results were calculated with the available answers and presented using descriptive statistics. For questions 15 and 18 (both aiming to characterise the relevance of DH tools as "not at all relevant", "slightly relevant", "neutral", "very relevant", and "totally relevant"), a weighted mean was calculated to summarise the overall relevance.

Results

In total, 117 CVHCP completed the questionnaire (response rate 10%). Respondents' characteristics are summarised in Table 1. Around 60% of the respondents had >50 years, most of them were medical specialists (63%), and 62% were doctors working in Cardiology (either residents or medical specialists). Around three-quarters worked in a public hospital. Of the respondents, 95% had a smartphone, 95% had a laptop, 64% had a tablet, and 39% had a smartwatch.

Most respondents rated their knowledge of DH to be "average" (45%) or "good" (40%), with 74% correctly identifying the most appropriate definition (DH is "the use of information and communication technologies to treat patients, conduct research, educate health professionals, screen for disease, and monitor public health").

Current implementation in clinical practice

Regarding participation in projects related to DH, 82% of the respondents denied being involved in any, and 67% were unaware of any DH-related project/initiative taking place in their place of work.

Most respondents (90%) thought that the COVID-19 pandemic significantly impacted the adoption of DH.

The results about the tools related to DH used day-to-day are shown in Fig. 1. Almost 84% of the responders used electronic medical information systems. More than two-thirds of participants used implantable technologies (sensors and devices), social media networks, mobile apps, and telemedicine in their professional activities.

Results concerning the relevance of each of the tools evaluated are shown in Table 2, as well as a radar chart with the weighted mean for each in Fig. 2. Around 85% of the participants considered electronic medical information systems (electronic health records, medical decision support platforms, clinical and institutional monitoring) either very relevant or totally relevant; this was considered the most relevant tool, with a weighted mean of 4.35. Implantable technologies with sensors or devices for

decision-making and adaptation of medical therapy (e.g., blood glucose monitors, implantable heart rate monitors, etc.) were also very or totally relevant for 85% of the respondents and had a weighted mean of 4.28. On the other hand, smartwatches were the least relevant, with a weighted mean of 3.42.

Expectations on DH

The expectations concerning the impact of DH in the daily routine of cardiovascular healthcare were subdivided into six statements, and the results are provided in Table 3. A total of 78% of respondents agreed (partially or totally) that DH contributes to improving health outcomes. The majority agreed (partially or totally) that DH contributes to improving the health literacy of the population (64%) and that it decreases healthcare costs (63%). Approximately half of the responders (53%) agreed that DH increases patient satisfaction. The results concerning the threat to the privacy of doctors and patients and the impact on the workload of healthcare professionals were very dispersed.

Barriers to the adoption of DH

An overview of all nine barriers is given in Table 4. A radar chart with a weighted mean for each of the barriers is shown in Fig.3. At least half of the participants categorised the following blockers as "very relevant" or "totally relevant": limited access to electronic devices (65%), the inability of patients to use smartphones (62%), lack of legal regulation of DH (60%), lack of motivation among patients (60%), lack of reimbursement/financing of the medical act (56%) and little recognition and trust in DH (55%).

The weighted mean calculated emphasises patients' inability to use smartphones as the most significant barrier (3.81), followed by the limited access to electronic devices (3.80) and lack of legal regulation of DH (3.79).

Discussion

This is a pivotal study exploring the adoption and expectations of DH tools by CVHCP in Portugal.

The main findings of this study were: i) implantable technologies and electronic medical information systems are the most used and considered to be the most useful tools related to DH; ii) cardiovascular healthcare professionals seem confident that DH contributes to improving health outcomes, reducing healthcare costs and increasing patient satisfaction; iii) serious barriers need to be addressed to allow better usage of DH in routine clinical practice, namely the inability of patients to use smartphones, limited access to electronic devices, the and the lack of legal regulation of DH.

Where are we?

CVHCP were familiar with this subject, and the majority recognised the most suitable definition of DH. However, only a minority took part in DH-related projects, which is probably associated with the lack of investment in this field (13).

Most respondents agree that the COVID-19 pandemic significantly impacted the adoption of DH, which is consistent with the existing evidence. In fact, during the COVID-19 pandemic, the adoption of telemedicine consultation increased abruptly in less than a year (14, 15).

CVHCP considered more relevant those DH tools that were already implemented and with which they were already familiarised. Specifically, electronic medical information systems and implantable technologies were believed to be the most relevant in improving cardiovascular healthcare. Undeniably, the Portuguese electronic medical information system and the implantable technologies are widely spread tools, making the performance of CVHCP more effective and efficient (16, 17). Social media were also a very used and top-rated tool, which is in line with the existing evidence: a recent study carried out in 2021 in Portugal also showed that the feeling of CVHCP towards the use of social media and its potential in improving clinical outcomes is very positive (18).

On the other hand, smartwatches and robotics were the least used and considered the least relevant to healthcare. This may suggest a particular fear of the "unknown" and doubts regarding the potential of new tools. These tools, less trusted by cardiovascular healthcare professionals, can be so just because they are not as established in clinical routine as others are, and not because they are less efficient (19-21).

Concerning the expectation towards DH, approximately 78% of the respondents agreed that it contributes to improving healthcare outcomes. Most believe in its usefulness in reducing healthcare costs and increasing patient satisfaction. Although evidence about CVHCP's expectations of DH is scarcely available, other studies have shown similar results. One recent study, published in 2019 in the Netherlands, concluded that cardiologists are optimistic towards DH. Most of them also considered it to be clinically beneficial and to improve patient satisfaction and information (8). Another study published in Spain in 2017 revealed that physicians believed in the usefulness of telemedicine in improving the healthcare systems and that the attitude of CVHCP towards this concept is a facilitating factor for its implementation (11).

Results regarding the threat to the privacy of doctors and patients and the impact on the workload of healthcare professionals were not consensual. The available scientific evidence suggests that the chance of privacy violation will never be nonexistent. Still, different privacy-preserving mechanisms have recently been developed in DH models to overcome this issue (22). Evidence of the impact of DH on health professionals' workload is reduced. Remote monitoring of ICDs has been demonstrated to decrease office visits and rehospitalisation (23). Nonetheless, considering other patient populations and other forms of remote monitoring, data is inconclusive (8).

Despite the enormous expectations on DH, some critical barriers have been identified by our respondents, namely the inability of patients to use smartphones, limited access to electronic devices and the lack of legal regulation of DH. A systematic review published in 2021 that aimed (among other things) to discuss barriers to the uptake of DH technology in cardiovascular care reported that "difficult-to-use technology" was one of the most common patient-level barriers, which is in line with our results (24). Lack of legal clarity, lack of patient motivation and DH literacy skills or limited access to DH care were also concerns identified in a similar study by the European Society of Cardiology, published in 2021 (9). Our survey also supports these findings. However, different results were found concerning the lack of scientific evidence regarding its effectiveness and cost-effectiveness. While this was reported as a significant concern in the indicated study, it was the least-rated barrier in our questionnaire. This could be explained by the vast amount of studies published in the past few years demonstrating DH cost-effectiveness (4, 25, 26), results that were probably not so elucidating when this article was published.

Where are we going?

DH has evolved considerably over the last 20 years. The COVID-19 pandemic accelerated the digital transformation of the health sector, directly impacting the entire healthcare ecosystem. This trend will likely continue after the pandemic subsides (14).

In the present, DH is rapidly progressing and emerging, driven by technological innovations and the growing request for better and more personalised healthcare. We can expect to see in the future further integration of digital tools into healthcare, as well as an increased emphasis on using data to improve healthcare outcomes and the patient experience (27).

Our study proves that CVHCP have a positive attitude towards the future of DH and are generally confident about its potential. Nevertheless, some critical blockers need to be overcome to allow this transformation. It is necessary to ensure that leadership, systems, and people are prepared to deal with these technologies, to allow taking advantage of them and leveraging investment. Further instruction and support should be a priority, especially for those who need to become more familiar with DH and DH tools. The road ahead should be focused on promoting a patient-centered and clinically relevant DH tool development pipeline, implemented with appropriate privacy and security standards, under more explicit regulation concerning legal matters. In addition, the investment in convenient access to electronic devices and the provision of scientific updates and medical education for the general population should all be considered while going through this technological revolution (9, 28).

Limitations

One of the limitations of our study is the low response rate (10% of those contacted per email), however similar to other voluntary-based inquiries (29).

