Academic Health Science Network
North East and North Cumbria

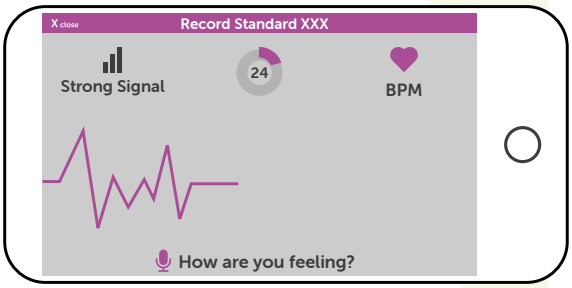
AliveCor®

Mobile ECG Device (AliveCor) Project

Learnings from Academic Health Science Network North East and North Cumbria

Stroke Prevention in Atrial Fibrillation Programme

November 2019



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Executive Summary

Over the next 10 years, detailed in NHS Long Term Plan, is the ambition to prevent 150,000 strokes, heart attacks and dementia cases in England. Considerable health gains can be achieved by improving the detection and treatment of the high-risk conditions of atrial fibrillation (AF), hypertension and high cholesterol. The risk of cardiovascular events can be reduced through treatment; however there still remain a substantial number of people who are undiagnosed or sub-optimally treated.

Stroke is the fourth leading cause of death in the UK with approximately 100,000 people having a stroke each year. Atrial fibrillation (AF) contributes to 1 in 5 strokes in the UK and is associated with greater disability and mortality that non AF-related strokes.

In 2017, NHS England commissioned the 15 Academic Health Science Networks (AHSNs) across England to facilitate adoption of innovative technology aimed at reducing the incidence of stroke by increasing detection and closing the AF prevalence gap. This was alongside ongoing work to increase anticoagulation treatment rates in England.

6,000 mobile ECG devices were distributed across the country by the AHSNs, allowing a greater range of healthcare and non-healthcare settings to offer opportunistic pulse rhythm checks to asymptomatic groups at increased risk of AF. AHSN NENC was responsible for the distribution of 374 mobile ECG devices.

AliveCor mobile ECG devices were distributed to a wide range of clinical and non-clinical settings to offer opportunistic pulse rhythm checks to asymptomatic individuals at increased risk of AF. Patients then followed their local pathway for timely diagnosis with 12-lead ECG and treatment with anticoagulants to reduce the incidence of AF-related stroke.

Across NENC, a total of 20,735 pulse rhythm checks were recorded from January 2018 – March 2019, detecting 1,175 people with possible AF. Demonstrating the AHSN NENC's role in real world validation, this report aims to provide insight into the viability and value of opportunistic testing for AF across a variety of settings using the AliveCor mobile ECG device.

Background

Cardiovascular disease (CVD) causes a quarter of all deaths in the UK and is the largest cause of premature mortality in deprived areas. Given that most CVD cases are preventable, there is a huge opportunity to make a difference by improving CVD outcomes for people in NENC.

The NHS Long Term Plan includes the major ambition to prevent 150,000 strokes, heart attacks and dementia cases in England over the next 10 years. Improving the detection and treatment of the high-risk conditions of atrial fibrillation (AF), hypertension and high cholesterol has the potential to unlock considerable health gains. Although treatment of these conditions reduces the risk of cardiovascular events, there are still many people undiagnosed or sub-optimally treated.

Stroke is the fourth leading cause of death in the UK with approximately 100,000 people having a stroke each year.[1] This human burden is mirrored by the cost to treat stroke, accounting for approximately 3-5% of all healthcare expenditure,[2] with stroke costing health care services an average of £13,452 at one year post stroke, increasing to £22,429 for both health and social care costs at one year post stroke, and £46,039 in health and social care costs over 5 years.[9]

AF contributes to one in five strokes in the UK and is associated with greater disability and mortality that non AF-related strokes.[1] Having AF leads to a significantly increased risk of stroke, heart failure and renal disease and increases mortality when compared to those without AF.[7] While two thirds of people with AF experience symptoms, one third do not,[3] with many only becoming aware of the condition when they have a stroke.[4] AF is relatively easy to diagnose, and treatment with anticoagulants can reduce the risk of stroke by two thirds.[5] Despite this, it is estimated that up to 500,000 people in the UK have undiagnosed AF,[6] and with an ageing population, it is predicted that the number of people aged >55 years living with AF will more than double by 2060.[8]

10-year CVD ambitions for England

To complement the NHS Long Term Plan, the CVD Prevention System Leadership Forum have developed specific 10-year cardiovascular ambitions for England for the detection and management of the high-risk conditions.[19] These ambitions are underpinned by the need to do more to reduce health inequalities.

The England ambitions for AF are:

- 85% of the expected number of people with AF are detected by 2029[12]
- 90% of patients with AF who are already known to be at high risk of stroke are to be adequately anticoagulated by 2029[12].

NENC Ambitions

In May 2019, AHSN NENC launched the AF Strategy. The AHSN NENC working together with NHSE, NICE, PHE, NHS RightCare and the voluntary sector can align work through the ICS to enable faster spread of innovation and improvement.

Vision Statement: To achieve nationally set standards (mandated by NHSE for AHSNs) closing the prevalence gap for those with AF, and achieving greater rates of effective anticoagulation by working across the whole health economy at a system level[13].

