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EDITORIAL

Photoplethysmography rhythm interpretation: an essential skill in an era of novel technologies

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Introduction

Innovations in smart wearables and mHealth have provided avenues in screening and monitoring of cardiovascular health at a population wide level. With the disruption to conventional healthcare during the coronavirus-19 (COVID-19) pandemic, the role of remote monitoring and management of different health conditions have accelerated and have taken a huge step forward, providing clinicians with many novel devices to support these endeavours.

The TeleCheck-AF study is a multicentre study utilizing photoplethysmography (PPG) technology through a built-in camera allowing semi-continuous heart rate and rhythm monitoring for patients with atrial fibrillation (AF).[1] Despite the widespread use of PPG-based technology, clinicians and health care providers have not been introduced to it formally and in a structured way like in the case of electrocardiograms (ECGs).

In this issue of the journal, the TeleCheck-AF investigators provided, based on their experience, a structured stepwise practical guide on evaluating and interpreting PPG signals. This comprises of a simple five-step approach: (i) checking the quality of tracing, (ii) checking the output of the PPG FibriCheck© algorithm, (iii) checking for regularity, (iv) checking medical history to increase likeliness of arrhythmia and increase pre-test probability, and (v) proceeding with further diagnostic testing and therapy as indicated.[1]

Apart from this, the investigators also shared some common clinical scenarios to help clinicians better understand the application in real life, including the important limitations of PPG such as the inability to differentiate between regular tachycardias and the requirements for ECG documentation for the final diagnosis.

This is a pertinent topic, with the current rapid advancements and adoption of novel devices into routine clinical practice. It certainly appears that the integration of practical guides of interpretation of PPG into the medical curriculum, similar to that of ECG interpretation, may not be too far in the future of medical education.

Where do we go from here?

Artificial intelligence (AI) algorithms were used in TeleCheck-AF to determine which patients were clearly in AF. Those where the diagnosis was uncertain were then checked for regularity. Nonetheless, clinicians should be provided with the knowledge to interpret the results of these devices not only to double-check the interpretation of the algorithm but also to unravel the enigma surrounding new technology. Also, the future of medical education goes beyond the skill of PPG interpretation and, whilst not explicitly tackled in van der Velden *et al*.,[1] is a current theme that runs throughout.

The use of AI to assist with interpretation should not be a deterrent for healthcare professionals to learn its interpretation. Indeed, there has been an exponential growth in AI use the diagnosis and risk assessment of patients with AF.[2] Indeed, AI has also been applied to help improve stroke risk stratification, accounting for dynamic changes in stroke risks.[3,4]

The bottom line is that AI and *in silico* medical technologies, along with robotics and medical devices, are developing at a rapid pace. Undoubtedly, these new technologies will play a vital role in the future of medicine, as will the ability to understand their use and limitations. Hence, medical education must expand to incorporate the use and assessment of novel technologies in clinical settings. While attitudes to new technologies are on the whole positive, uptake of these technologies remains poor, primarily due to a lack of knowledge of the technology and discomfort when using them.[5,6]

The TeleCheck-AF project is therefore an important step towards bridging that knowledge gap and developing familiarity with PPG

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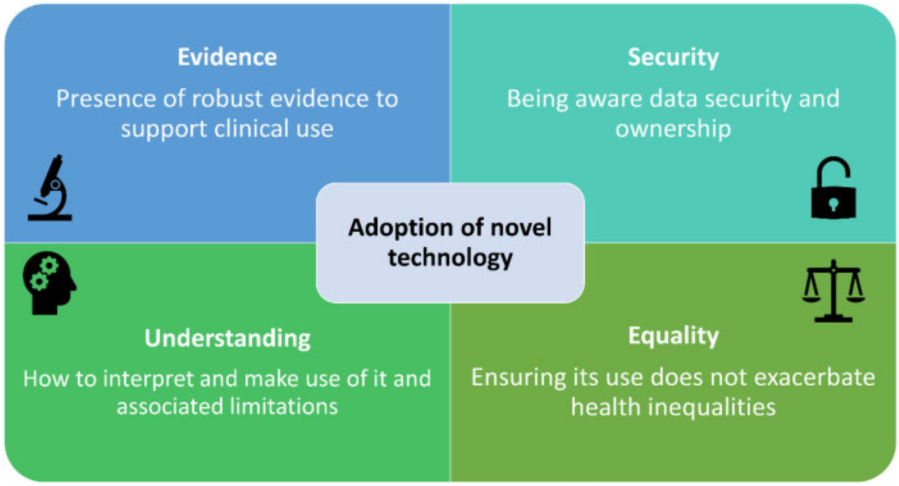

Figure 1 Schematic demonstrating four necessary considerations for the successful adoption of novel technology.

rhythm interpretation. Without these initiatives to enhance adoption, the technology itself is ineffectual, and as such this is a crucial step in the improvement of digital health provision.

For the successful adoption of novel technologies, it is not only sufficient that there is robust evidence to support their clinical use (*Figure 1*). The successful application of mobile health (mHealth) technologies to improve patient care in AF has been in the mAFA-II trial, which was a cluster randomized trial comparing the ABC (Atrial fibrillation Better Care) pathway against usual care, resulting in a significant reduction in stroke/thromboembolism, mortality and bleeding with the mAFA App-based intervention.[7] Importantly, the long-term extension cohort showed a high adherence (>70%) and persistence (>90%) of use.[8] This is important given that ABC pathway compliance has major implications for reducing mortality and morbidity from stroke, major bleeding and hospitalizations.[9,10]

Nonetheless, healthcare professionals must also understand the use of the technology and its limitations. The limitations are particularly important as this will create clear bounds of use. Beyond an understanding of the technology and the limitations of its use, data security, ownership, and access are crucial aspects of technology integration that are needed to build trust. Again, this is an area where technology can help, through the use of blockchain for example.[11] Care must also be taken to avoid the exacerbation of existing health inequalities through the adoption of digital healthcare solutions. It is sobering to remember that just under half the world's population has no access to the internet[12] and that lack of internet access is associated with poorer health.[13]

Taken together, strong evidence, strong data security, a workforce that is familiar and understands the technology, along with a focus on healthcare equity and equality, all combine to accelerate the successful adoption of these novel healthcare technologies. Time will tell.

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