BRIEF REPORT

Concerns on digital health from a cardiac implantable electrical device remote monitoring clinic perspective: results from an international survey

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Introduction

In the past decade, there has been an exponential rise in patient utilization of digital health applications.[1] Digital health is an umbrella encompassing the digital transformation of healthcare.[1] Mobile health (mHealth) is a subgroup which is defined as all medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, and other wireless devices.[1] A significant proportion of mHealth applications are focused on rhythm monitoring and analysis of heart rate as marker of wellness. Because mHealth also includes remote monitoring (RM) of patients with cardiac implantable electronic devices (CIEDs), the workload associated with other mHealth applications intuitively flow toward the RM CIED clinics. While care pathways for RM of patients with CIEDs are generally well defined, the CIED clinics are already burdened by an increasing workload.[2,3] The question arises how the additional workload associated with wearables, mHealth, and other digital health applications is perceived when their workflows and reimbursement models have not yet been established for these technologies.

A recent survey, supported by the Heart Rhythm Society Digital Health Committee,[4] included questions about current experiences and concerns of wearable technologies and digital health applications.

KEYWORDS Digital Health; Wearables; Remote monitoring; Cardiac implantable electronic devices; Device clinic (Heart Rhythm O^2 2024;5:479–482)

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Methods

Survey design and study population

The survey, distributed to the Heart Rhythm Society global network using the SurveyMonkey platform on December 8, 2022, was part of a qualitative improvement initiative by the Heart Rhythm Society Digital Health Committee. The details and main results of the survey were presented in a separate manuscript.[4] The survey comprised 40 questions on a variety of topics, including qualitative questions on their current experience with wearables and digital health in the RM CIED clinic. The latter included ranking questions with predefined responses about major concerns regarding wearables and digital health, and a question gauging the current impact of digital health on clinical practice. Informed consent was provided electronically prior to proceeding to the survey. The survey targeted all CIED clinic staff, including both physicians and allied professionals. Complete and analyzable responses submitted by December 31, 2022, are presented in the current analysis. Ethical approval was not required, but the research adheres to the Declaration of Helsinki.

Statistical analysis

Categorical variables are presented as number and percentage. Continuous variables were presented as median and interquartile range (IQR), as all continuous variables showed a non-normal distribution using the Kolmogorov-Smirnov test. The results of the ranking question are ordered from most important to least important based on the median rank and the frequency that a response was ranked as first or second most important concern. Subsequently, results are presented in a violin plot. Statistical analyses were performed using Stata version 17 (StataCorp LLC) and SPSS version 29 (IBM).

https://doi.org/10.1016/j.hroo.2024.06.001

KEY FINDINGS

- In this international survey on concerns on digital health from a cardiac implantable electrical device perspective, data deluge was reported as the most important concern with wearables and digital health in clinical practice. The lack of a billing workflow and difficulty in analyzing wearable tracings were ranked second and third most important concerns, respectively.
- Half of the respondents (50.2%) stated that digital health devices improved patient care, but 73.1% of the respondents reported that digital health devices also increased their workload.
- Contemporary cardiac implantable electronic device clinics are insufficiently prepared for the increasing workload when adding digital health devices and wearables technologies to their responsibilities. To guarantee a successful incorporation of digital health into clinical practice, structural and organizational improvements are urgently needed.

Results

Respondent characteristics

A total of 548 responses were received. After excluding incomplete responses (n = 204), responses from industry (n = 2), and third-party RM services (n = 3), a total of 339 analyzable responses from 302 unique centers in 47 different countries remained. The questions on wearables and digital health had 276 respondents from 249 unique centers. Details on the characteristics and origin of available responses are presented in Table 1.