Objectives:

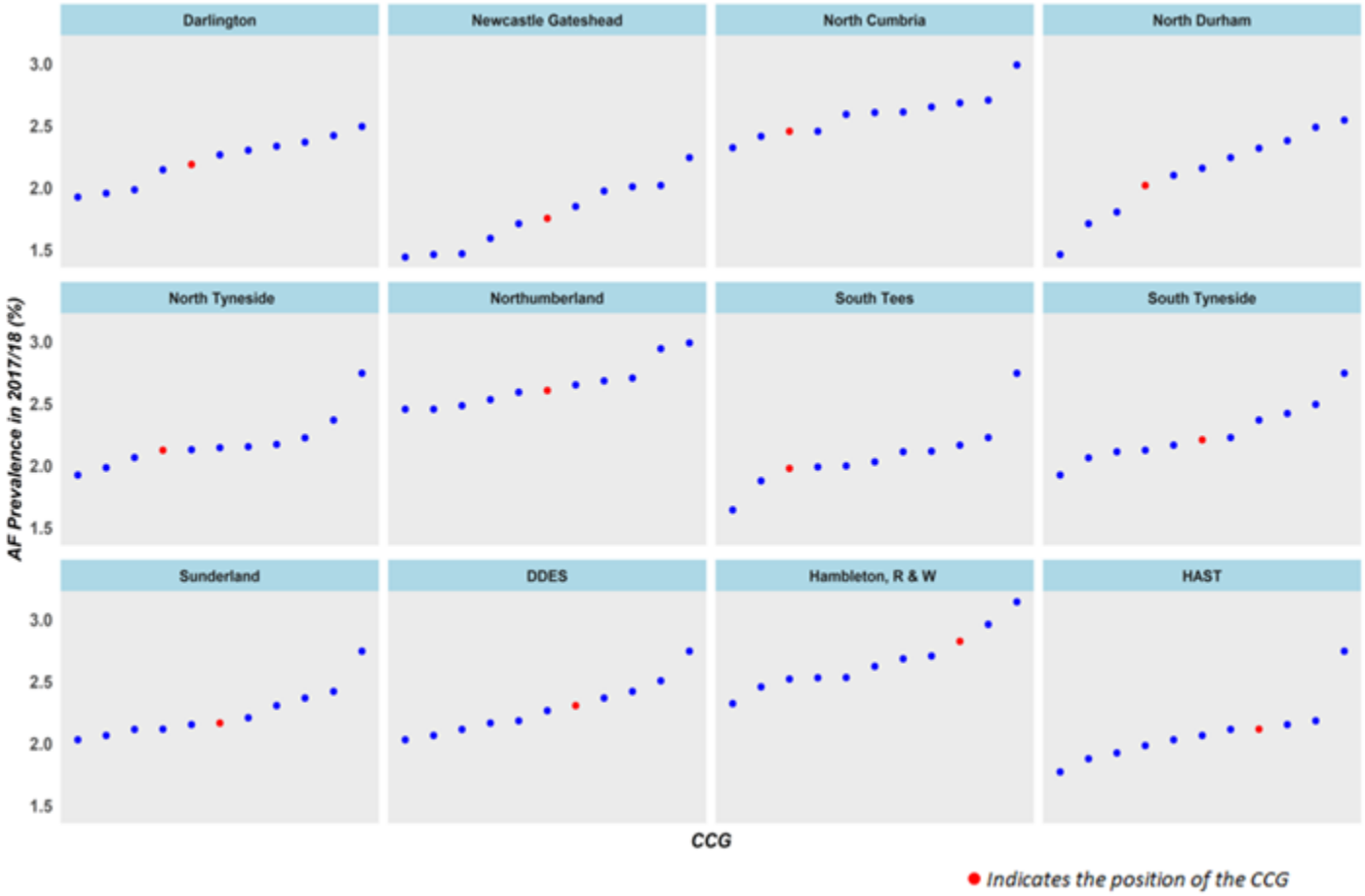
- To achieve at least 85% detected prevalence across the NENC area by March 2020.

- To achieve 90% of all CCGs achieving 84% of all patients with a CHA2DS2VASc score of 2 receiving anticoagulation, with all CCGs above 80%, across the NENC area by March 2020.

Detect

The number of people in NENC with a diagnosis of AF (QOF AF001) against the expected number has increased from 76% (in 2016-17) to 81% (2017-18)[14]. This equates to 8,404 patients added to the AF register. Each CCG is compared with the 10 most similar CCGs below. Despite the increase in detection between 2016/17 and 2017/18, there is much to do across NENC to meet the 85% national and local detection ambitions.

Figure 1. AF Prevalence in 2017/18 by NENC CCGs compared to their 10 most similar CCGs.

