Cardiovascular disease

How useful is smartphone technology for detecting AF?

Smartphone applications can allow self-detection of arrhythmias in patients with atrial fibrillation (AF). However, current evidence of their usefulness is based on small low-quality studies, a systematic review and meta-analysis has found.

Photoplethysmography (PPG) technology in smartphone cameras can be used for AF screening. PPG technology uses the light-emitting diode in cameras to measure pulsatile changes in light intensity that are reflected from a finger or the face.

Several smartphone PPG applications are currently available, but their clinical value for AF detection is unclear. The majority are commercial products. The authors of this study assessed the diagnostic accuracy of AF detection using smartphone PPG applications in comparison with a gold standard ECG recording.

The researchers carried out a systematic review of studies between 1980 and December 2020 where smartphone PPG was compared with a reference ECG (1-, 3- or 12-lead). Overall, 28 studies were included (ten full-text publications and 18 abstracts), providing 31 comparisons of smartphone PPG versus ECG for AF detection. A total of 11,404 participants were included; 2,422 had an ECG diagnosis of AF. Most studies were small and based in secondary care.

Sensitivity and specificity values for AF detection were high, ranging from 81 to 100%, and from 85 to 100%, respectively.

All studies were assessed by two independent reviewers using the Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) tool. This tool assesses four domains: patient selection; index test used (smartphone application for AF detection via fingertip or facial PPG signal); reference standard used (1-,3-, or 12-lead ECG); and flow and timing. Each domain was assessed for risk of bias using signalling questions, and the first three for applicability to the review question. Each domain is given a score of high, low or unclear for risk of bias and applicability.

The studies were of low quality overall with none meeting all QUADAS-2 criteria.

A total of 20 comparisons from 17 studies were included in the meta-analysis, including 6,891 participants (2,299 with AF).

'Unrealistically high values' for sensitivity 94% (95% CI: 92-95%) and specificity 97% (96-98%) were found, with substantial heterogeneity ($P < 0.01$). There was a high risk of bias particularly for patient selection, insufficient information about the study design and the potential for publication bias.

Screening of patients over the age of 65 has the potential to identify AF early and since patients may be asymptomatic this provides a window of opportunity to initiate anticoagulant therapy. However, paroxysmal AF can easily be missed particularly by opportunistic pulse checks, a 12-lead ECG and even on shorter duration ambulatory monitoring such as the traditional 24-hour Holter monitor.

The development of novel screening devices has the potential to improve the success rates of screening programmes. Furthermore, smartphone applications that allow self-detection of arrhythmias can be empowering for patients. PPG is an interesting non-invasive, patient-led screening tool for AF.

However, current evidence is limited to small, low-quality studies with unrealistically high sensitivity and specificity. Further larger studies are required, ideally independent from manufacturers, to determine if this is a valuable screening technology or not.

The study authors state: 'Due to its paroxysmal nature in many patients, the detection of AF can be challenging using conventional ECG methods. With the growing use of smartphones, PPG technology offers the potential for large scale, non-invasive, patient-led screening of AF.

'PPG technology has shown promise for AF detection with high sensitivity and specificity. However, the current evidence base consists of small, biased and low-quality studies which are insufficient to advise clinicians on the true value of PPG devices for AF detection.'

'In view of the extensive global use of such devices, further research is urgently required with reference standards, standardised validation and transparent algorithms.'

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Gill S, Bunting KV, Sartini C et al. Smartphone detection of atrial fibrillation using photoplethysmography: a systematic review and meta-analysis. *Heart* 2022;108:1600-07

Paediatrics

Can the Ages and Stages Questionnaire identify developmental delay?

If a child aged 12-60 months passes the Ages and Stages Questionnaire (ASQ) in all domains there is a moderate probability that there is no severe developmental delay, a systematic review and meta-analysis has found.

A total of 43 studies that met the inclusion criteria were included in the systematic review. These criteria were: ASQ carried out in children aged 12 to 60 months, or where the median age at ASQ was at least 12 months; and formal comparative developmental assessments i.e. reference tests were performed either two months before or after the ASQ. Of these 43 studies, 36 were included in the meta-analysis.

Two thresholds were used to define failure on the ASQ; scores > 2 SD below the mean (ASQ-2SD) and ASQ scores >1 SD below the mean (ASQ-1SD) in one or more domain.