The fact that the survey was conducted online also represents a limitation. Since DH is tightly connected to technology and internet access, respondents were likely to be more interested and knowledgeable about DH than non-responders. Therefore, the results of expectations on DH can be slightly overestimated, and concerns about the barriers to the implementation of DH are underestimated.

Not every item of the questionnaire needed to be answered. Therefore, some questions had a higher response rate than others. Respondents likely chose not to answer those questions because they were unsure about the answer, which could have led to diverting the results towards the extremes.

In addition, this was a survey conducted in Portugal. Thus, our results can not be generalised to other countries.

Conclusion

Overall, this snapshot of the implementation of DH in the daily routine of Portuguese cardiovascular HCP emphasised three points: i) the most common DH tools are also those considered to be the most useful, in particular, implantable technologies (sensors/devices) and electronic medical information systems; ii) cardiovascular healthcare professionals have, in general, a positive attitude towards DH

and expect it to improve health outcomes, reduce healthcare costs and increase patient satisfaction; iii) the inability of patients to use smartphones, limited access to electronic devices and the lack of legal regulation of DH were the top-ranked blockers of broader adoption of DH.

Conflicts of interest

The authors have no conflicts of interest to declare.

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TABLES

TABLE 1 - Participants' characteristics.

	N (%)
Gender	
Female	62 (53%)
Male	55 (47%)
Age	
<30	6 (5,1%)
30-39	31 (26,5%)
40-49	12 (10,3%)
50-59	27 (23,1%)
60-69	27 (23,1%)
>70	14 (12%)
Professional group	
Medical specialist	74 (63,3%)
Cardiopneumology/Clinical Physiology Technician	28 (23,9%)
Medical resident	9 (7,7%)
Nurse	5 (4,3%)
Investigator	1 (0,9%)
Specialty (if doctor)	
Cardiology	72 (61,5%)
Internal Medicine	5 (4,3%)
Cardiothoracic surgery	4 (3,4%)
Pediatric Cardiology	2 (1,7%)
Other	1 (0,9%)
Working environment	
Public non university Hospital	44 (37,6%)
Public University Hospital	42 (35,9%)
Private Hospital	27 (23,1%
University	3 (2,6%)
Primary health care center	1 (0,9%)
Region of work	
Norte	41 (35%)
Centro	20 (17,1%)
Lisboa e Vale do Tejo	45 (38,5%)
Alentejo	4 (3,4%)
Algarve	3 (2,6%)
Açores	4 (3,4%)

TABLE 2 - Relevance of selected DH-related tools/ applications in improving cardiovascular healthcare (1=not at all relevant, 2 - not very relevant, 3 - neutral, 4 – very relevant, 5 – totally relevant).

	1	**2**	**3**	**4**	**5**
Smartwatches.	2 (1.70%)	15 (12.82%)	40 (34.19%)	36 (30.77%)	14 (11.97%)
Implantable technologies with sensors or devices for decision making and adaptation of medical therapy (e.g., blood glucose monitors, implantable heart rate monitors, etc.).	3 (2.56%)	3 (2.56%)	9 (7.69%)	43 (36.76%)	56 (47.87%)
Telemedicine and teleconsultations (online or telephone consultations).	2 (1.70%)	8 (6.84%)	15 (12.82%)	45 (38.46%)	41 (35.04%)
Electronic medical information systems (electronic health records, medical decision support platforms, clinical and institutional monitoring).	3 (2.56%)	0 (0.0%)	9 (7.69%)	42 (35.90%)	57 (48.72%)
Health related Apps for smartphones/tablets.	2 (1.70%)	5 (4.27%)	32 (27.35%)	49 (41.88%)	23 (19.66%)
Informatics platforms for randomization and remote follow-up of clinical trial participants.	1 (0.85%)	8 (6.84%)	24 (20.51%)	48 (41.03%)	29 (24.70%)
Artificial intelligence applied to cardiovascular medicine as an aid in the definition of diagnosis, prognosis and therapeutic strategy.	1 (0.85%)	6 (5.13%)	24 (20.51%)	47 (40.17%)	34 (29.06%)
Robotics/Interventions carried out remotely.	2 (1.70%)	8 (6.84%)	42 (35.09%)	36 (30.77%)	24 (20.51%)
Social networks for scientific updating and medical education.	1 (0.85%)	11 (9.40%)	29 (24.79%)	49 (41.88%)	22 (18.80%)

TABLE 3 - Expectations concerning the impact of DH in the daily routine of cardiovascular healthcare**.**

	Totally disagree	**Partially disagree**	**Neutral**	**Partially agree**	**Totally agree**
Improved health outcomes	2 (1.70%)	5 (4.27%)	10 (8.55%)	44 (37.6%)	47 (40.17%)
Reduced healthcare costs.	4 (3.42%)	8 (6.84%)	21 (17.95%)	42 (35.90%)	32 (27.35%)
Increased patient satisfaction.	3 (2.56%)	11 (9.40%)	31 (26.50%)	44 (37.60%)	18 (15.39%)
Improved health literacy of the population.	4 (3.42%)	6 (5.13%)	21 (17.95%)	50 (42.74%)	25 (21.37%)
Threat to the privacy of both doctor and patient.	7 (5.98%)	33 (28.21%)	34 (29.06%)	27 (23.08%)	6 (5.13%)
Increased workload of healthcare professionals.	12 (10.26%)	19 (16.24%)	30 (25.64%)	31 (26.50%)	15 (12.82%)

TABLE 4 - Main blockers the implementation of DH applications/tools in clinical practice (1=not at all relevant, 2 - not very relevant, 3 - neutral, 4 – very relevant, 5 – totally relevant).

	1	**2**	**3**	**4**	**5**
Lack of scientific evidence regarding its effectiveness and/or cost-effectiveness.	2 (1.70%)	16 (13.68%)	50 (42.74%)	37 (31.62%)	3 (2.56%)
Little recognition and/or trust in DH.	1 (0.85%)	13 (11.11%)	31 (26.50%)	55 (47.01%)	9 (7.69%)
Lack of motivation among patients.	2 (1.70%)	7 (5.98%)	30 (25.64%)	57 (48.72%)	13 (11.11%)
Lack of legal regulation of DH.	1 (0.85%)	7 (5.98%)	32 (27.35%)	46 (39.32%)	24 (20.51%)
Inability of patients to use smartphones.	1 (0.85%)	6 (5.13%)	29 (24.79%)	50 (42.74%)	23 (19.66%)
Limited access to electronic devices.	2 (1.70%)	9 (7.69%)	23 (19.66%)	51 (43.59%)	25 (21.37%)
Risk of data privacy breach.	4 (3.42%)	23 (19.66%)	40 (34.19%)	30 (25.64%)	11 (9.40%)
Lack of motivation among healthcare professionals.	3 (2.56%)	11 (9.40%)	39 (33.33%)	46 (39.32%)	8 (6.84%)
Lack of reimbursement/financing of the medical act.	4 (3.42%)	8 (6.84%)	31 (26.50%)	45 (38.46%)	21 (17.95%)

FIGURES/LEGENDS

TAKE-HOME FIGURE:

