WHITEPAPER

Digital Health and Clinical Development: The Promise, Challenges and Considerations for Integrating Wearable Biosensor Technologies into Clinical Studies

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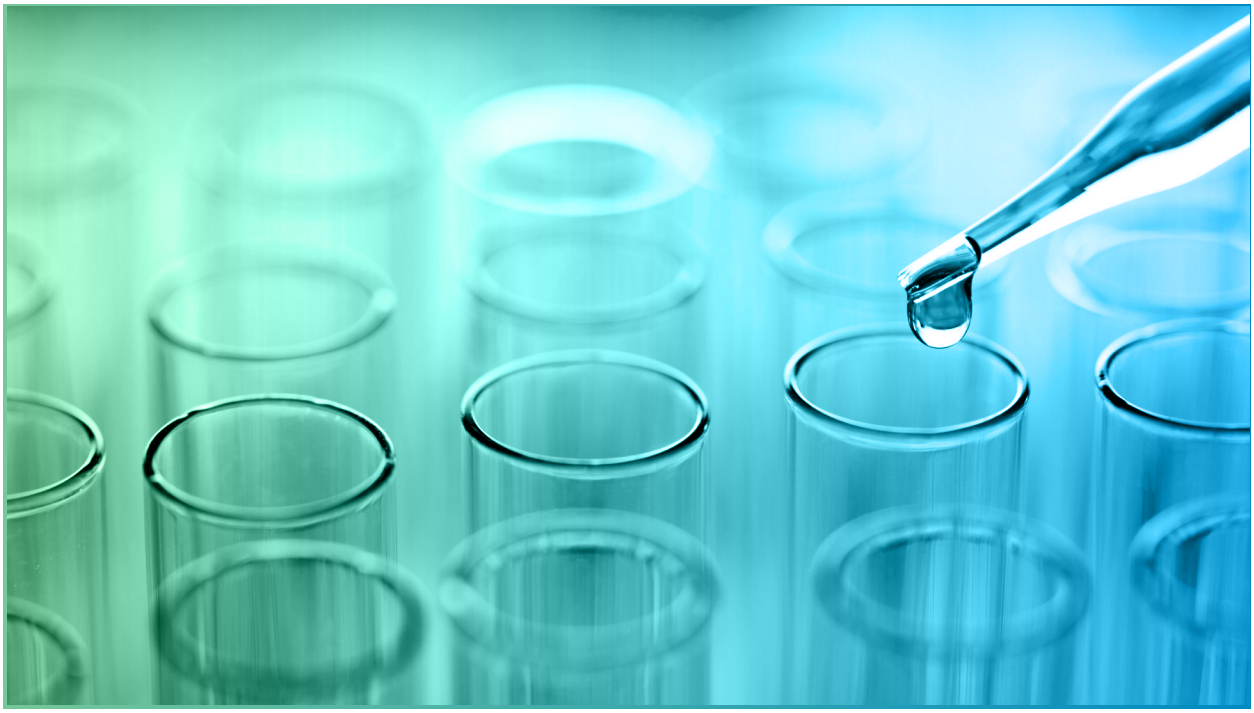
Wearable biosensors are transforming clinical research to the benefit of patients, sites and sponsors alike. Deploying sensors can make studies more convenient for participants, accelerate recruitment and radically expand opportunities to collect objective patient data. However, the novel approach creates new challenges that sponsors need to address to realize the promise of wearable biosensors.

Historically, the collection of objective data in clinical trials required patients to visit a study site. The use of patient-reported outcomes offered some subjective insights into the condition of participants between site visits but study teams were largely in the dark about the health of their subjects. That is no longer the case.

The rise and validation of wearable biosensors are transforming clinical trials by enabling sponsors to remotely collect data on vital signs and other digital endpoints. Sponsors can collect objective, timely insights into patients between site visits and easily capture data on variables such as sleep that were impractical to gather in the past.