Table 1 Characteristics on survey respondents

CIED clinic role (n = 276)	
Adult electrophysiologist	144 (52.2)
Pediatric electrophysiologist	11 (4.0)
Nurse practitioner	22 (8.0)
Nurse	51 (18.5)
Physician assistant	10 (3.6)
Other	48 (13.8)
Continent (n = 276)	
Asia	28 (10.1)
Europe	65 (23.6)
Central South America	10 (3.6)
North America	166 (60.1)
Africa	3 (1.1)
Oceania	4 (1.4)
CIED clinic type (n = 276)	
Hospital based	174 (63.0)
Office based	102 (37.0)
Clinic funding (n = 270)	
No funding	66 (24.4)
Per patient payment	170 (63.0)
Global budget	34 (12.6)
Use of third-party RM service (n = 273)	46 (16.8)
CIED clinic hours of operation (n = 265)	
Business hours access to staff	200 (75.5)
24/7 access to staff	65 (24.5)
Number of implanters in center (n = 274)	4 (3–6)
Number of CIED patients followed per year (n = 272)	2400 (750–4725)
Percentage of CIED patients on RM (n = 265), %	80 (40–90)
Staff-to-patient ratio (n = 208)	750 (500–120)

Values are n (%) or median (interquartile range).
CIED = cardiac implantable electronic device; RM = remote monitoring.

Major concerns on wearables and digital health in clinical practice

A total of 177 (64.1%) respondents deemed their staff knowledgeable about commercial wearable and digital health devices. The median time spent each week on reading, uploading, processing, and discussing the results from wearables and digital health devices was 1.0 hour (IQR, 0.5–3.0 hours). Data deluge was reported as the most important concern with wearables and digital health in clinical practice (Figure 1). The lack of a billing workflow and difficulty in analyzing wearable tracings were ranked second and third most important concerns, respectively, followed by uploading digital health reports to the electronic medical record, the frequency of data transmissions by patients, and the difficulty in understanding the different wearable platforms. The lack of centralized databases and reading platforms for wearables and digital health devices, the incorrect diagnosis of tracing, and patient education and counseling in the use of wearables were reported least important.

When responses on the impact of digital health on clinical practice are combined (Figure 2), half of the respondents (50.2%) stated that digital health devices improved patient care, but 73.1% of the respondents reported that digital health devices also increased their workload. While only 4.7% of the respondents stated that digital health devices improved patient care with equal or decreased workload, 22.6% of respondents reported that digital health devices increased the workload while resulting in equal patient care.

Discussion

The results of this international survey illustrate that contemporary CIED clinics perceive major concerns to tackle the additional burden of data resulting from the increasing use of wearable technology and digital health applications. Several organizational and structural barriers are standing in the way of a successful implementation of digital health in RM.

First and foremost, the lack of reimbursement by health insurances and governments limits the use of digital health applications to patients who are willing to purchase the technology out of their own pocket. This induces socioeconomic disparities and digital health inequity, which is already reflected in systematic reviews, as this often results in a low-risk population.[5,6] Studies should target intermediate and high-risk populations to establish the clinical benefit of

