

Point-of-care testing, your cardiologist, and affairs of the heart



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BACKGROUND Point-of-care testing (POCT) has applications across medical specialties and holds promise to improve patient care. While cardiovascular medicine has been attractive for POCT applications in recent years, little is known about how cardiovascular health professionals perceive them.

OBJECTIVE The objective of our study was to examine differences in perceptions and attitudes towards POCTs between cardiovascular health professionals compared to other healthcare professionals.

METHODS We surveyed healthcare professionals to assess perceptions of POCT usage and their benefits and concerns between October 2019 and March 2020. Questions regarding POCT perceptions were assessed on a 5-point Likert scale.

RESULTS We received a total of 148 survey responses; of the responders, 52% were male, 59% were physicians, and 50% worked in a hospital setting. We found that cardiology professionals were

less likely, compared to other specialties, to view POCTs as improving patient management or reducing errors. These cardiology professionals were not constrained by resources or a lack of investment opportunities to implement these technologies.

CONCLUSION This study provides a better understanding of perceptions about POCTs among healthcare specialists. To improve patient outcomes through the adoption and usage of POCTs, greater collaboration is advised among key industry and healthcare stakeholders.

KEYWORDS Cardiovascular medicine; Healthcare professional; Medical devices; Point-of-care; Technologies

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Introduction

Point-of-care tests (POCTs) are rapid diagnostics that can be performed at the point of care in a clinic or home setting instead of in a conventional central laboratory (examples of these tests include blood glucose, blood pressure, electrocardiogram, and carbon monoxide breath tests). POCT results are often available rapidly, thereby aiding with diagnosing a disease or monitoring responses to diagnostic maneuvers or therapeutic interventions. POCTs are changing the contemporary landscape of medical practice and have enabled diagnostic and management options for a growing

number of important conditions, including diabetes, infectious diseases, hypertension, and other cardiovascular diseases.^{1,2} Cardiovascular healthcare professionals frequently include POCTs in their clinical practices.^{1,3}

The advantages of delivering real-time results, informing appropriate follow-up care, and monitoring disease progression have been more widely appreciated during the COVID-19 pandemic. Although the diagnosis of SARS-CoV-2 itself highlights the demand for rapid results through POCTs, it also illustrates the deficiencies of centralized healthcare systems. Fear of exposure to SARS-CoV-2 has affected the rates of healthcare engagement and routine care visits, as evidenced by a decrease in cancer diagnoses and cardiac catheterizations as well as clinical trial enrollment and participation.⁴⁻⁶ The advantages of updating the

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KEY FINDINGS

- There is great need among healthcare professionals to use POCTs to help diagnose and manage/monitor cardiovascular diseases.
- Compared to other healthcare professionals, those working in the field of cardiology had more concerns about the benefits of POCTs.
- Fewer cardiology healthcare professionals thought that POCTs improved patient management, reduced medical error and enabled more effective treatment.
- In terms of access to resources to adopt new technologies, such as POCTs, cardiology professionals, compared to other healthcare specialists, noted having fewer constraints of resources.

infrastructures of medicine to better meet the needs of patients are widely appreciated. POCTs may contribute to closing this healthcare delivery gap.

Although use of POCTs in medical settings has increased over the years, their perceived utility and adoption among healthcare professionals and stakeholders has not been carefully assessed and are not well understood.⁷ To fill this gap in the research, a cooperation among development professionals, engineers, research and development teams, marketing strategists, and healthcare providers is needed. We studied healthcare professional opinions about POCTs and compare responses from those in cardiovascular medicine to other healthcare professionals.

Methods

Study design and participants

We selected a diverse group of participants with expertise based on their specialties in healthcare, which included clinicians, researchers, and device developers. All survey invitations were distributed via email. Potential respondents were identified from 16 internal and external email directories (the total of number of people reached via these directories is unknown). Personalized emails were also sent to 171 individuals identified through targeted searches using National Institutes of Health (NIH) Reporter (<https://projectreporter.nih.gov/reporter.cfm>) or Profiles (<https://profiles.umassmed.edu/search/>) / Direct2Experts (<http://direct2experts.org/>). For NIH Reporter, we identified National Heart, Lung, and Blood Institute (NHLBI)– and National Center for Complementary and Integrative Health–funded investigators from 2016 to the present using the keyword “point of care.” For Profiles and Direct2Experts, we searched using “point of care,” “point of care heart,” “point of care lung,” “point of care blood,” and “point of care sleep.” We recruited survey participants during outreach efforts at the Healthcare Innovations and Point-of-Care Technologies Conference, held in November 2019 in Bethesda, Maryland, and by a LinkedIn

