

Point-of-care screening for atrial fibrillation: Where are we, and where do we go next?



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Screening for undiagnosed atrial fibrillation (AF) is a growing priority. The prevalence of AF is increasing due to population aging, and strokes related to previously unrecognized AF remain common.¹ Fortunately, oral anticoagulation (OAC) is highly efficacious in preventing AF-related stroke, suggesting that screening may facilitate identification of asymptomatic AF and initiation of OAC to prevent stroke.² Furthermore, novel point-of-care technologies that can be used in the patient care office or at home, including mobile single-lead electrocardiograms (ECGs) and wearable technologies, make screening for AF feasible as part of routine care.

The current state of screening

A variety of AF screening interventions have been delivered via mass invitations, within pharmacies, and in vaccination settings.^{3–7} Although such approaches have the potential to reach large populations and are not reliant on individuals seeking care, their effectiveness may be limited by a target population composed primarily of individuals at low short-term AF risk and by a weak connection to a health care system or provider to confirm diagnoses and institute appropriate treatment. For example, among over 400,000 individuals undergoing wrist-worn wearable screening in the Apple Heart Study, only 0.5% received an irregular pulse notification, and 0.03% ultimately had AF confirmed with a patch monitor.⁵ In contrast, AF screening in the context of a clinical encounter, such as a primary care visit, may facilitate screening of individuals at sufficiently high AF risk and provide a ready mechanism for efficient response to confirm and manage newly diagnosed AF. The VITAL-AF study was a cluster randomized trial conducted within 16 primary care clinics in the United States, including a total of 30,715

patients aged 65 years or older (Figure 1).^{8,9} AF screening with a mobile device-based, single-lead ECG (KardiaMobile, AliveCor, Inc., San Francisco, CA) was embedded into routine care by medical assistants at the time of vital sign assessment. VITAL-AF demonstrated that an integrated approach to device-based AF screening within primary care visits was highly feasible, with 91% of intervention patients completing screening on at least 1 occasion and at 78% of all encounters during a 1-year period. Despite very successful deployment of the screening intervention as well as the advantages of screening within a primary care setting, VITAL-AF revealed no significant difference in the primary outcome of newly diagnosed AF over a 1-year period, although there was a suggestion of greater screening yield among individuals aged ≥ 85 years. Notably, office-based intermittent screening is limited in that only patients who visit may be screened, and paroxysmal AF may be missed.

The opportunity for targeted, effective screening and integration into the health care system

As more patients gain access to smartphone accessories and smartwatch devices capable of identifying AF using photoplethysmography or ECG sensors, there is an opportunity to use point-of-care testing, both within and outside the context of a traditional clinical encounter, to effectively identify undiagnosed AF. A comprehensive, effective, and efficient point-of-care strategy for AF screening likely requires each of the following: (1) identification of a population at sufficiently high risk for AF and stroke; (2) utilization of the most effective screening technologies to facilitate AF detection; and (3) integration of non-visit-based rhythm monitoring data into the health care system to facilitate efficient and appropriate action.

Previous studies have largely focused on screening efforts in patients aged 65 years or older, in keeping with current guidelines.^{10,11} However, many patients included in these previous interventions have low risk of developing AF or may be unlikely to be treated with OAC even if AF were diagnosed due to low risk of stroke. The pretest probability of the