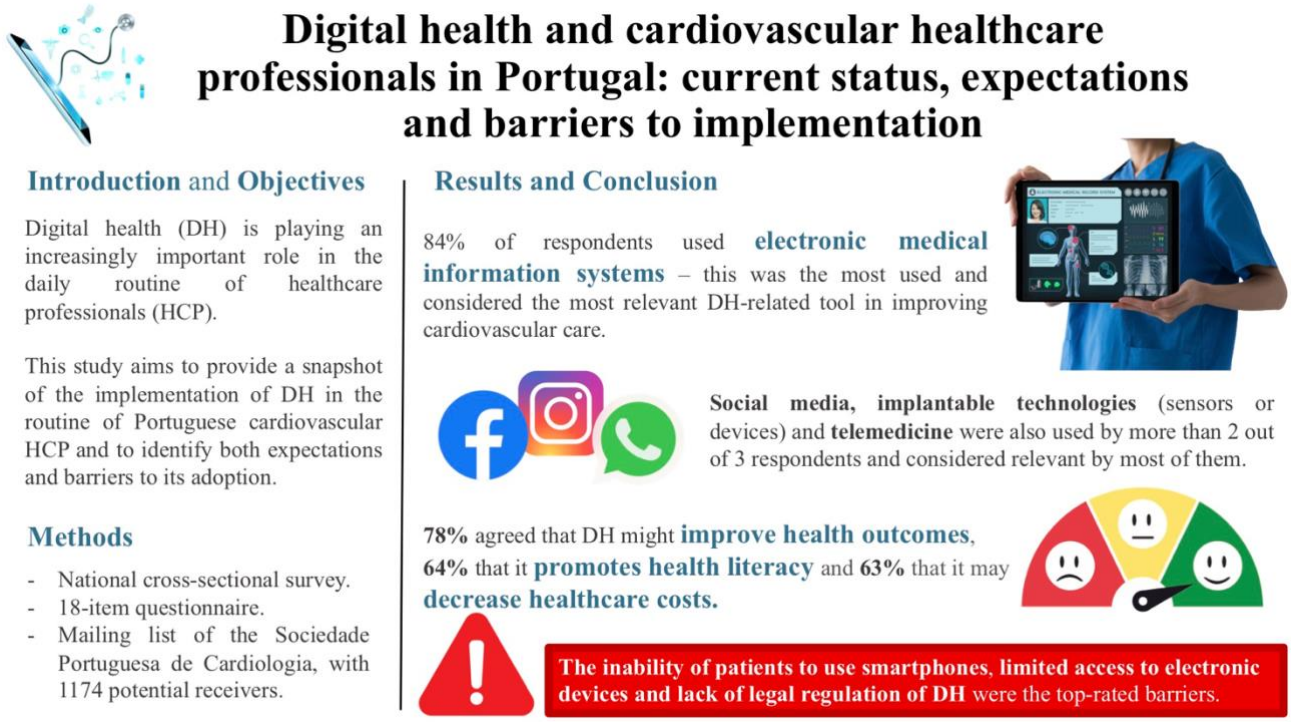


FIGURE 1 - Daily use of digital health tools.

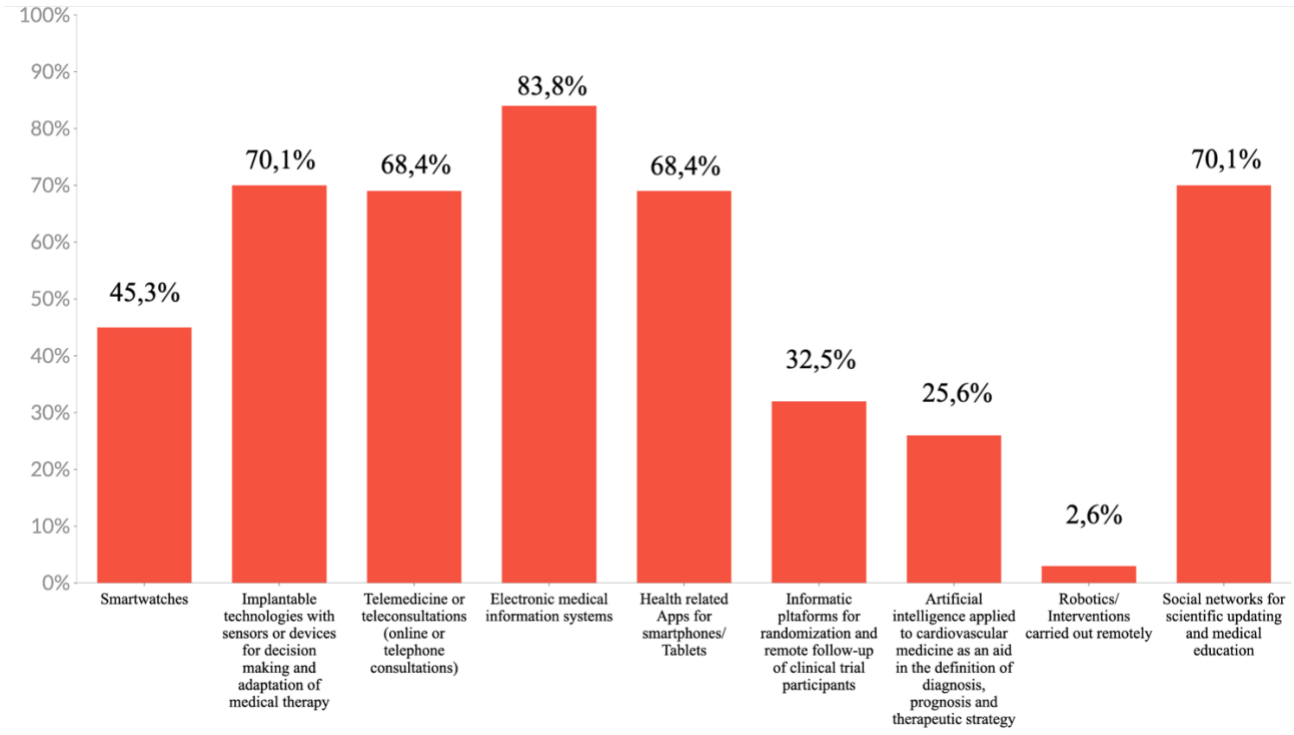


FIGURE 2 - Weighted mean for each of the following DH related tools/applications relevance in improving cardiovascular healthcare.

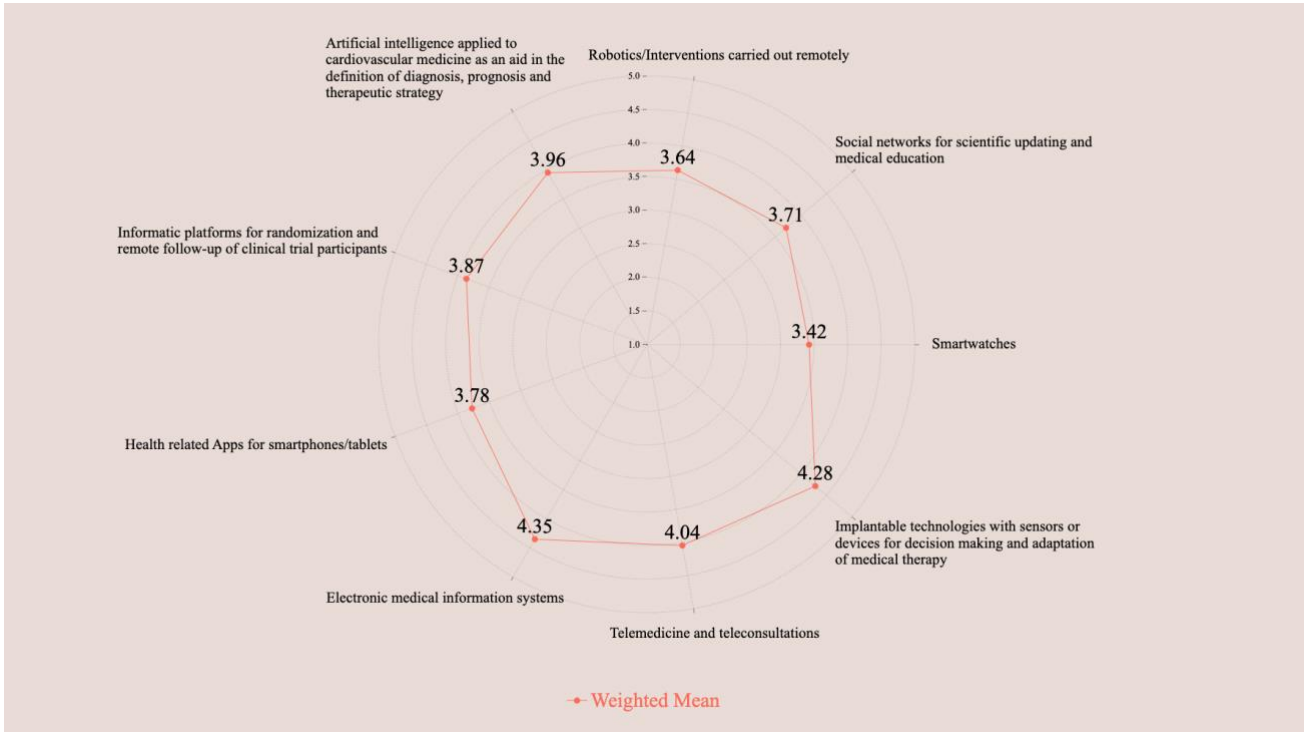
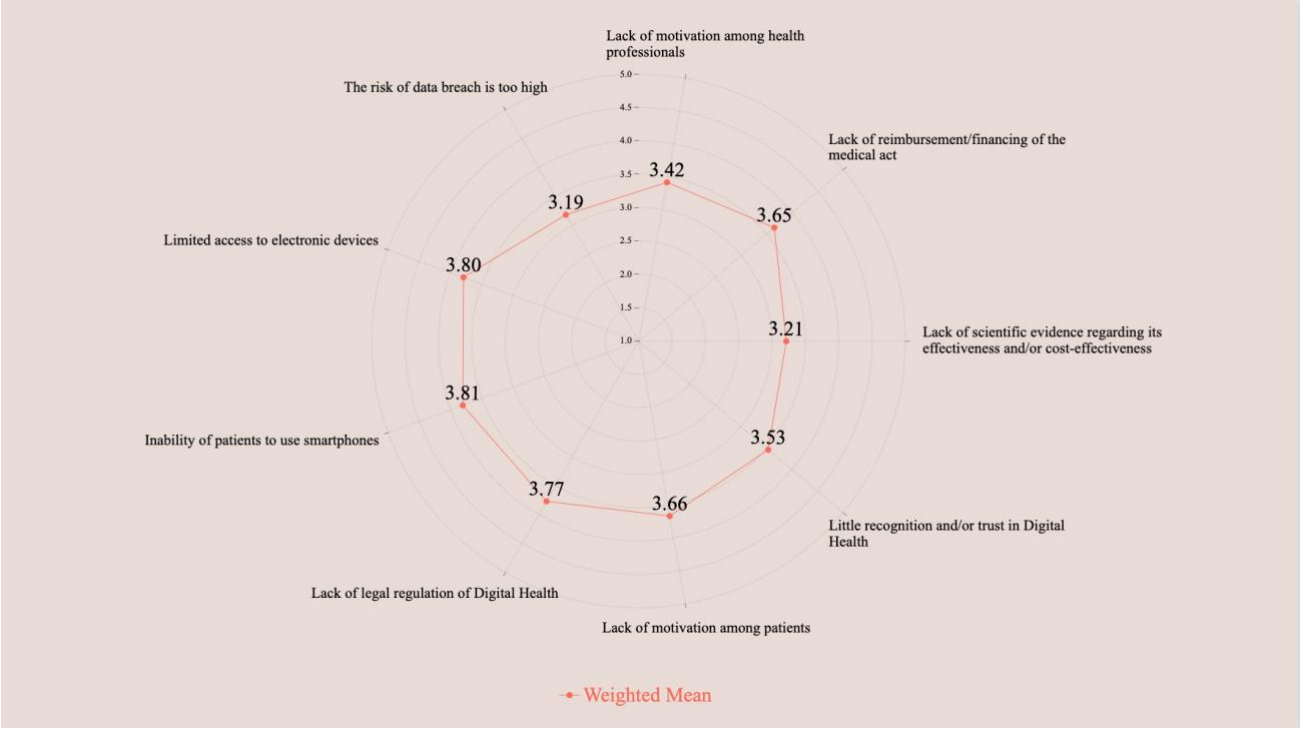