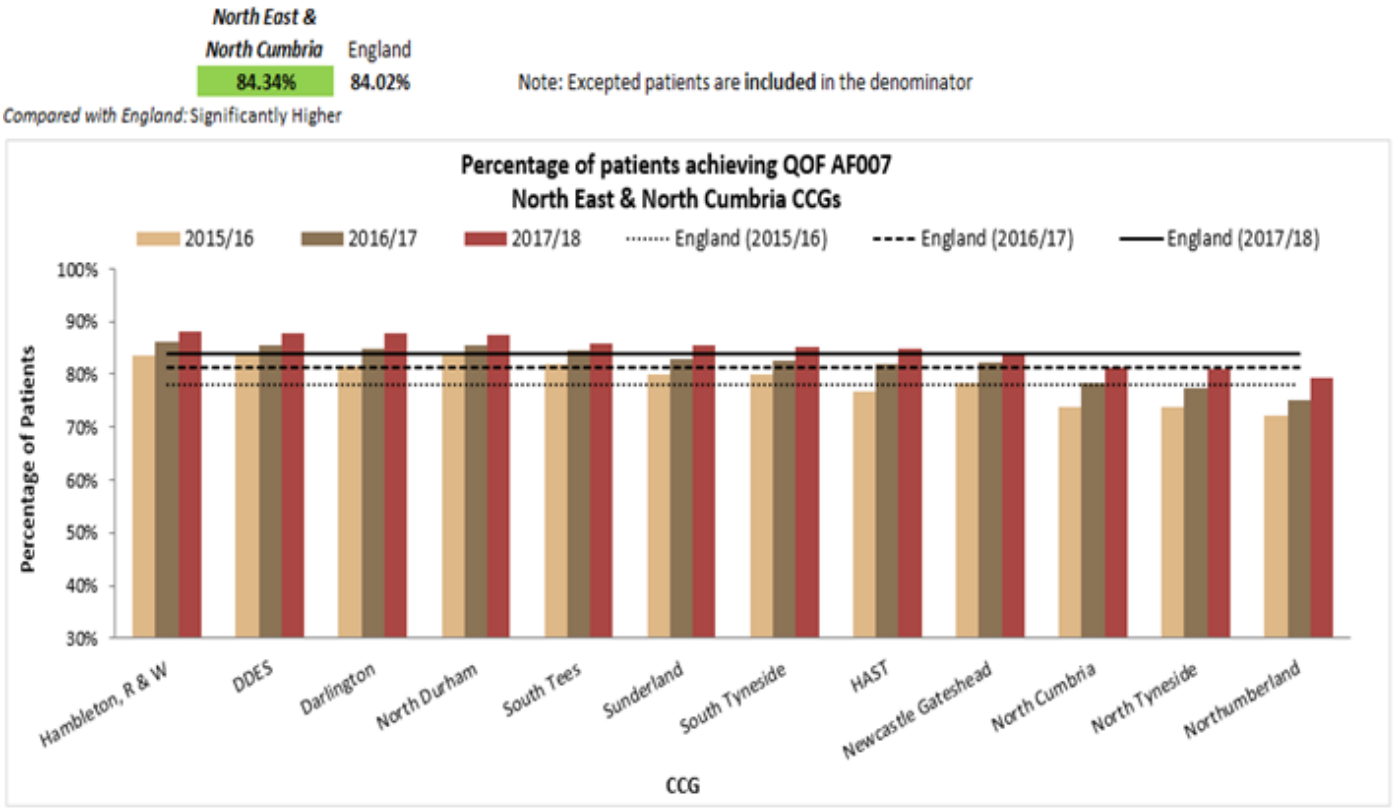


Data supplied by NEQOS.
Data sources: Quality and Outcomes Framework (QOF), NHS Digital (http://content.digital.nhs.uk/qof)© NHS Digital. QOF is licensed under the Open Government Licence v3.0 except where otherwise stated. NHS England Similar 10 CCG Explorer Tool, (https://www.england.nhs.uk/publication/similar-10-ccg-explorer-tool/)

Protect

The number of people in NENC with AF at risk of stroke (CHA2DSVasc score of 2 or more) and receiving anticoagulation (QOF AF007) has increased from 82% (in 2016/17) to 84% (in 2017/18)[14]. A breakdown of these figures by CCG can be seen below. Despite these increases, further improvements are required to meet the national ambition of treating 90% of people with AF at risk of stroke with anticoagulants by 2029. And three CCGs have yet to achieve the national target of 84%.

Figure 2. Percentage of patients with a CHA2DSVasc score of 2 or more receiving anticoagulation by CCG.



Mobile ECG Devices

In 2017, NHS England commissioned the 15 Academic Health Science Networks (AHSNs) across England to facilitate adoption of innovative technology aimed at reducing the incidence of stroke by increasing detection and closing the AF prevalence gap.

This novel approach to facilitate innovation adoption also aimed to reduce the incidence of stroke through increased detection of AF in England. As a result, 6,000 mobile ECG devices were distributed across the county by the AHSNs, allowing a greater range of healthcare and non-healthcare settings to offer opportunistic pulse rhythm checks to asymptomatic groups at increased risk of AF.

The AHSN NENC was responsible for the distribution of 374 AliveCor mobile ECG devices. Of the 6 mobile ECG devices available through the project, all devices selected by AHSN NENC were AliveCor, a small, portable single lead ECG device that uses a high frequency sound wave that is received via the microphone of a compatible smartphone or tablet. The app has a built-in AF detection algorithm that provides a 30 second single lead rhythm strip and a PDF of the trace that can be printed or emailed securely. This device was selected by AHSN NENC based on a superior sensitivity and specificity, ease of use and/or their lower unit price compared to other available devices. Systematic review and meta-analysis have found this device to have increased sensitivity and specificity compared to manual pulse palpation. Additionally, AHSN NENC already had experience of using AliveCor because 100 devices had already been bought and distributed prior to the national rollout. This prior experience was built upon with the NHSE-funded devices.

The AHSN NENC resources relating to this work can be seen at http://www.ahsn-nenc.org.uk/what-we-do/improving-population-health/atrial-fibrillation/alivecor/

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The AHSN NENC approached the 12 regional CCGs with details of NHS England's AF detection initiative. As interest in the devices spread throughout the NENC region, a variety of novel settings were included over the course of the project. This allowed the AliveCor mobile ECG device to be used in a range of traditional and some more non-traditional settings, to assess the viability and value in each. The wide range of settings that received AliveCor mobile ECG devices can be seen in table 1, below.