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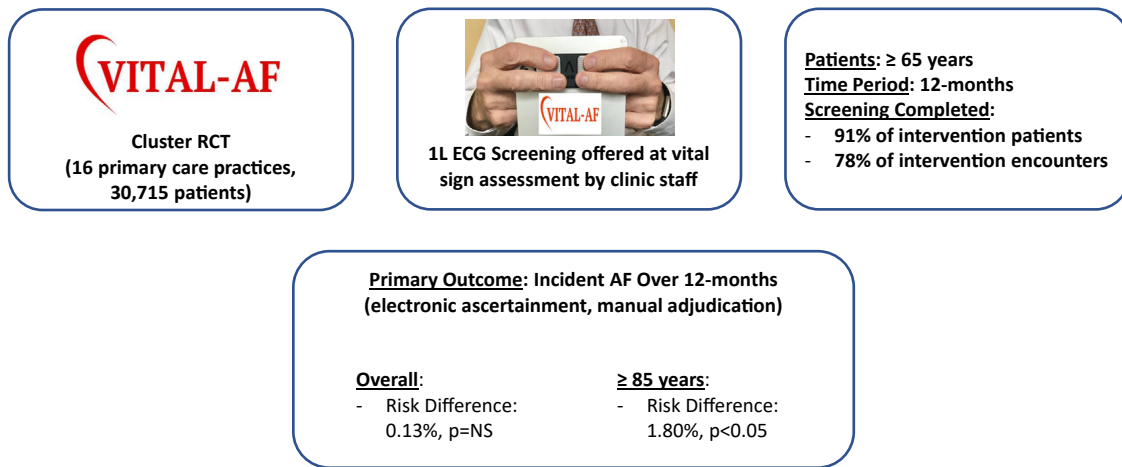
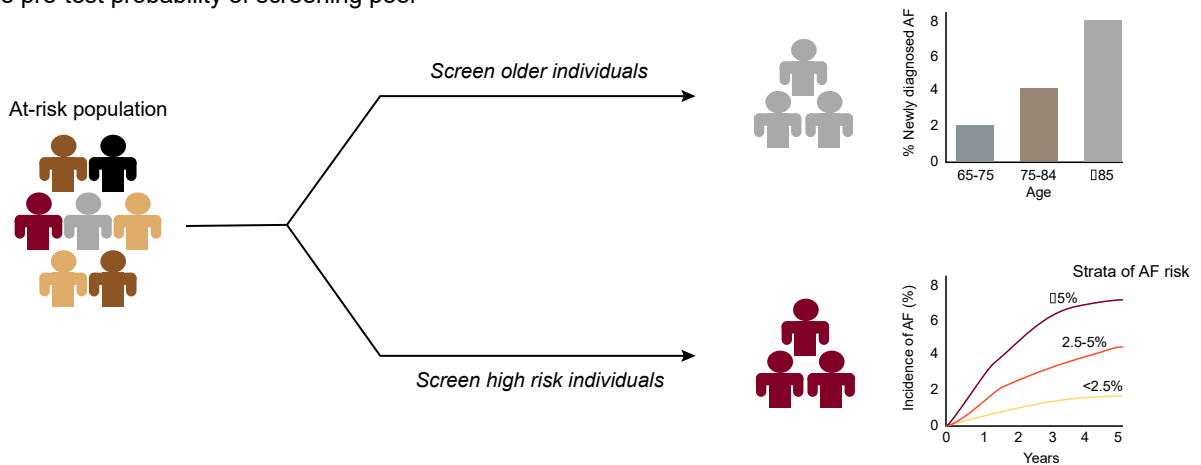


Figure 1 Key features of the VITAL-AF randomized controlled trial (RCT) of atrial fibrillation (AF) screening in primary care practices. ECG = electrocardiogram.

screening pool can be increased by screening older individuals (eg, ≥75 or ≥85 years) (Figure 2). Similarly, future AF risk can be estimated with reasonable accuracy using individual clinical risk factors through use of validated AF risk scores

such as the Cohorts for Heart and Aging Research in Genomic Epidemiology Atrial Fibrillation (CHARGE-AF) score.¹² Therefore, future screening interventions may select AF screening candidates based on a threshold pretest probability