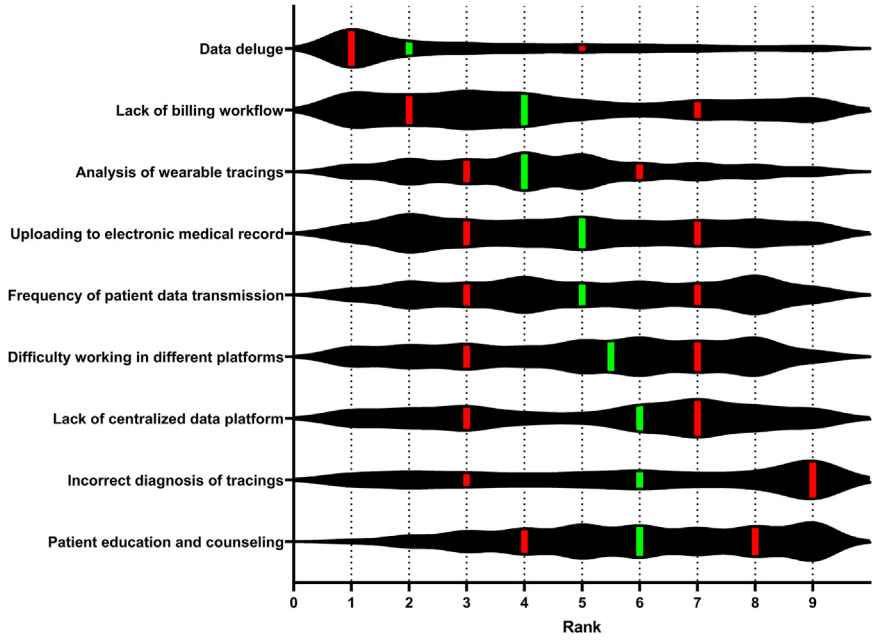

Figure 1 Violin plot of major concerns with wearables and digital health technology ranked most important to least important. The width of the violin plot corresponds to the frequency the corresponding rank was selected. Bars illustrating the median (green) and quartiles (quartiles 1 and 3, red) were added.

digital health applications prior to deciding which applications merit reimbursement.

Second, data workflow and interoperability of different digital health applications, including the electronic medical record and universal data platforms, are urgently needed to improve the nonclinical burden of interpretating results of digital health applications.

Last, as digital health is becoming an essential part of the future of healthcare, it should be recommended to include digital health literacy in the training of medical and allied health professionals. Unfortunately, a recent European survey showed that digital health–related formats are currently lacking during medical education, while students were eager to learn.[7] This would not only include analysis and interpretation of the results, but also provide the essentials on interpreting performance and generalizability of digital health applications.

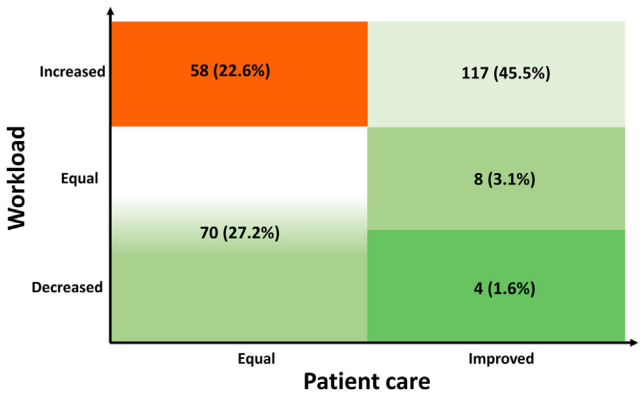

Figure 2 Contemporary impact of digital health on clinical practice.

Conclusion

Contemporary CIED clinics report significant concerns regarding the increased workload associated with incorporating digital health devices and wearable technologies into their responsibilities. To ensure the successful integration of digital health into clinical practice, urgent structural and organizational improvements are necessary. Given that the digital health revolution spans all areas of cardiovascular medicine, it is imperative for various disciplines to collaborate, with support from physicians, allied health professionals, and healthcare advocacy groups, to manage the escalating workload effectively.

Funding Sources: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Disclosures: Elaine Y. Wan has received grant support from the National Institutes of Health (R01HL152236); and served as a consultant for Boston Scientific, Abbott, and Zoll. Sanjiv M. Narayan has received grant support from the National Institutes of Health (R01HL149134 and R01HL83359); served as a consultant for UpToDate and TDK; and contributed to intellectual property owned by University of California Regents and Stanford University. Satish R. Raj has served as a consultant for Lundbeck LLC, Theravance Biopharma, Amneal Pharma, Servier Affaires Médicales, Regeneron, argenx BV, Antag Pharma, and STAT. The remaining authors disclose no conflicts.

Authorship: All authors attest they meet the current ICMJE criteria for authorship.

Patient Consent: Informed consent was provided electronically prior to proceeding to the survey.

Ethics Statement: Ethical approval was not required, but the research adheres to the Declaration of Helsinki.

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