Devices were rolled out across NENC between January 2018 and March 2019. AHSN NENC provided face to face training for AliveCor mobile ECG devices and a range of resources to aid implementation. This included the National AHSN Network project guidance covering information governance. The training and recommendations for use were adapted for each type of setting. We recommended pulse rhythm checks using the AliveCor Mobile ECG device were offered opportunistically to all people deemed at increased risk of AF that they encountered. Specifically, those at increased risk were identified as all those aged >65 years, or those aged <65 years with pre-existing CVD risk factors.

Table 1. Settings that received mobile ECG devices.

North Cumbria GP practices including ICCs: Eden Valley, Keswick & Solway and Copeland.	PREPwell pre-operative assessment clinic, James Cook University Hospital
Darlington GP practices	Northumberland Heart Failure Specialist Nurses
DDES GP practices	North Tyneside Heart Failure Specialist Nurses
Hartlepool & Stockton GP practices	RVI Cardiology Service
Hartlepool and Stockton Out of Hours Service	UHND Cardiology Service
Newcastle and Gateshead GP practices	North Tees and Hartlepool Cardiology Specialist Nurses
North Cumbria Fire and Rescue Service	North of Tyne LPC community pharmacies
Co Durham & Darlington LPC community pharmacies	South of Tyne & Gateshead LPC community pharmacies
PSNE Community Pharmacies	North Tyneside GP practices
Northumberland GP practices	South Tees GP practices
South Tyneside GP practices	Sunderland GP practices
NUFC Foundation	Sunderland City Hospitals Podiatry Dept.
HealthWorks, Newcastle (3rd sector carrying out PHE HealthChecks)	Pre-operative assessment clinic, Freeman Hospital

Where pulse rhythm checks were already being offered to individuals at lower risk of AF, manual pulse palpation was replaced by a pulse rhythm check using AliveCor mobile ECG device. At the time of use, if the subject was tachycardic (heart rate >100bpm) or bradycardic (heart rate <50bpm), regardless of heart rhythm, this would be identified using AliveCor. However, if subjects had a heart rate of between 50 and 100 bpm and their rhythm was not 'normal' and not 'possible AF' then AliveCor would interpret this as 'unclassified'. Examples include ischaemic heart disease, left bundle branch block and cardiomyopathy. In such cases, users were advised to wait a few minutes and then retest up to twice. If unclassified readings persisted, users were advised to treat in the same way as a possible AF finding. In such cases, a PDF of any abnormal traces detected using AliveCor could be printed or emailed for advice from a GP, or appropriately trained healthcare professional depending on the setting.

AliveCor usage was captured and reported monthly through the national AHSN Network project. This usage data was shared regularly with the local project leads and users of the mobile ECG device. Users also received a series of automated emails for three months post-training to encourage continued use of AliveCor. These emails detailed case studies, infographics and testimonials. Mobile ECG device users were invited to a community of practice to discuss their experiences and were also invited to complete a questionnaire to provide their feedback on the project.

The AliveCor mobile ECG device should be seen in the context of the entire patient pathway, with a referral process for a 12-lead ECG reading to confirm or refute diagnosis, and initiation of anticoagulation if appropriate. One of the objectives of the national project was to examine the viability of using the AliveCor mobile ECG devices in a variety of settings for opportunistic testing for patients at increased risk of AF. It also aimed to demonstrate the value of different settings at detecting possible AF, so that new potential settings for opportunistic testing for AF could be identified for future commissioning intentions for AF detection.

Findings

All 374 AliveCor mobile ECG devices were distributed across the NENC area between January 2018 and March 2019, with the majority being deployed between May 2018 and March 2019. A total of 20,735 pulse rhythm checks were recorded using AliveCor, detecting 1,175 people with possible AF.

100% of AliveCor mobile users had their devices registered (registration happened during training) with the AHSN Network, so all activity was captured.

Figure 3. The cumulative number of uses of AliveCor Mobile during the project.