invitation post. The survey officially launched in October 2019 and closed in March 2020. Reminder emails were sent several weeks after the initial invitation. A total of 148 respondents completed the survey. This study was deemed to be exempt from the requirement for obtaining informed consent by the Institutional Review Board (IRB) in July 2019 by the University of Massachusetts Chan Medical School’s (UMMS) IRB (docket # H00018195).

Survey, data collection, and storage

The survey contained the following elements: (1) demographics, including gender, years in practice, profession, and patient practice environment; (2) open text field for respondents to list POCTs that could be used to diagnose and manage/monitor diseases; (3) perceived benefits and concerns of POCTs; and (4) product adoption practices of these new technologies.

Survey questions that measured POCT usage, benefits and concerns were based on the NHLBI strategic vision published in 2016⁸ and a survey developed by researchers from one of the Point of Care Technology Research Network centers located at Johns Hopkins University.⁹ The survey underwent multiple rounds of review and comment by the authors and NIH program officials. After this, the survey was shared with a small group (~10) of healthcare professionals for their input on topics such as survey length and the clarity of the questions ([Supplemental Appendix](#)). We adapted the survey to address the broad spectrum of POCT needs from the perspective of a variety of healthcare professionals who see patients with heart, blood, lung, and sleep disorders. Given the industry-driven nature of healthcare technology, we also assessed critical technology-related aspects regarding healthcare technology use and adoption, and adapted questions from 2 seminal studies focused on the adoption of new technologies.^{10,11}

All questions, except for those pertaining to demographics, were assessed on a 5-point Likert scale, with uniformly anchored responses ranging from “strongly disagree” to “strongly agree.” In addition, we asked participants 2 open-ended questions to list up to 5 conditions for which POCTs can help with the (1) diagnosis of a disease and (2) management or monitoring of a disease. An internal team of experts with combined clinical medicine and business development experience were consulted and participated in the development of this survey. Prior to the survey being beta tested by professionals, clinicians, and faculty, we incorporated feedback from the NIH Program Officers/Scientific Officers. All feedback was incorporated to not only enhance the veracity and clarity of the survey questions but also ensure that questions addressed the goals of the study.

The survey interface was generated by a secure instance of the REDCap data management platform, with all data received from participants being transmitted directly into the study server for storage. The server is hosted by the secure and encrypted UMMS network and was only accessed by authorized study personnel.

Statistical analysis

Open-ended responses were categorized using an adapted list of standard medical specialties.⁷ Variables assessed on a 5-point Likert scale were collapsed into 2 categories: (1) responses indicating “strongly agree” and “agree” were collapsed into agreement, and (2) “strongly disagree” and “disagree” were categorized as disagreement. Neutral responses were excluded from analysis. χ^2 tests were used to compare survey responses from cardiovascular professionals to all other professionals surveyed. Data analysis was completed in SAS version 9.3.

Results

Participant demographics

A total of 148 participants responded to the survey. Of those, 52% were men and 31% have been in practice for less than 5 years, while a quarter have been in practice for over 20 years. While the majority of responses (59%) were from physicians, our overall sample was diverse and we observed a wide distribution of other key stakeholders involved in healthcare device development (Table 1).

POCTs for diagnosis and management/monitoring of disease

Of the 148 participants, 77 respondents (52%) named at least 1 cardiovascular condition when asked to identify up to 5 conditions for which a POCT could help make a diagnosis for a disease. Further, cardiovascular conditions were the

greatest concern among respondents ($n = 122$). Other conditions included infectious disease ($n = 87$), endocrine ($n = 78$), respiratory ($n = 58$), and hematology ($n = 34$) (Figure 1). Similarly, cardiovascular conditions ($n = 98$) were the largest category of responses for which a POCT could help monitor or manage a disease, followed by endocrine ($n = 73$), respiratory ($n = 58$), infectious disease ($n = 44$), and hematology ($n = 40$) (Figure 1).