“The pharma and device industry will benefit significantly because we’ll be able to get much better pictures of what’s going on with these patients. If you have visits every four weeks, that’s the best time point I can get. But if I can get something weekly or daily or hourly, that’s going to give us so much more data. I think it’s something we’re going to learn to embrace and utilize and make better health decisions,” Salvatore Zabbatino, Senior Director Core Labs at Medpace, said.

Equipped with ways to monitor study subjects during their day-to-day lives, sponsors can now design decentralized and hybrid clinical trials that eliminate or reduce the need for participants to visit study sites. The idea of decentralized studies, also known as remote



or virtual clinical trials, predates the rise of wearables but the technology has significantly increased the types of patient data that can be collected remotely.

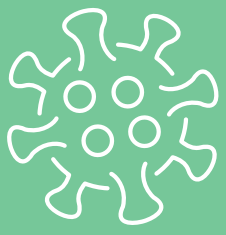
Interest in decentralized clinical trials surged as the COVID-19 pandemic made site visits impossible. In a May 2020 survey, 76% of clinical trial professionals said the pandemic was increasing the use of decentralized clinical trials.[1] Ninety-one percent of respondents expected the pandemic to trigger a long-term increase in use of the model. Home visits by nurses enabled the emergency pivot to the decentralized model during the pandemic but that approach is too expensive for ongoing routine use. Wearables enable the cost-effective adoption of decentralized and hybrid clinical trial models.

All stakeholders benefit from the deployment of biosensor technologies, particularly when they are used to enable decentralized and hybrid clinical trials. Patients benefit from greater convenience, as there is less travel to sites and greater transparency. Sites have increased access to data and a lower burden because results they used to generate are now gathered automatically by wearables. Finally, sponsors gain access to new data sources, accelerate enrollment and lower their costs.

How Biosensors Benefit Clinical Trials

The value of effective sensor deployment is shown clearly by certain use cases. Continuous glucose monitoring (CGM), for example, is transforming how and when data are collected in diabetes clinical trials. In the past, patients manually checked their blood glucose levels three or four times a day. The approach placed a burden on patients and created a risk of missing data. Even if readings were taken consistently, studies only got a partial picture of a patient's blood glucose levels.

While fingerstick readings are taken a few times a day, CGM systems collect data every five minutes.[2] "This is a definite advantage because just using a hit-and-miss approach with the fingerstick glucose measurement doesn't give you the overall pattern of a patient's glycaemic control. Few patients with diabetes measure glucose levels after meals or overnight. Consequently, postprandial hyperglycemia and asymptomatic nocturnal hypoglycemia might be seen. With fingersticks, the sponsor would never know. But with a CGM all of that data can be captured," Susan Brumm, Advanced Clinical Practitioner at Medpace, said.



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The applications of CGM include cardiovascular disease prevention clinical trials. Cardiovascular trials more broadly showcase the value of other types of biosensors, notably wearable electrocardiogram (ECG) devices and actigraphs.

Holter monitors have enabled the remote collection of ECG data for decades but the devices were bulky and typically only gathered data for 24 to 72 hours.[3] Today, small, wearable patches collect ECG data automatically and unobtrusively for two or more weeks at a time. The patches have delivered a range of major benefits.

"Ultimately, it actually saves money. It decreases time spent traveling to the site to get assessments, it decreases the amount of time the investigator has to spend with the subject at the site to perform a 12-lead standard ECG and it saves money for the sponsor. It's estimated using one biosensor can save $3,000 per patient in terms of five-year costs, so it's much more efficient. And the data streams are much more efficient. You get data sent right away. You could have real-time analysis," Richard Lee, Senior Medical Director at Medpace, said.

Cardiovascular clinical trials also benefit from actigraphs that track the activity of patients around the clock. By deploying the devices, sponsors can, for the first time, gather objective data on the effect of a medical intervention on the activity of cardiovascular disease patients in the real world. If a drug helps a patient walk twice as far before they get angina, an actigraph can help sponsors detect the effect of the intervention and thereby demonstrate the value of their treatment.

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Why Biosensors Create New Challenges

The increasingly validated benefits of incorporating wearable biosensors into clinical trials are driving record levels of interest in the technology. Successful deployment of biosensors requires sponsors to grapple with a new set of challenges and considerations to maximize the benefits and minimize the burdens of the technology for all stakeholders.