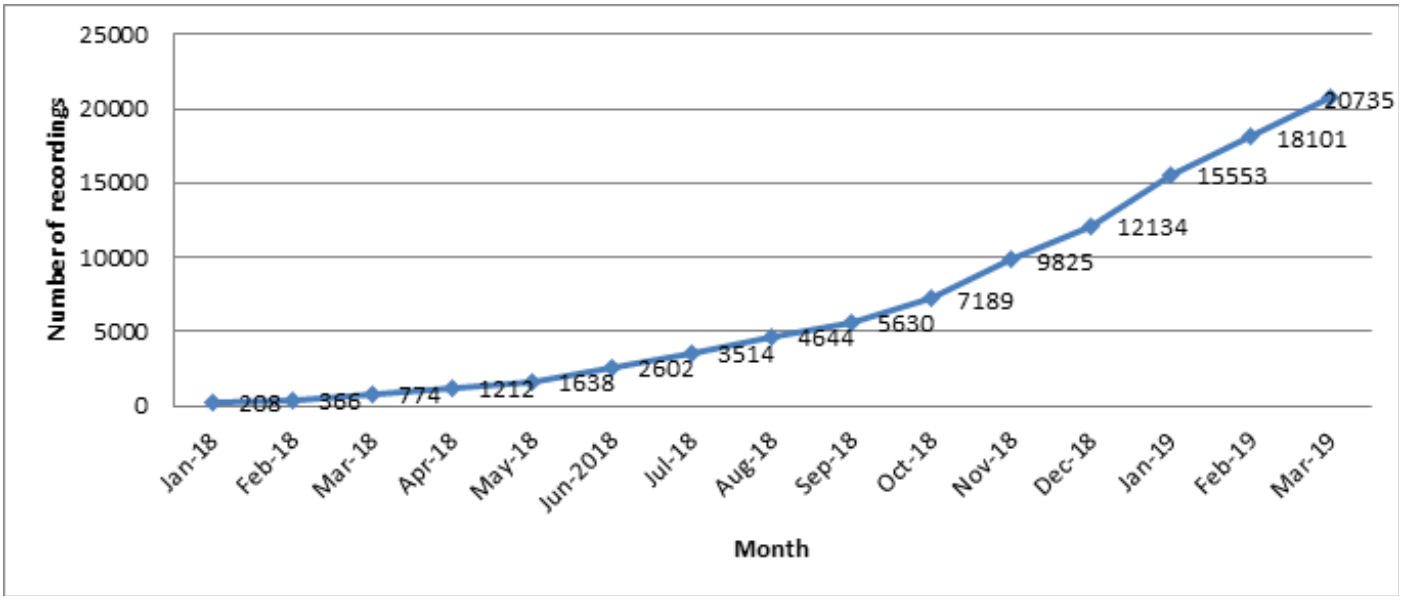
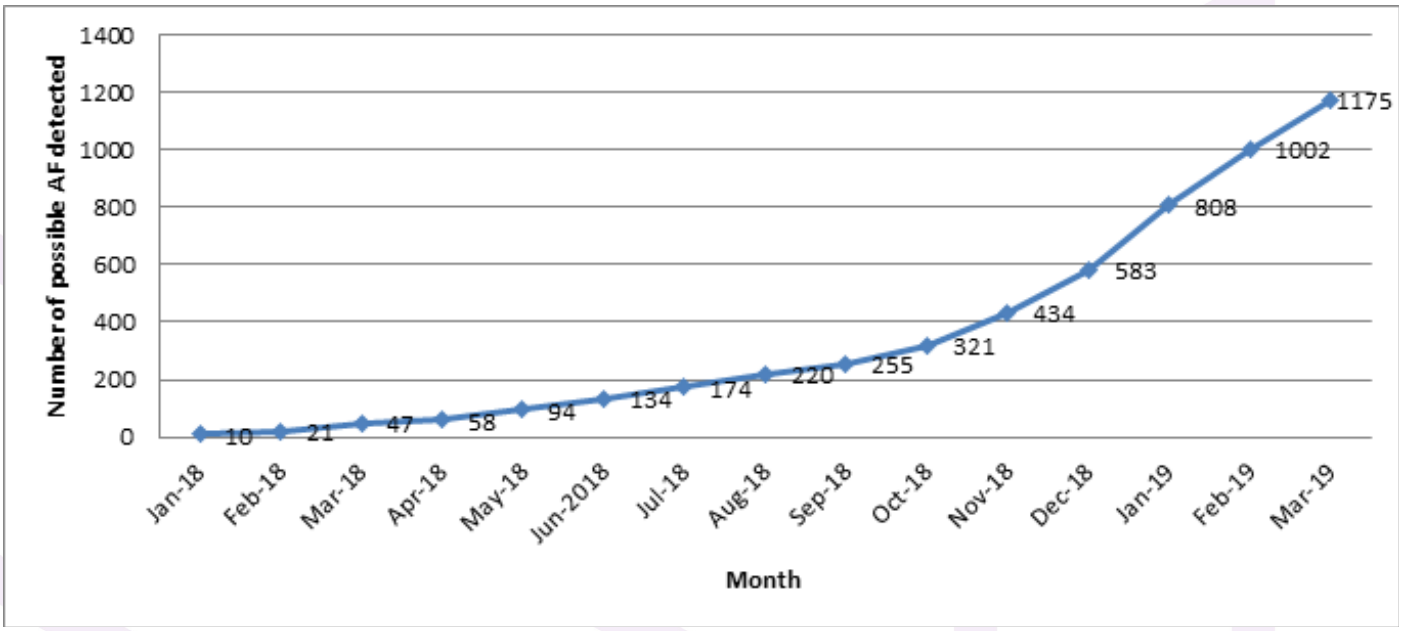


Figure 4. The cumulative number of possible AF detected by AliveCor during the project.



Device usage was fed back to users and organisations each month and learning was collated, allowing training materials and processes to be regularly improved. The AliveCor mobile device was grouped into similar settings where possible to enable interpretation into the effectiveness of different settings at identifying possible AF. This enabled the estimation of the detection rate and prevalence of possible AF in each setting which can be seen in table 2. Some of the settings are discussed in more detail below.

Table 2. The impact of AliveCor across the different settings in NENC.

	Pulse rhythm checks	Possible AF	Detection prevalence %	Detection rate
GP practices	15,759	736	4.7	1 in 21
- GP	2,741	139	5.1	1 in 20
- Practice Nurse	5,617	246	4.4	1 in 23
- Health Care Assistant	7,401	351	4.7	1 in 21
Community pharmacy	1,355	70	5.2	1 in 19
Pre-operative Assessment	436	24	5.5	1 in 18
GP Out of Hours Service	400	12	3	1 in 33
Podiatry	334	54	16.2	1 in 6
Fire & Rescue	169	11	6.5	1 in 15
Outpatient Cardiology	303	9	3	1 in 33
Community Cardiology	1,086	251	23.1	1 in 4
Third Sector	893	8	0.9	1 in 111
Total	20,735	1,175	6	1 in 18

NB. Purple figures have been sub-divided from the total GP practices figure.