FIGURE 3 - Weighted mean of each of the following factors' contribution to the difficulty in the implementation of Digital Health applications/tools in clinical practice.



SUPPLEMENTARY MATERIAL: QUESTIONNAIRE

A Saúde Digital está presente no dia-a-dia de todos os profissionais de saúde cardiovascular e ouvimos falar dela cada vez mais. Mas será que sabemos o que é? Será que já somos utilizadores de ferramentas digitais relacionadas com a saúde/doença cardiovascular e não sabemos?

O presente inquérito foi elaborado pelo Grupo de Estudo de Saúde Digital da Sociedade Portuguesa de Cardiologia e destina-se a todos os profissionais de saúde cardiovascular em Portugal. Pretende fazer o diagnóstico nacional da relação entre a saúde digital e a medicina cardiovascular, com o objetivo de criar linhas de ação para os próximos anos que permitam ultrapassar barreiras e promover todas as suas potencialidades.

O questionário é de resposta rápida (aproximadamente 5 minutos).

Agradecemos desde já sua colaboração.

1. What is your gender?
    - Female
    - Male

2. How old are you?
    - <30
    - 30-40
    - 40-50
    - 50-60
    - 60-70
    - 70+

3. Professional group:
    - Doctor in residency program
    - Specialized doctor
    - Nurse
    - Cardiopneumology/Clinical Physiology Technician
    - Radiology/Medical Image and Radiotherapy Technician
    - Investigator
    - Other
        - Which one: _____

4. If you are a doctor, what is your Specialty (either intern or specialized)?
    - Cardiology
    - Pediatric Cardiology

- Cardiothoracic surgery
- Vascular surgery
- Internal Medicine
- General and Family Medicine
- Neurology
- Nephrology
- Endocrinology
- Other
    - Which one: _____

5. In what type of Health Institution do you work?
    - Public university hospital
    - Public hospital
    - Private Hospital
    - Primary health care center
    - University
    - Other
        - Which one: _____

5.1 Region
- Alentejo
- Algarve
- Centro
- Lisboa e Vale do Tejo
- Norte
- Madeira
- Açores

6. Do you have a smartphone?
    - Yes
    - No

7. Do you have a smartwatch?
    - Yes
    - No

8. Do you have a portable computer?
    - Yes
    - No

9. Do you have a *tablet*?
    - Yes
    - No

10. How do you classify your knowledge about Digital Health?

    - Excellent
    - Good
    - Average
    - Weak
    - Absent

11. What is the definition of Digital Health that you consider the most appropriate?

    - Digital Health is the use of Artificial Intelligence to simulate a pattern of certain diseases, increase knowledge and improve teaching possibilities;
    - Digital Health is the use of electronic devices for the assessment and recording of biological parameters in a medical setting;
    - Digital Health is the use of information and communication technologies to treat patients, conduct research, educate health professionals, screen for disease, and monitor public health;
    - Digital Health is the use of electronic data collected for epidemiological, administrative, and research purposes;
    - Don't know

12. In your day-to-day clinical practice do you participate in any projects related to digital health?
    - Yes
    - No

13. Are you aware of any digital health related project/initiative taking place in the institution where you work?
    - Yes
    - No

14. In your personal and professional daily life, do you have contact with the following applications/tools related to Digital Health?

	1	2	3	4	5
Smartwatches.					
Implantable technologies with sensors or devices for decision making and adaptation of medical therapy (e.g., blood glucose monitors, implantable heart rate monitors, etc.).					
Telemedicine and teleconsultations (online or telephone consultations).					
Electronic medical information systems (electronic health records, medical decision support platforms, clinical and institutional monitoring).					
Health related Apps for smartphones/tablets.					
Informatics platforms for randomization and remote follow-up of clinical trial participants.					
Artificial intelligence applied to cardiovascular medicine as an aid in the definition of diagnosis, prognosis and therapeutic strategy.					
Robotics/Interventions carried out remotely.					
Social networks for scientific updating and medical education.					

15. How relevant are each of the following Digital Health related applications/tools to improving cardiovascular healthcare? (1=not at all relevant, 2 - not very relevant, 3 - neutral, 4 - very relevant, 5 – totally relevant)

	SIM	NÃO
Smartwatches.		
Implantable technologies with sensors or devices for decision making and adaptation of medical therapy (e.g., blood glucose monitors, implantable heart rate monitors, etc.).		
Telemedicine and teleconsultations (online or telephone consultations).		
Electronic medical information systems (electronic health records, medical decision support platforms, clinical and institutional monitoring).		
Health related Apps for smartphones/tablets.		
Informatic platforms for randomization and remote follow-up of clinical trial participants.		
Artificial intelligence applied to cardiovascular medicine as an aid in the definition of diagnosis, prognosis and therapeutic strategy.		
Robotics/Interventions carried out remotely.		
Social networks for scientific updating and medical education.		

16. Do you consider that the pandemic of COVID-19 has contributed to accelerating the implementation of digital health applications/tools in the clinic?

- Yes
- No

17. The following statements relate to the usefulness of Digital Health. Please indicate your opinion about them (totally or partially agree, neutrality, totally or partially disagree).