Each stakeholder has a different set of challenges and considerations. For patients, ease of use is key. Wearable biosensors must pose minimal burdens on patients to ensure compliance. If a patient does encounter a problem, the device and associated support system need to enable them to identify and resolve the issue in conjunction with the technical team. Some

patients will find it easy to use and troubleshoot devices, but study teams need to consider less tech-savvy participants to consistently deploy wearable biosensors successfully.

The needs of patients overlap with those of sites. Biosensors that are hard to set up and use impose burdens on sites and patients. It is also important that the critical patient-site relationship remains in place even though the use of a biosensor has changed when and where some data are collected. The study team needs to ensure sites understand they remain involved in the day-to-day management of patients.

Sponsors can help sites retain close links to patients by avoiding any changes that make the lives of investigators and their teams harder. Data collection procedures, for example, should be simple. The list of site-specific things to consider extends to whether study centers have the space to store devices in between taking receipt of the shipment and giving the biosensors to participants.

Sponsors face their own set of challenges and considerations, although again there is overlap with the needs of other stakeholders. Biosensor reliability is critical to sponsors, given the risk of missing data if devices malfunction and the burden of resolving faults. The cost of deploying biosensors is important, too, as are a range of operational considerations including whether a device is authorized for use in all the targeted regulatory jurisdictions, logistics and the need for local-language materials.

More broadly, sponsors need to consider what data is needed and what is just nice to have. It is now possible to collect data on innumerable aspects of patients using wearable biosensors but each extra endpoint imposes costs, in terms of both the cost of a study and its complexity. Sponsors have the most success when they are realistic about what data they can capture in a clinical trial.

How to Run Biosensor-enabled Trials

Sponsors can ensure the successful integration of wearable biosensor technologies into clinical trials by working closely with an experienced vendor and the other stakeholders. Enlisting the support of a vendor with the experience and infrastructure to design and manage biosensor-enabled clinical trials mitigates challenges and positions sponsors to reap the benefits.

Biosensor systems must support data visualization and be regulatory ready but that is just the start. In the fast-evolving biosensor technology space, there are advantages to using a

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vendor-neutral platform. Each biosensor manufacturer has a different way of collecting and sharing data, down to details such as the frequency and format of transmissions. Vendor-neutral platforms enable sponsors to manage the diversity of devices and data formats.

"We have the skill set and the systems in place to be able to take that data from these different devices, work with those different platforms and be able to then translate it into a common data structure that we can then use to manage the study and to collect the appropriate endpoints that are of interest for us," Medpace's Zabbatino said.

Again, the benefits of the platform are illustrated by the CGM use case. Commercial software from CGM providers is not secure, leading the FDA to recommend the data originates from a 21 CRF, Part 11 electronic records process. Medpace's platform manages that requirement while also enabling the collation of data from connected glucometers, insulin pumps, and smart pens produced by different vendors.

The platform puts data into formats that are digestible by centralized review systems, an increasingly important consideration given how COVID-19 accelerated the shift to risk-based monitoring. The pandemic led regulators to encourage sponsors to monitor trials remotely and further validated the benefits of centralized, risk-based monitoring.[4] With monitoring accounting for 9% to 14% of clinical trial costs, there are opportunities to save money while enabling timely, targeted actions.[5]

Thoughtful deployment of biosensors and supporting infrastructure can position sponsors to realize those opportunities. As the biosensor-enabled future of healthcare takes shape, the industry will be exposed to many more chances to improve clinical trials.

Health monitors are already part of day-to-day life for many millions of people, with more than 20% of Americans using a smartwatch or fitness tracker even before their popularity rose because of the effect of COVID-19 on remote work and consumer interest in health monitoring.[6,7] Global spending is forecast to hit $81.5 billion in 2021, up 18.1% from the prior year. Further improvements to the devices and the breadth of data they can collect will make health monitors an essential product for still more people in the future.