20,735

Patients have been screened for AF

374

AliveCor Mobile ECG devices were distributed across the NENC area

High Impact Settings

High impact settings are those with detection prevalence greater than 5%.

Community Cardiology

This covers a variety of roles and teams with both **County Durham and Darlington NHS Foundation Trust, North Tees and Hartlepool NHS Foundation Trust** and **Northumbria Healthcare NHS Foundation Trust.** These include: Heart Failure Nurses, Cardiology Clinical Nurses, CHD Nurses, Occupational Therapists, Physiotherapists, District Nurses and Consultants within the Cardiac Rehabilitation team, Community Stroke team, Stroke Rehabilitation team and Community Nursing team. They work with patients who have existing cardiology conditions and likely to be at higher risk of developing AF. These teams reported that AliveCor helped with work efficiencies; using AliveCor meant they sometimes did not need to either travel back to their base, or return to their car, to retrieve a portable ECG machine, because AliveCor ruled out an irregular rhythm.

Podiatry

Podiatrists carrying out diabetes foot checks assess patients' pulses and therefore any patient with an irregular pulse can be detected as part of the review process. They are ideally placed to carry out opportunistic checks for undiagnosed AF as part of a routine podiatry assessment and when encountering visual symptoms that suggest an underlying circulatory disorder. The increased detection rate in diabetes podiatry may be due to patients being at greater risk of cardiovascular conditions as well as being older. A routine appointment with a podiatrist is typically between 15-20 minutes, which provides a greater opportunity to undertake a pulse check than some other settings which may have shorter appointments. The podiatry team at **Sunderland City Hospitals NHS Foundation Trust** built-in opportunistic testing for AF using AliveCor as this gave increased confidence to podiatrists who traditionally do not check for regularity of pulse and who, at this Trust, do not use a Doppler. Any 'possible AF' was communicated to the GP by sending a 'task' through Systm1 or in writing, with a PDF of the trace being posted or emailed to the GP practice, ensuring timely and appropriate onward referral for 12-lead ECG and initiation of anticoagulation where appropriate.

"AliveCor has helped clinicians to build confidence in onward referral to GPs, giving them more assurance that there is something of significance occurring. This has been invaluable for the staff." Elaine Ricci, Clinical Lead Podiatrist, Sunderland Royal Hospital.

Fire & Rescue

Cumbria Fire and Rescue Service used AliveCor as part of their Safe and Well Checks which focused on older, more frail and vulnerable people. They actively promoted AliveCor's use in North Cumbria and specifically in Eden Integrated Care Community (ICC) as well as Keswick & Solway ICC and Copeland ICC. The initial challenge was to obtain a route for referral from the Fire and Rescue Service so the person identified with possible AF could receive a 12-lead ECG to confirm or refute a diagnosis of AF. This was managed according to local ICC arrangements, so any possible AF's were referred to the Lead GP at Eden ICC who contacted patients' practice, whereas the other two ICCs had referrals through the HART Hub at the Fire and Rescue Service who then sent this onto the identified person's GP.

"One referral of note recorded, was in Whitehaven and was undertaken by Green Watch who whilst undertaking the AF test within a property where care was being administered identified that the occupant's carer tested as abnormal for AF. Whilst the carer was taken aback by the result the crew calmly reassured and explained to her what the result meant and the next steps to take. The following afternoon the carer telephoned Whitehaven station to thank the crew for potentially saving her life. She explained she visited her GP that morning with the information of the test carried out by CFRS; she was tested by her GP who confirmed the presence of AF and high blood pressure. The GP prescribed blood thinning medications as there was a very high chance of her suffering a stroke. She was very grateful to the crew as she had not been to see her GP for four years as she regularly exercised, ate well and never felt any symptoms of illness. Had it not been for the visit of the crew that day, the outcome could have been life changing for herself, her husband and her family and she could not stress enough the importance of taking the test when offered, as it has potentially saved her life."
Catherine Moody, Home Accident Reduction Team Leader, Cumbria Fire and Rescue Service, Fire, Rescue & Resilience, Cumbria County Council.

Pre-operative Assessment

Large numbers of patients are seen within these settings and a routine ECG is performed on those patients over 50 years old. AliveCors were incorporated throughout the pre-operative assessment clinics at The Freeman Hospital in **Newcastle University Teaching Hospitals NHS Foundation Trust.** As a direct result of this patients with a normal AliveCor result were not then required to have a routine ECG, thus reducing the number of patients and the waiting time in the ECG clinic. AliveCors were also part of the PREP-Well Project, a pre-operative assessment community based clinic operated by a community physiotherapist out of James Cook Hospital at **South Tees NHS Foundation Trust.**

Community Pharmacy

AliveCor was used in several community pharmacies across NENC. The Local Pharmacy Committees (LPCs) across the patch were approached in 2017 and mixed results about using AliveCor were received. Pulse checks within this setting are unpaid, and this was a major barrier for implementation. Therefore, most of the community pharmacies who did participate were independent, progressive stores. A group of pharmacies (n=21), called **Pharmacy Services North East or PSNE** (County Durham & Darlington, South of Tyne and North of Tyne, omitting Newcastle) were incentivised through funding obtained from industry to check pulses. In the past, scratch cards regarding alcohol intake had been successfully used in community pharmacies, because a request from a patient is more powerful than a pharmacist initiated discussion. Therefore, a scratch card for AF was developed for use in community pharmacies, but this has yet to be evaluated.