	Totally agree	Partially agree	Neutral	Partially disagree	Totally disagree
Digital Health contributes to improving Health outcomes.					
Digital Health decreases Healthcare costs.					
Digital Health increases patient satisfaction.					
Digital Health contributes to improving the health literacy of the population.					
Digital Health threatens the privacy of both doctor and patient.					
Digital Health will increase the workload of healthcare professionals.					

18. What is the contribution of each of the following factors to the difficulty in the implementation of Digital Health applications/tools in clinical practice? (1-not at all relevant; 2-slightly relevant; 3-neutral; 4-very relevant; 5-totally relevant):

	1	2	3	4	5
Lack of scientific evidence regarding its effectiveness and/or cost-effectiveness.					
Little recognition and/or trust in Digital Health					
Lack of legal regulation of Digital Health					
Inability of patients to use smartphones					
Limited access to electronic devices					
The risk of data breach is too high					
Lack of motivation among health professionals					
Lack of motivation among patients					
Lack of reimbursement/financing of the medical act					

REPORTING GUIDELINES - CHECKLIST

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	8
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	8
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	10
Objectives	3	State specific objectives, including any prespecified hypotheses	10
Methods			
Study design	4	Present key elements of study design early in the paper	10
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	10
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	11
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10/11
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	---
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	11
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why.	11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	11
		(*b*) Describe any methods used to examine subgroups and interactions	11
		(*c*) Explain how missing data were addressed	11
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	11
		(*e*) Describe any sensitivity analyses	11
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	---
		(c) Consider use of a flow diagram	---
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11
		(b) Indicate number of participants with missing data for each variable of interest	11
Outcome data	15*	Report numbers of outcome events or summary measures	11/12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	---
		(*b*) Report category boundaries when continuous variables were categorized	---
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	---
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	---
Discussion			

Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13/14
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

REPORTING GUIDELINES – EXAMPLES

1 - "Therefore, this national cross-sectional study aims to provide a snapshot of the implementation of DH in the routine of Portuguese cardiovascular HCP and to identify both expectations and barriers to its adoption (…) Overall, most Portuguese cardiovascular HCP had at least three electronic devices (mostly smartphones, laptops and tablet) and showed positive expectations regarding the current and future impact of DH in cardiovascular medicine. Patient DH literacy and technology adoption, as well as DH regulation, were identified as the most important blockers to increasing the adoption of DH tools in cardiovascular medicine."

2 - "However, information about these issues focusing on Portuguese cardiovascular healthcare professionals (CVHCP) is not available."

3 - "This study aimed to provide a snapshot of the implementation of DH tools in the routine of CVHCP in Portugal, as well as to identify both expectations and barriers to implementation of those tools in clinical practice."

4 – "A digital survey consisting of 18 questions was released in November 2022. The complete survey is available in Appendix A. It was developed and published in Portuguese for this national cross-sectional study, inspired by other questionnaires with similar objectives (8, 9), following the guidelines for designing questionnaires and Checklist for Reporting Results of Internet E-Surveys (CHERRIES) guidelines (12)."

5 – "A digital survey consisting of 18 questions was released in November 2022 (…). The questionnaire was available online for two consecutive weeks and answers were collected anonymously and voluntarily."

6 - "…sent, by e-mail, to the mailing list of the SPC. The mailing list of the SPC had 1174 potential recipients, including doctors, nurses, technicians, and researchers."

7 - "The first part aimed to characterize the profile of each respondent: gender, professional group, institution and region of work. Furthermore, respondents' age category was registered as follows: <30, 30–39, 40–49, 50–59, 60-69 or +70 years. Successively, questions were asked regarding the following topics: i) personal possession of smartphones, smartwatch, tablets and portable computer; ii) self-knowledge about DH and involvement in projects related to this topic; iii) current use of DH and evaluation (in a scale of 1-5) of its relevance in the clinical practice, considering smartwatches, teleconsultations, remote monitoring devices, electronic medic information systems, digital apps related to Health, social media, among other tools; iv) the impact of COVID-19 pandemics in the acceleration of the DH implementation; v) expectations towards DH, subdivided into six statements about possible benefits or drawbacks, to which respondents could totally agree, partially agree, be neutral, partially disagree and fully disagree and vi) perceived barriers to implementation of DH, to which respondents could indicate the level of importance (1, not at all relevant to 5, totally relevant)."

8 - There was only one group, therefore, comparability of assessment methods was not performed.

9 + 10 – "The questionnaire was approved by the Digital Health Study Group of the Portuguese Society of Cardiology (SPC). The first page of the questionnaire provided informed consent. Following its approval, the questionnaire was transferred to a Google Forms webpage and sent, by e-

mail, to the mailing list of the SPC. The mailing list of the SPC had 1174 potential recipients, including doctors, nurses, technicians, and researchers. The questionnaire was available online for two consecutive weeks and answers were collected anonymously and voluntarily. No financial compensation was provided for answering it."

11 + 12 – "Results were calculated with the available answers and presented using descriptive statistics. For questions 15 and 18 (both aiming to characterise the relevance of DH tools as "not at all relevant", "slightly relevant", "neutral", "very relevant" and "totally relevant") a weighted mean was calculated to summarise the overall relevance."

13 – "In total, 117 CVHCP filled out the questionnaire (response rate 10%)."

14 – "Respondents' characteristics are summarised in Table 1. Around 60% of the respondents had >50 years, most of them were medical specialists (63%) and 62% were doctors working in Cardiology (either medical specialty interns or medical specialists). Around three-quarters worked in a public hospital."

15 – "In terms of participation in projects related to DH, 82% of the respondents denied being involved in any and 67% were not aware of any DH-related project/initiative taking place in their place of work. Most respondents (90%) thought that the COVID-19 pandemic had a major impact on the adoption of DH(...) Almost 84% of the responders used electronic medical information systems. More than two-thirds of participants used in their professional activity implantable technologies (sensors and devices), social media networks and mobile apps and telemedicine (…) Around 85% of the participants considered electronic medical information systems (electronic health records, medical decision support platforms, clinical and institutional monitoring) either very relevant or totally relevant; this was considered the most relevant tool, with a weighted mean of 4.35. Implantable technologies with sensors or devices for decision-making and adaptation of medical therapy (e.g., blood glucose monitors, implantable heart rate monitors, etc.) were also very or totally relevant for 85% of the respondents and had a weighted mean of 4.28. On the other hand, smartwatches were the least believed, with a weighted mean of 3.42(...)A total of 78% respondents agreed (partially or totally) that DH contributes to improving health outcomes. The majority agreed (partially or totally) that DH contributes to improving the health literacy of the population (64%) and that it decreases healthcare costs (63%). Approximately half of the responders (53%) agreed that DH increases patient satisfaction. The results concerning the threat to the privacy of both doctors and patients and the impact on the workload of healthcare professionals were very disperse(…)At least half of the participants categorised the following blockers as "very relevant" or "totally relevant": limited access to electronic devices (65%), inability of patients to use smartphones (62%), lack of legal regulation of DH (60%), lack of motivation among patients (60%), lack of reimbursement/financing of the medical act (56%) and little recognition and/or trust in DH (55%). The weighted mean calculated emphasizes the inability of patients to use smartphones as the most significant barrier (3.81), followed by the limited access to electronic devices (3.80) and lack of legal regulation of DH (3.79)."

16 + 17 – Not applicable because only descriptive statistics was performed.

18 – "The main findings of this study were: i) implantable technologies and electronic medical information systems are the most used and considered to be the most useful tools related to DH; ii) cardiovascular healthcare professionals seem confident that DH contributes to improving health outcomes, reducing healthcare costs and increasing patient satisfaction; iii) serious barriers need to be addressed in order to allow a better usage of DH in routine clinical practice, namely the inability of

patients to use smartphones, limited access to electronic devices, the and the lack of legal regulation of DH."

19 – "One of the limitations of our study is the low response rate (10% of those contacted per email), however similar to other voluntary-based inquiries (29). The fact that the survey was conducted online also represents a limitation. Since DH is tightly connected to technology and internet access, respondents were likely to be more interested and knowledgeable about DH than non-responders. Therefore, results of expectations on DH can be slightly overestimated and concerns on the barriers to implementation of DH underestimated. Not every item of the questionnaire needed to be answered. Therefore, some questions had a higher response rate than others. It is likely that respondents chose not to answer those questions they were not sure about the answer, which could have led to the diverting of the results towards the extremes. In addition, this was a survey conducted in Portugal. Thus, our results can not be generalized to other countries."