Biopharma and medical device companies will benefit significantly from the proliferation of health monitors. With people routinely tracking multiple measures of their wellbeing, companies will gain

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a much more detailed picture of patient health. Sponsors that embrace the rise of health monitors and partner with experts in biosensor clinical trials stand to accelerate drug and device development, start the age of truly big data and support better health decisions for everyone.

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MEDPACE

About Medpace

Medpace is a scientifically-driven, global, full-service CRO providing Phase I-IV clinical development services to the biotechnology, pharmaceutical and medical device industries. Medpace's mission is to accelerate the global development of safe and effective medical therapeutics through its high-science and disciplined operating approach that leverages regulatory and therapeutic expertise across all major areas.

MEDPACE

THE MEDPACE ADVANTAGE TO CONNECTED DEVICES: FROM CONCEPT TO REALITY

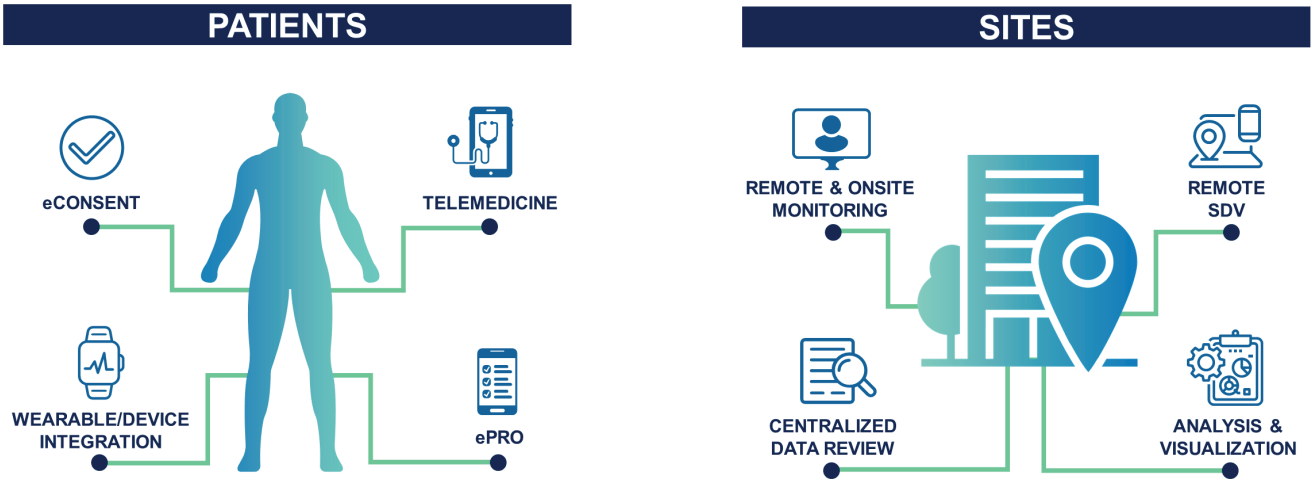
Amassed aggregate health data from connected devices can confirm trial safety and can also be leveraged to evaluate the effectiveness of a medical therapy or drug, while delivering many other vital operational and analytical advantages

As a full-service CRO offering comprehensive support for clinical trials, Medpace can help Sponsors seamlessly incorporate remote biosensors into their research. From selecting and deploying the right sensors to meet endpoints, to ensuring compliance and engagement, to transforming data to support regulatory review, Medpace has the expertise to reach your goals.

- SELECTION OF TRIAL-SPECIFIC VALIDATED SENSORS
- MANAGING LOGISTICS AND AVAILABILITY TO SITES
- SECURE DATA CAPTURE AND STORAGE
- INTEGRATION INTO CLINICAL STUDY RECORDS
- REVIEW, ANALYSIS, HARMONIZATION, AND VISUALIZATION OF TRIAL DATA
- TRANSFORMING DATA TO SUPPORT REGULATORY REVIEW

BEYOND CONNECTED DEVICES

Connected devices is just one way we enable decentralized and hybrid clinical studies. Understanding the capabilities of a site and providing the tools, technology, and communication to support them is crucial.



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