"I can report a very positive start to the project The GP was very impressed with the AliveCor print out. I have had similar discussions with other pharmacists who also that have had very positive outcomes from referrals. The staff found the device very simple and quick to use and the patients are also loving it."
Dawn Cruickshank, Chair County Durham and Darlington LPC, Superintendent Pharmacist, John Low Ltd.

Moderate Impact Settings

Moderate impact settings are those with detection prevalence between 2% - 5%.

General Practice

The most common setting that AliveCor mobile ECG devices were used during the project was in general practice; 75% of devices were within GP surgeries. Opportunistic heart rhythm checks were offered within practices and used with a variety of patients. It was recommended that AliveCor be used in long term conditions clinics and with patients deemed to be at higher risk of AF (patients aged over 65), but it was known that practitioners used devices according to their own work practices. A degree of flexibility was needed regarding implementation to encourage usage of AliveCor. Nine of twelve CCGs had practices who used AliveCor, and two CCGs (South Tees CCG and Hambleton, Richmondshire and Whitby CCG) expressed interest but came on-board after the national work had been completed. One CCG, North Durham, had alternative pulse checking programmes of work in place. In total, 127 practices across the NENC area had an AliveCor. Use by practitioner within this setting varied; GPs had the greatest identification rate and practice nurses the least but the variation between them was small. The greatest number of uses was by healthcare assistants.

"A very useful tool in General Practice which has helped pick up arrhythmias in those patients whom we would have otherwise missed."
Dr Vivienne Tut, GP, Bensham Family Practice, Gateshead.

"Alivecor is a very useful tool that helps to pick up AF during routine GP consultations if you clinically suspect an irregular pulse. It is easy to use, portable and particularly helpful in settings like home visits or when nursing clinics are extremely busy. It saves time for the clinician and patient and is reliable."
Dr Raj Bethapudi, GP Partner, Trainer & Appraiser, Galleries Medical Practice, Washington.

Outpatient Cardiology

Patients were referred to this setting as they had presenting symptoms and needed to start a diagnostic process such as a loop recorder. AliveCor helped within the diagnostic process; for example patients with paroxysmal AF were given an AliveCor and asked to use the device when they felt unwell and email their traces into a secure email for a healthcare professional to read. This often speeded up the process of diagnosis. The palpitation clinic at **South Tyneside NHS Foundation Trust** as well as the RVI in **Newcastle University Teaching Hospitals NHS Foundation Trust** and **North Tees and Hartlepool NHS Foundation Trust** used the AliveCor.

Out of Hours

Hartlepool and Stockton-on-Tees Out of Hours Service run by GP Federation Hartlepool and Stockton Health (**HASH**) had 9 AliveCor devices. The variation in patients accessing this service is wide and will include people younger than those is some of the other settings.

Lower Impact Settings

Low impact settings are those with detection prevalence less than 2%.

Third Sector

Two organisations had AliveCor devices: **Healthworks** in Newcastle and **Newcastle United Football Club (NUFC) Foundation.** Healthworks have the contract to deliver PHE NHS Health Check and they provide outreach into the community and work with hard to reach groups such as BME and those in deprived communities. NUFC Foundation run programmes such as Walking Football and Man v Fat as well as a HealthCheck programme.

"Newcastle United Foundation's Health and Wellbeing Team have successfully implemented the use of the technology as part of their NHS Health Check service in which they carry out health screening across the region, helping people live happier and healthier lives. We have successfully screened and referred a number of individuals with undiagnosed cardiopulmonary issues, the implications of early diagnosis and treatment for these people could be live saving."
Sam Cooper, Health and Wellbeing Project Officer, Newcastle United Foundation.

Lessons Learned

Roll out of AliveCor mobile ECG at scale over a relatively short timeframe presented a number of challenges. And during implementation many lessons were gathered. These included:

Clinical Leadership

This is needed at all levels from GP practice, through to Heads of Departments, CCGs and as part of the AHSN NENC AF Programme Team.

Positive Relationships

Good, positive relationships between the roll out team and users of AliveCor are required for successful roll out.

Key Ingredients for Practice Engagement

A number of factors are needed here and these included: at least one person interested in the topic (AF); senior practice staff to support and buy-in to the work; active promotion by the CCG using consistent key messages on a frequent basis using a variety of communications modes i.e. newsletters, education events, practice facilitators, practice drop-ins.

Time for Implementation

Estimated time for roll out was under-estimated. Use of new technology can be perceived as threatening so time for people to become comfortable and familiar needs to be built in. There is wide variation in the way AliveCor is used and time is needed to allow people to figure out how the technology can work within their environment.

Dedicated Project Lead

This is needed to drive the work forward.

Training in Small Groups

Training on a large scale (more than 10-12 people) does not work. Small groups are needed to allow for training to be understood and applied.

Regular Contact Highlighting Importance of Using AliveCor Mobile

Engagement falls away after training and initial excitement, so regular contact is needed highlighting the importance of the work. In this case, a series of automated emails 3 months post-training to keep pulse checking front of mind was used.