Cardiology professionals compared to other specialists

We observed several significant differences among respondents who worked in a cardiology setting vs other settings. In general, we found that cardiology professionals agreed less with the perceived benefits of POCT and agreed more with the perceived concerns of POCTs. Compared to other specialties, a lower proportion of cardiology professionals thought that POCTs improve patient management (80% vs 93%, $P = .04$) and reduce medical errors (71% vs 91%, $P = .04$) (Table 2). Additionally, a lower proportion of cardiology professionals noted that POCTs enable more effective treatment (85% vs 95%, $P = .06$).

In contrast, we found that cardiology professionals reported greater perceived opportunities when asked about availability to new technologies at higher rates than other specialists. A larger proportion of cardiology professionals responded that they operate in a technological business environment with growing investment opportunities compared to other specialists (67% vs 32%, $P = .02$) (Table 2). Further, cardiology professionals more frequently reported not being constrained by resources for product adoption than other specialists (35% vs 12%, $P = .01$).

Discussion

In this study of healthcare professionals, we found that most respondents perceived an unmet need for POCTs that diagnose or manage/monitor cardiovascular diseases. The majority of participants identified cardiovascular conditions when asked to name major applications of POCTs. Despite this finding, a lower proportion of cardiology professionals noted the potential for POCTs to improve patient management or reduce medical errors than professionals from other specialties. Interestingly, a larger proportion of cardiovascular health professionals self-reported more favorable technological business environments in regard to both investment opportunities and resources available for product adoption, as compared to other medical specialists.

Our data suggest that cardiology professionals may have reservations regarding the adoption of POCTs compared to those in other health specialties, and this may be a function of several factors. For instance, cardiovascular disease monitoring via commercial wearable devices is one of the earliest instances of the interface between mass consumer health technologies and the medical infrastructure. A multitude of consumer technologies capable of comprehensive cardiac monitoring (ie, heart rate, rhythm, atrial fibrillation detection)

Table 1 Demographics of survey respondents

Participant demographics	% respondents ($n = 148$)
Gender	
Male	52%
Female	42%
Undisclosed	6%
Years in practice	
0–5 years	31%
6–10 years	14%
11–15 years	11%
16–20 years	12%
Over 20 years	25%
Undisclosed	7%
Profession	
Physician (MD/DO)	59%
Advanced practice provider (NP/APN/PA)	5%
RN-registered nurse	14%
Healthcare professional	3%
Healthcare researcher	7%
Medical device developer	5%
Other	3%
Undisclosed	4%
Patient practice environment	
In-hospital	50%
Ambulatory care	18%
Emergency room	11%
In-home	2%
Other	14%
Undisclosed	5%

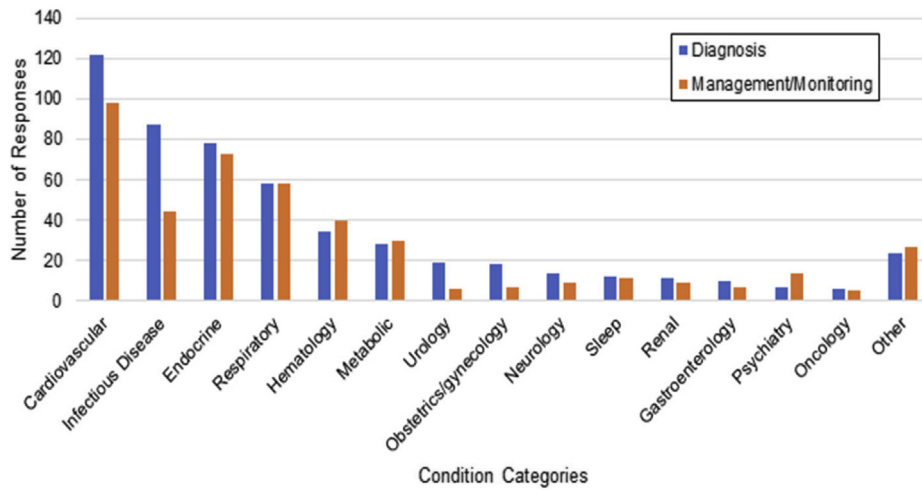


Figure 1 Healthcare professional responses and classified conditions for which point-of-care tests can help with the (1) diagnosis of a disease and (2) management and monitoring of a disease. Note: Condition responses were classified into standard medical specialties and sorted by the number of responses in each category. “Other” category includes any conditions outside of the categorization scheme and any categories for which there were fewer than 5 responses.