20 – "However, only a minority took part in projects related to DH, which is probably associated with the lack of investment in this field (13). Most of the respondents agree that the COVID-19 pandemic had a major impact on the adoption of DH, which is consistent with the existing evidence. In fact, during the COVID-19 pandemic, the adoption of telemedicine consultation increased abruptly in less than a year (14, 15)(...)Undeniably, the Portuguese electronical medical information system and the implantable technologies are widely spread tools, making the performance of CVHCP more effective and efficient (16, 17). Social media were also a very used and top-rated tool, which is in line with the existing evidence: a recent study carried out in 2021 in Portugal also showed that the feeling of CVHCP towards the use of social media and its potential in improving clinical outcomes is very positive (18) (...) This may suggest that there is a certain fear of the "unknown" and doubts regarding the potential of new tools. These tools, less believed by cardiovascular healthcare professionals, can be so just because they are not as established in clinical routine as others are, and not because they are less efficient (19-21) (…)Although evidence about CVHCP's expectations on DH is yet scarcely available, similar results have been shown in other studies. One recent study, published in 2019 in the Netherlands, concluded that cardiologists are optimistic towards DH and most of them also considered it to be clinical beneficial and to improve patient satisfaction and information (8). Another study published earlier in Spain, in 2017, revealed that physicians believed in the usefulness of telemedicine in improving the healthcare systems and that the attitude of CVHCP towards this concept is a facilitating factor for its implementation (11) (...) A systematic review published in 2021 that aimed (among other things) to discuss barriers of the uptake of DH technology in cardiovascular care, reported that "difficult to use technology" was one of the most common patient-level barriers, which is in line with our results (24). Lack of legal clarity, lack of patient motivation and DH literacy skills or limited access to DH care were also concerns identified in a similar study carried out by the European Society of Cardiology, published in 2021 (9). Our survey also supports these findings (…)This could be explained by the vast amount of studies published in the past few years demonstrating DH cost-effectiveness (4, 25, 26), results that were probably not so elucidating when this article was published(…)In the present, DH is rapidly progressing and emerging, driven by technological innovations and the growing request for better and more personalized healthcare. We can expect to see in the future further integration of digital tools into healthcare, as well as an increased emphasis on using data to improve healthcare outcomes and the patient experience (27). Our study proves that CVHCP have a positive attitude towards the future of DH and are, in general, confident on its potential. Nevertheless, some important blockers need to be overcome to allow this transformation."

21 – "In addition, this was a survey conducted in Portugal. Thus, our results can not be generalized to other countries."

22- “The authors would like to acknowledge all the respondents who answered this survey for making this study possible.”

INSTRUCTIONS FOR AUTHORS

REVISTA PORTUGUESA DE CARDIOLOGIA

AUTHOR INFORMATION PACK

TABLE OF CONTENTS

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DESCRIPTION

The *Portuguese Journal of Cardiology*, the official journal of the Portuguese Society of Cardiology, was founded in 1982 with the aim of keeping Portuguese cardiologists informed through the publication of scientific articles on areas such as arrhythmology and electrophysiology, cardiovascular surgery, intensive care, coronary artery disease, cardiovascular imaging, hypertension, heart failure and cardiovascular prevention. The Journal is a monthly publication with high standards of quality in terms of scientific content and production. Since 1999 it has been published in English as well as Portuguese, which has widened its readership abroad. It is distributed to all members of the Portuguese Societies of Cardiology, Internal Medicine, Pneumology and Cardiothoracic Surgery, as well as to leading non-Portuguese cardiologists and to virtually all cardiology societies worldwide. It has been referred in Medline since 1987.

Revista Portuguesa de Cardiologia, órgão oficial da Sociedade Portuguesa de Cardiologia, foi fundada em 1982 com o objectivo de informar e formar os cardiologistas portugueses através da publicação de artigos científicos na área da arritmologia, cirurgia cardíaca, cuidados intensivos, doença coronária, ecocardiografia, electrofisiologia, hipertensão arterial, insuficiência cardíaca, mêtodos de imagem entre outros. Trata-se duma revista mensal de elevada qualidade científica e gráfica, publicada em português e em inglês desde 1999 o que permitiu a sua larga projecção no estrangeiro. É distribuída a todos os sócios da Sociedade Portuguesa de Cardiologia, da Sociedade de Medicina Interna, da Sociedade de Portuguesa de Pneumologia e da Sociedade de Cirurgia Cardiotorácica, bem como a cardiologistas estrangeiros de renome internacional e a quase todas as sociedades congéneres do mundo. É referenciada desde 1987 na Medline e posteriormente no Índex Copernicus.

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ABSTRACTING AND INDEXING

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INTRODUCTION

The Portuguese Journal of Cardiology, the official journal of the Portuguese Society of Cardiology, was founded in 1982 with the aim of updating cardiologists through the publication of scientific articles on areas such as arrhythmology and electrophysiology, cardiovascular surgery, intensive care, coronary artery disease, cardiovascular imaging, hypertension, heart failure and cardiovascular prevention. The Journal is a monthly publication with high standards of quality in terms of scientific content and production. Since 2021 it has been published only in English, which has widened its readership abroad. The only exception is for Clinical Recommendations / Recomendac?es Clinicas, that, if the authors wish, may be submitted in Portuguese.
The abstract and the title must also be submitted in Portuguese.

The Journal accepts the following categories of articles:

Research (Original Investigation and Systematic Reviews with or without Meta-Analysis), Review and Education (Narrative Reviews, Scoping Reviews), Guidelines, Case Reports, Images in Cardiology and Snapshots, Opinion (Current Perspective), Correspondence (Editorial Comment, Letters to the Editor, Research Letter and Observation), Study Protocol, Clinical Recommendations / Recomendac?es Clinicas.(see summary table)

Types of article

Manuscripts submitted for publication should be prepared in accordance with the "Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals" of the International Committee of Medical Journal Editors (ICMJE). This document is available at http://www.icmje.org/recommendations/.

Summary table of *Revista Portuguesa de Cardiologia* types of articles characteristics .

Recommended reporting guidelines:
Clinical trials: For a clinical trials, use the CONSORT checklist and also include a structured abstract that follows the CONSORT extension for abstract checklist, the CONSORT flowchart and, where applicable, the appropriate CONSORT extension statements (for example, for cluster RCTs, pragmatic trials, etc.). A completed TIDieR checklist is also helpful as this helps to ensure that trial interventions are fully described in ways that are reproducible, usable by other clinicians, and clear enough for systematic reviewers and guideline writers.
Systematic reviews and meta-analysis: For systematic reviews or meta-analysis of randomised trials and other evaluation studies, use the PRISMA checklist and flowchart and use the PRISMA structured abstract checklist when writing the structured abstract.
Diagnostic accuracy: STARD checklist and flowchart
Observational studies: For observational studies, use the STROBE checklist and any appropriate extension STROBE extensions.
Genetic risk prediction: GRIPS guidelines.
Economic evaluation studies: CHEERS guideline
Study protocols: SPIRIT or PRISMA-P
Case reports: CARE

Original Investigation

Original Investigation articles (original articles) cover areas of clinical or basic research: Clinical trial, Systematic Reviews with or without Meta-Analysis, Intervention study, Cohort study, Case-control study, Epidemiologic assessment, Survey with high response rate, Cost-effectiveness analysis, Decision analysis, Study of screening and diagnostic tests, Other observational studies. They should have a maximum of 4000 words, with a total of up to 10 tables and/or Figures, and should be structured as follows: Abstract (maximum 250 words; divided into Introduction and Objectives, Methods, Results, and Conclusion(s)); 3-10 keywords; Introduction; Objectives; Methods; Results; Discussion; Conclusion(s); Learning points/Take home messages with bullet points (maximum 100 words) Acknowledgements, if any; References (up to 50); and figure legends, if any. Follow EQUATOR Reporting Guidelines.

Regarding figures, the original articles should include the Central Picture. See the rules below:

Authors should submit a Central Picture, to appear as a small thumbnail on the first page of the manuscript, in electronic tables of contents, and in our promotional material for the paper.
This can be a new image or a repeat of a figure (or portion of a figure) already in the paper.
The Central Picture should illustrate an important component of the manuscript and its purpose is to provide a memorable visual snapshot of the paper.