Increase pre-test probability of screening pool



Improve detection of paroxysmal AF

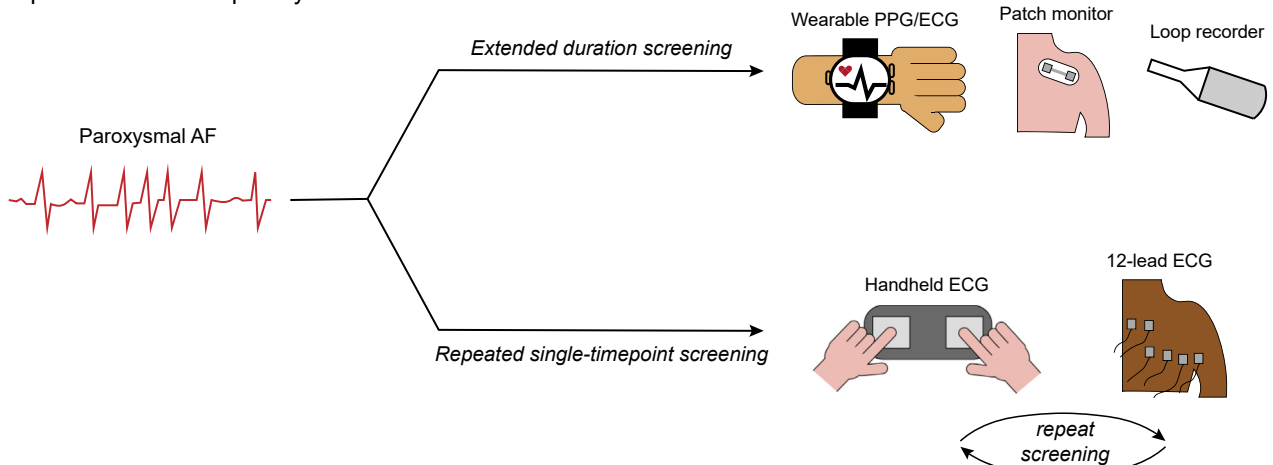


Figure 2 Screening interventions may be selectively deployed to high-risk populations (top) and utilize screening modalities that can detect paroxysmal atrial fibrillation (AF) (bottom). ECG = electrocardiogram; PPG = photoplethysmogram.

of AF, which may vary according to the target population and screening strategy under consideration (Figure 2). In addition, because patients with greater health care utilization may have more opportunity to have AF diagnosed, patients with a weaker connection to the health care system could be a specific focus of screening efforts.

With the proliferation of mobile technology available at relatively low cost to consumers, there is also an opportunity to use consumer devices to extend the reach of a point-of-care screening strategy. For this opportunity to be realized, it will require demonstration of the efficacy of mobile devices in identifying undiagnosed AF, evidence of sufficient tolerability and ease of use in the target population, and the potential for integration of results into the health care system to achieve high follow-up rates. Because most devices are meant to screen but not necessarily diagnose AF, establishing mechanisms to connect data from patient-facing devices used outside the office into clinic-based data systems is critical. Given the potentially massive scale of the data collected by such devices, development of efficient pathways to translate raw data into clinically actionable information is paramount. Potential avenues may include manual adjudication of tracing data by dedicated staff before review by a clinician or, better yet, application of accurate machine learning methodologies to identify actionable information automatically. It is possible that future algorithms could highlight specific segments of tracing data for manual review by a provider, or provide automated decision support to guide follow-up testing based on the degree of abnormality detected.

If information from consumer devices can be integrated successfully into the health care system, they can be used as another tool to improve detection of undiagnosed AF. The detection of infrequent paroxysmal AF, a weakness of office-based screening strategies applying single timepoint screening modalities, may be a particular strength of mobile devices in addition to traditional modalities capable of continuous monitoring (Figure 2). Specifically, to identify more paroxysmal AF, the duration of monitoring could be extended by using longer-term continuous screening methods such as patch monitors or loop recorders, or potentially consumer wearable technologies.¹³ Alternatively, intermittent screening methods could be repeated more frequently. As above, the efficiency of such strategies may be optimized using individual patient risk. Because access to technology may vary importantly according to race/ethnicity, age, and financial status, risk status could be used for identifying patients to prioritize for other screening methods such as patch monitors. Importantly, AF risk could also be used to exclude young, healthy individuals (a group who may be more likely to own consumer wearable devices) from screening programs in order to reduce the potential for false-positive results. Notably, because stroke risk increases with AF burden, future work quantifying the degree to which stroke risk is elevated by very rare paroxysmal AF detected only through screening will be critical to inform whether the benefit of detecting rare AF episodes justifies the cost and potential harms associated with more intense screening efforts.^{13–15}

Conclusion

We have the tools and technology available to develop and implement robust point-of-care AF screening strategies. At the same time, recent evidence from randomized trials such as VITAL-AF suggests that routine point-of-care screening in the context of a clinical encounter targeting all individuals aged 65 years or older may not be an efficient approach to AF detection. As more patients gain access to consumer devices capable of monitoring heart rhythm, pivotal next steps are to assess the effectiveness of deploying rhythm monitoring resources selectively to high-risk populations, to test whether screening strategies with progressively greater capacity to detect rare AF episodes improve outcomes, and to ensure mechanisms exist to incorporate data from patient-facing devices into the health care system in a manner such that actionable AF is treated expeditiously and appropriately.

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