are available on the United States market without a medical prescription (eg, Apple Watch, KardiaMobile, etc), thereby inverting the traditional flow of healthcare provider-initiated patient care. However, while patients have the potential to access more data about their health (eg, commercially available digital health tools to visualize their own cardiac data), it is unclear how this translates into how they engage with the healthcare system.¹² Cardiologists were among the first to recognize the implementation challenges that accompany this technology. Therefore, it is possible that professionals in cardiovascular medicine may be more cautious about the potential of such devices for clinical use.

Another barrier to the adoption of POCTs may stem from the life-threatening nature of the conditions that they treat. Cardiovascular-related POCT use is often designed to circumvent disastrous health outcomes, including delayed recognition and treatment of time-sensitive disorders such as myocardial infarction and stroke. The inefficiency of inaccurate diagnoses or misdiagnoses could be a contributing factor behind the relative hesitancy towards adopting POCTs that we observed in these healthcare professionals. For instance, a recent survey of cardiac electrophysiology providers found that 30% of respondents who did not recommend the use of digital health tools cited accuracy concerns as a primary reason, and two-thirds indicated that more accurate data, compared to clinical gold-standard devices, was necessary.¹³

What remains less understood is why there is a difference between the perceived need for POCTs for cardiovascular disorders and the potential for POCTs to improve care. In part, a reason could be that there are a growing number of emerging POCTs focused on cardiovascular disease management and diagnosis, including hypertension, atrial fibrillation, and cardiac biomarkers. Yet, these technologies have had mixed success being accepted into routine clinical practice.^{14,15} Compared to other medical specialties, the nature of practice characteristics of cardiovascular disease specialists may affect perceptions about the effectiveness of POCT devices differently than other specialties. These opinions may be moderated by factors such as the catastrophic health outcomes of misdiagnoses or improper management of cardiovascular conditions.¹⁴ A further concern is the shift moving away from physician-initiated point of care for cardiovascular diagnoses. The widespread usage of commercially available wearable devices may increase the number of false-positive diagnoses of cardiovascular conditions, particularly when applied to patient populations typically not at risk for these conditions, and have low true-positive rates.^{14,15} Managing potential incorrect diagnoses can generate stress for patients, create unpredictable workloads for their healthcare providers, and promote increased healthcare expenditures, which may be of concern for those in the cardiovascular field.

Table 2 Professional healthcare opinions of point-of-care testing use by specialty

Cardiology professional healthcare opinions vs professionals in other specialties	% Cardiology professionals agree	% Professionals in other specialties agree	χ^2 statistic
POCTs improve patient management	80%	93%	0.04
POCTs enable more effective treatment	85%	95%	0.06
POCTs reduce error	71%	91%	0.04
Many investment opportunities in business environment	67%	32%	0.02
Adoption of new products is not constrained by resources	35%	12%	0.01

POCTs = Point-of-care tests.

Conclusion

The US healthcare system has undergone extensive digitization over the past decade, with advances in POCTs.¹⁶ The ongoing COVID-19 pandemic has further highlighted the growing potential of asynchronous data coming from home POCTs to monitor patients in remote settings.^{17–19} As new point-of-care technologies emerge, however, cardiovascular healthcare professionals appear to still have unaddressed concerns. In this regard, there is much discussion in the field about the restructuring of healthcare clinics around the increased use of “care traffic controllers”²⁰ that can leverage artificial intelligence and digital workflows to sift through rich POCT data. To address these concerns and to measure whether POCTs make medicine better by improving patient outcomes, greater collaboration among technology industry partners, healthcare professionals, patient groups, and professional societies is recommended.

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The authors declare no potential financial conflicts of interest.

Authorship

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

Patient Consent

Not applicable.

Ethics Statement

This manuscript was exempt from the Institutional Review Board. It adhered to all relevant ethical guidelines.

Disclaimer

Given his role as Editor-in-Chief, David McManus had no involvement in the peer review of this article and has no access to information regarding its peer review. Full

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Appendix

Supplementary data

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.cvdhj.2021.10.004>.

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