The Central Picture must meet the following criteria:
Colour is required. The size is approximately 5 cm high x 3.8 cm wide. Select only a single frame or panel from a multi-frame image. Author photo(s) are not acceptable as Central Picture. Central Picture Legend: The Central Picture must be accompanied by an abbreviated legend not exceeding 90 characters including spaces. Please provide the abbreviated legend in the body of the manuscript (in addition to the text box in the submission process).

Central Message: The Central Message of 200 characters including spaces containing the essence of the manuscript-the main message of the paper. It is not a brief summary of results. Rather, for clinical manuscripts, it is the inference(s) that will be supported by the results. It is often identical to the conclusions of the abstract.The Central Message will be included immediately beneath the title of the paper in the table of contents and on the first page of accepted manuscripts

Optional, but encouraged, if these add educational value to the article:
Graphical abstract: - a concise, visual summary of the main findings of the article, helping readers to quickly understand the findings of the paper and its relevance to them.Video abstract- a short video summary of the article (2-3 minutes total). Please provide a transcript of your video script, ideally prior to filming, so this can be peer reviewed alongside the article.Tweetable abstract-a tweetable abstract for the Journal Editor to use when sharing the article via social media, summarizing the key message of the article and including any relevant hashtags. Tweets can be up to a maximum of 280 characters, however ~200 characters is recomendable.

Systematic Reviews with or without Meta-Analysis: must be structured as Introduction, Methods, Results, Discussion and Conclusion(s). The subject should be clearly defined. The objective of a systematic review should be to produce an evidence-based conclusion. The Methods should give a clear indication of the literature search strategy, data extraction, grading of evidence and analysis. Systematic Reviews should not normally exceed 4000 words, with a total of up to 6 tables and/or figures and up to 100 references.

Authors are strongly recommended to consult the PRISMA statement (http://www.prisma-statement.org/), which is intended to help improve the reporting of systematic reviews and meta-analyses. We encourage authors to develop a systematic review protocol (e.g. following PRISMA-P) and register with PROSPERO.

Review Articles and Scoping Reviews
Review Articles should have a maximum of 5000 words, with a total of up to 15 tables and/or figures, and should be structured as follows: Abstract (maximum 250 words; unstructured); 3-10 keywords; Introduction; thematic sections at the discretion of the authors; Conclusion(s); Acknowledgements, if any; References (up to 75); and figure legends, if any. These articles should also have a Central Picture. The rules are referred above in the section of the Original Articles.

Guidelines
It is recommended to consult the AGREE II instrument for which items should be reported that highlighted particular quality aspects of guideline development. In general, published statements intended to guide clinical care (e.g., guidelines, practice parameters, recommendations, consensus statements and position papers) should describe the clinical problem to be addressed, the mechanism by which the statement was generated, a review of the evidence for the statement (if available), and the statement on practice itself.
To minimize confusion and to enhance transparency, such statements should begin with the following questions, followed by brief comments addressing each question:

What other guideline statements are available on this topic?Why was this guideline developed?How does this statement differ from existing guidelines? Why does this statement differ from existing guidelines?

The statement should have an unstructured abstract of up to 350 words, 3 to 10 keywords and can include up to 4000 words, a total of up to 6 tables and/or figures and up to 100 references.

Case Reports
The Portuguese Journal of Cardiology no longer publishes Case Reports.

Images in Cardiology
Images in Cardiology should have a maximum of 250 words, without Abstract, keywords, up to 2 figures and no tables, or division into sections and up to 5 references may be included.

Current Perspectives
This type of manuscript is submitted upon invitation by the Editorial Board. It may cover a broad diversity of themes focusing on cardiology and healthcare: current or emerging problems, management and health policies, history of medicine, society issues and epidemiology, among others. An author who wishes to propose a manuscript in this section is requested to send an abstract to the Editor-in-Chief including the title and Author list for evaluation. The text should not exceed 1200 words, and up to 10 references, two tables or two figures are allowed. An abstract is not required.

Editorial Comments
Editorials are submitted at the invitation of the Editor. They should not exceed 1000 words and can contain up to 20 references and 1 table and 1 figure. They do not have an Abstract or keywords. A photo of the author is required.

Letters to the Editor
A Letter to the Editor generally takes one of the following forms:
A substantial re-analysis of a previously published article in the Journal will be considered up to 8 weeks after the publication of the article in questionAn article that raises issues of general interest to the broad readership of Revista Portuguese CardiologyA brief report of cases adequate for the journal's scope and of particular interest to the community.
They should not exceed 600 words and can contain up to 5 references and two figures but without Abstract, keywords or tables. They should have no more than 3 authors.

Research or Observation Letter
Research Letters are concise, focused reports of original research or observations consisting of short reports of 1 or 2 complicated, unique cases. These should not exceed 600 words of text and 6 references and may include up to 2 tables or figures. Online supplementary material is not allowed. Research Letters may have no more than 7 authors.

If the patient(s) described in these manuscripts is identifiable, a Patient Permission form must be completed and signed by the patient(s) and submitted with the manuscript. Omitting data or making data less specific to unidentify patients is acceptable but changing any such data is not acceptable.

Study Protocols
A study protocol ("methodology manuscript") describes in detail the plan for conducting a specific clinical study and explains the purpose and function of the study as well as how to carry it out.
Study protocols will be published without peer review if the study receives ethics approval and a grant from a major funding body. Any protocols that do not meet both these criteria will be sent for open external peer review.
Protocol manuscripts should report planned or ongoing research studies. If data collection is complete, we will not consider the manuscript. We encourage the submission of protocol manuscripts at an early stage of the study.
Study Protocols must abide by the following criteria in order to be considered for publication:
Papers must be for proposed or ongoing research and dates must be included in the manuscript. Articles that report work previously completed will not be considered. Study protocols must have ethics approval (if applicable)All considerations must adhere to the following EQUATOR guidelines:

PRISMA-P (Preferred Reporting Items for Systematic review and Meta- Analysis Protocols); SPIRIT (Standard Protocol Items for Randomized Trials)Registration is mandatory for any clinical trial as well as for any systematic review and meta- Analysis Protocols.
Approved registries for clinical trials need to meet all of the ICMJE Clinical Trial Registration guidelines. Trial Registration numbers will need to be included in the abstract.
Word Count:4000 words of text and up to 30 references and up to 3 tables or figures.

Contact details for submission
You can send your manuscript at https://www.editorialmanager.com/repc

Language
This journal is published in Portuguese and in English language.
The title (and abstract and key words if applicable) must be submitted in both English and Portuguese. Articles submitted to the Journal should be clearly written in Portuguese (from Portugal) and/or English of a good standard. Text may be edited to maintain linguistic quality and to conform with standard American English.
ADVANCE NOTICE FOR AUTHORS
Please, take into account that as of January 2021, Revista Portuguesa de Cardiologia will require new article submissions to be written in English language.

Submission checklist
You can use this list to carry out a final check of your submission before you send it to the journal for review. Please check the relevant section in this Guide for Authors for more details.

Ensure that the following items are present:

One author has been designated as the corresponding author with contact details:
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For further information, visit our Support Center.

BEFORE YOU BEGIN

Ethics in publishing
Please see our information on Ethics in publishing.

Studies in humans and animals
If the work involves the use of human subjects, the author should ensure that the work described has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. The manuscript should be in line with the

Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals and aim for the inclusion of representative human populations (sex, age and ethnicity) as per those recommendations. The terms sex and gender should be used correctly.

The privacy rights of human subjects must always be observed. A statement must be included to the effect that the study was conducted in accordance with the amended Declaration of Helsinki, that the local institutional review board or independent ethics committee approved the protocol, and that written informed consent was obtained from all patients. The name of the committee, the name of the chairperson of the committee (or the person who approved the protocol), the date of approval and the approval number should follow this statement in the Methods section. For multicenter studies, a list of the relevant approvals may be provided in a separate document to be published as supplementary material.

All animal experiments should comply with the ARRIVE guidelines and should be carried out in accordance with the U.K. Animals (Scientific Procedures) Act, 1986 and associated guidelines, EU Directive 2010/63/EU for animal experiments, or the National Institutes of Health guide for the care and use of Laboratory animals (NIH Publications No. 8023, revised 1978) and the authors should clearly indicate in the manuscript that such guidelines have been followed. The sex of animals must be indicated, and where appropriate, the influence (or association) of sex on the results of the study.

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Studies on patients or volunteers require ethics committee approval and informed consent, which should be documented in the paper. Appropriate consents, permissions and releases must be obtained where an author wishes to include patient descriptions, photographs, video, and pedigrees of patients and any other individuals (parents or legal guardians for minors) who can be identified (including by the patients themselves) in such patient descriptions, photographs, video, and pedigrees. Written consents must be retained by the author but copies should not be provided to the journal. Only if specifically requested by the journal in exceptional circumstances (for example if a legal issue arises) the author must provide copies of the consents or evidence that such consents have been obtained. For more information, please review the Elsevier Policy on the Use of Images or Personal Information of Patients or other Individuals. Unless you have written permission from the patient (or, where applicable, the next of kin), the personal details of any patient included in any part of the article and in any supplementary materials (including all illustrations and videos) must be removed before submission.

Patient Identification

Omitting data or making data less specific to deidentify patients is acceptable, but changing any such data is not acceptable. Only those details essential for understanding and interpreting a specific case report or case series should be provided. Although the degree of specificity needed will depend on the context of what is being reported, specific ages, race/ethnicity, and other sociodemographic details should be presented only if clinically or scientifically relevant and important. Cropping of photographs to remove identifiable personal features that are not essential to the clinical message may be permitted as long as the photographs are not otherwise altered. Please do not submit masked photographs of patients. Patients' initials or other personal identifiers must not appear in an image.

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Authors must disclose any interests in two places:
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Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content. One or more authors should take responsibility for the integrity of the work as a whole, from inception to published article. According to the guidelines of the International Committee of Medical Journal Editors (ICMJE), authorship credit should be based on the following 4 criteria:

1. substantial contributions to conception or design of the work, or the acquisition, analysis, or interpretation of data for the work; and
2. drafting of the work or revising it critically for important intellectual content; and
3. final approval of the version to be published; and
4. agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Changes to authorship. Role of the corresponding author

A single corresponding author (or coauthor designee in the event that the corresponding author is unavailable) will serve on behalf of all coauthors as the primary correspondent with the editorial office during the submission and review process. If the manuscript is accepted, the corresponding author will review an edited manuscript and proof, make decisions regarding release of information in the manuscript to the news media or federal agencies, handle all postpublication communications and inquiries, and will be identified as the corresponding author in the published article. The corresponding author also is responsible for ensuring that the Acknowledgment section of the manuscript is complete and that the conflict of interest disclosures reported of the manuscript are accurate, up-to-date, and consistent with the information provided in each author's potential conflicts of interest section in the Authorship Form.

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Only in exceptional circumstances will the Editor consider the addition, deletion or rearrangement of authors **after** the manuscript has been accepted. While the Editor considers the request, publication of the manuscript will be suspended. If the manuscript has already been published in an online issue, any requests approved by the Editor will result in a corrigendum.

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In line with the position of the International Committee of Medical Journal Editors, the journal will not consider results posted in the same clinical trials registry in which primary registration resides to be prior publication if the results posted are presented in the form of a brief structured (less than 500 words) abstract or table. However, divulging results in other circumstances (e.g., investors' meetings) is discouraged and may jeopardise consideration of the manuscript. Authors should fully disclose all posting in registries of results of the same or closely related work.

Reporting clinical trials
The ICMJE defines a clinical trial as any research project that prospectively assigns human participants to intervention or comparison groups to study the cause-and-effect relationship between an intervention and a health outcome. Interventions include but are not limited to drugs, surgical procedures, devices, behavioral treatments, educational programs, dietary interventions, quality improvement interventions, process-of-care changes, and the like.

All manuscripts reporting clinical trials, including those limited to secondary exploratory or post hoc analysis of trial outcomes, must include the following: CONSORT flow diagram
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In concert with the ICMJE, our journal requires, as a condition of consideration for publication, registration of all trials in a public trials registry that is acceptable to the ICMJE (ie, the registry must be owned by a not-for-profit entity, be publicly accessible, and require the minimum registration data set as described by ICMJE).

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isrctn.org
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PREPARATION

Peer review

This journal operates a rigorous single blind peer review process, in which manuscripts are sent to external reviewers selected from an extensive database. All contributions will be initially assessed by the editor for suitability for the journal. Papers deemed suitable are then typically sent to a minimum of two independent expert reviewers to assess the scientific quality of the paper. The Editor is responsible for the final decision regarding acceptance or rejection of articles. The Editor's decision is final. More information on types of peer review.

Peer reviewers will respond to the Editor within 30 days recommending acceptance, revision or rejection. The Editor will decide within 10 days whether to accept the manuscript without modification, to send the reviewers? comments to the authors for modification, or to reject it. When modifications are proposed, the authors have 30 days (which can be extended on request) to submit a revised version of the manuscript, incorporating the comments of the reviewers and the Editor. Any amendments should be highlighted in a different colour. The Editor will decide within 10 days whether to accept the new version, reject it, or send it for further review by one or more reviewers.

Letters to the Editor and Editorials will be reviewed by the Editorial Board, but external peer review may also be requested.

Use of word processing software
It is important that the file be saved in the native format of the word processor used. The text should be in single-column format. Keep the layout of the text as simple as possible. Most formatting codes will be removed and replaced on processing the article. In particular, do not use the word processor's options to justify text or to hyphenate words. However, do use bold face, italics, subscripts, superscripts etc. When preparing tables, if you are using a table grid, use only one grid for each individual table and not a grid for each row. If no grid is used, use tabs, not spaces, to align columns. The electronic text should be prepared in a way very similar to that of conventional manuscripts (see also the Guide to Publishing with Elsevier). Note that source files of figures, tables and text graphics will be required whether or not you embed your figures in the text. See also the section on Electronic artwork.
To avoid unnecessary errors you are strongly advised to use the 'spell-check' and 'grammar-check' functions of your word processor.

Article structure

Subdivision
Divide your article into clearly defined sections. Each subsection is given a brief heading. Each heading should appear on its own separate line. Subsections should be used as much as possible when cross-referencing text: refer to the subsection by heading as opposed to simply 'the text'. Use generic names of drugs (first letter: lowercase) whenever possible. Registered trade names (first letter: uppercase) should be marked with the superscript registration symbol ? or ? when they are first mentioned.

The Journal recommends the guidelines for publication of the EQUATOR network (http://www.equator-network.org), including the CONSORT statement and its extensions for randomized trials (http://www.consort-statement.org/), STROBE for observational (cohort, case-control and cross-sectional) studies (http://www.strobe-statement.org/), STARD for diagnostic accuracy studies (http://www.stard-statement.org/), PRISMA for systematic reviews and meta-analyses (http://www.prisma-statement.org/), SQUIRE for quality improvement studies (http://www.squire-statement.org/) and CARE for case reports (http://www.care-statement.org/). Reporting of the statistical aspects of studies should be in accordance with the Statistical Analyses and Methods in the Published Literature (SAMPL) guidelines (http://www.equator-network.org/reporting-guidelines/sampl/).

Introduction
State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

Material and methods
Provide sufficient details to allow the work to be reproduced by an independent researcher. Methods that are already published should be summarized, and indicated by a reference. If quoting directly from a previously published method, use quotation marks and also cite the source. Any modifications to existing methods should also be described.

Results
Results should be clear and concise.

Discussion
This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

Conclusions
The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

Cover letter and Essential title page information

Submission of an article must include a cover letter with the following information:
a brief description of the article's significance and/or interest; a declaration of originality, specifying that none of the paper's contents have been published or are under consideration elsewhere; a declaration that all authors have read and approved the manuscript; a full disclosure of any potential conflict of interest for any of the authors; and which manuscript type is being submitted for publication.
Title page must contain the following information:

Title. Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible. Preferably not exceed 12 words. It may also include a subtitle of up to 4 words. All nouns, adjectives and verbs in the title and subtitle must begin with a capital letter.

Author names and affiliations. Please clearly indicate the given name(s) and family name(s) of each author and check that all names are accurately spelled. You can add your name between parentheses in your own script behind the English transliteration. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.

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Word count of the manuscript text.

Structured abstract

A structured abstract, by means of appropriate headings, should provide the context or background for the research and should state its purpose, basic procedures (selection of study subjects or laboratory animals, observational and analytical methods), main findings (giving specific effect sizes and their statistical significance, if possible), and principal conclusions. It should emphasize new and important aspects of the study or observations.

Abstracts for all article types should not contain any references. Abbreviations should be avoided or kept to a minimum.

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