Patient Support Materials for Community Settings

Use of AliveCor within community settings required greater support materials for patients.

Flexibility in How the Device was Used

Being too prescriptive in how AliveCor was used meant some people were not receptive to employing the device. It was therefore necessary to retain flexibility and work with people helping them to discover the best way it could be used within their working practices.

Reward & Recognition

Giving a monthly prize (flowers or a voucher) to a staff member who had frequently used their AliveCor encouraged friendly competition between users. The presentation of the prize needed to be in front of their peers, often at a shared learning event, because it stimulated those attending to either use their allocated device or inspired others to request an AliveCor.

Discussion

This project demonstrates some key learning and awareness into the opportunities and challenges of using AliveCor mobile ECG devices across a wide variety of settings for providing opportunistic pulse checks for patients at high risk of developing AF.

A systematic review of screening for new AF reported that undiagnosed AF was found in 1% of the overall population (1 in 100) and 1.4% in those aged 65 years or older (1 in 71).[9] Another study focusing on an older population found prevalence increasing to greater than 13% in those aged over 85 years.[10] Using AliveCor mobile ECG devices across a wide variety of settings, allows the estimation of the numbers of people needed to test in each setting to detect possible AF.

As expected, settings which offered pulse checks for AF in groups of older people, those with existing CVD, and those with other high risk, long term conditions such as diabetes found a greater prevalence of possible AF. These included community services such as community cardiology and community pharmacies as well as older, frail people targeted by the Fire and Rescue Safe and Well Checks. Other high impact settings included podiatry focusing on patients with diabetes and pre-operative assessment clinics. Our results suggest that it is viable to use the AliveCor mobile ECG device in a variety of healthcare and non-healthcare settings, by both healthcare professionals such as GPs and non-healthcare professionals such as Fire Officers. They are effective in detecting possible AF in a number of innovative high impact settings. A proportion of the population does not have regular contact with healthcare services, so it is crucial to use a variety of non-healthcare settings for pulse checks to ensure harder to reach groups are included. This would include a lower impact setting of the third sector that have an important role to play in reaching such groups.

Although 374 AliveCor mobile ECG devices were distributed across NENC area, there was variation in their use. Some settings took up the device very quickly and incorporated its use into their practice on a regular and frequent basis. The provision of monthly data helped to drive increased usage. Some settings used AliveCor mobile ECG periodically, without fully incorporating their use into practice and relied upon key users who had a particular interest in AF, while people in some settings who were allocated devices

never used them. Those people and settings who successfully incorporated AliveCor used a variety of ways that made their use easy and standard practice; for example using them in already established health checks, such as those used for long term conditions; using a dedicated work smartphone or tablet; and building in prompts into existing clinical systems to remind staff to pulse check.

There were some strong lessons in the implementation of this work and the provision of regular data helped identify some key points. We noted that after initial excitement in receiving the device usage tailed off after 2-3 months, hence introducing an automated email campaign for the first 3 months after training to ensure pulse checking was at the fore front of trainees' minds. Using reward and recognition of staff who were high users of AliveCor, presenting them with flowers or a voucher, in front of their peers stimulated other users present to use the device. Training was a key aspect of the implementation and this had to be done in groups of less than 10-12 people to be effective. Training in large groups such as a primary care education Time In Time Out (TITO) events were pointless with frustration for the trainees and trainers; staff technical knowledge varied hugely and this impacted the speed of the training. A more one-to-one approach was needed to successfully train staff. No one received an AliveCor device unless they were trained by the AHSN Project Lead, who distributed the AliveCor at training. This allowed NENC to have all 374 devices registered (this was done by the Project Lead at training), ensuring data from all our allocated devices was captured. A dedicated project lead to drive the work and clinical champions at various levels (organisational and department/ practice) were key components to success, along with flexibility for each organisation/ practice/ department to implement AliveCor that suited their working practices.

Limitations

There are limitations of this project which need to be acknowledged. It was not possible to follow up what proportion of those patients identified with possible AF went on to obtain a diagnosis of AF. Future work would be required to discover the conversion rate from a finding of possible AF on an AliveCor mobile ECG device to a diagnosis of AF from 12-lead ECG. Trainees and AliveCor mobile ECG users were discouraged from using the device on people who already had a diagnosis of AF, but it was impossible to enforce this advice; therefore some possible AF recordings could have been performed on those patients with known AF.

A limitation of AliveCor mobile ECG is that it works using an app that has to

be downloaded onto a smartphone or tablet. Some healthcare and non-healthcare professionals had access to a dedicated work device which was used with the AliveCor mobile ECG, but some staff could not access a work smart device which limited their engagement with the project. However, a number of settings purchased a smart device or used old ones, often donated by staff, specifically for this project, removing this as barrier to participation.

There was also a wide variation in the acceptance of new technologies across the different settings. Those with no access to work smartphones or tablets, inadequate internet connection, and little or no confidence in using technology had worse device utilisation. AliveCor mobile ECG devices then became a challenge to incorporate in some areas, limiting its value and use. Most challenges had a work-around such as staff donating smart devices, but this did impact some settings and organisations.

Other Considerations

One AF-related stroke is prevented for every 25 people diagnosed with AF and treated with anticoagulants[11], so any settings and organisations that do not have access to AliveCor mobile ECG devices, a manual pulse palpation should be considered as it still remains an effective method of detecting an irregular pulse. For those responsible for organising and commissioning healthcare services, the results of this project provides insight to the effectiveness of different settings for offering pulse checks.

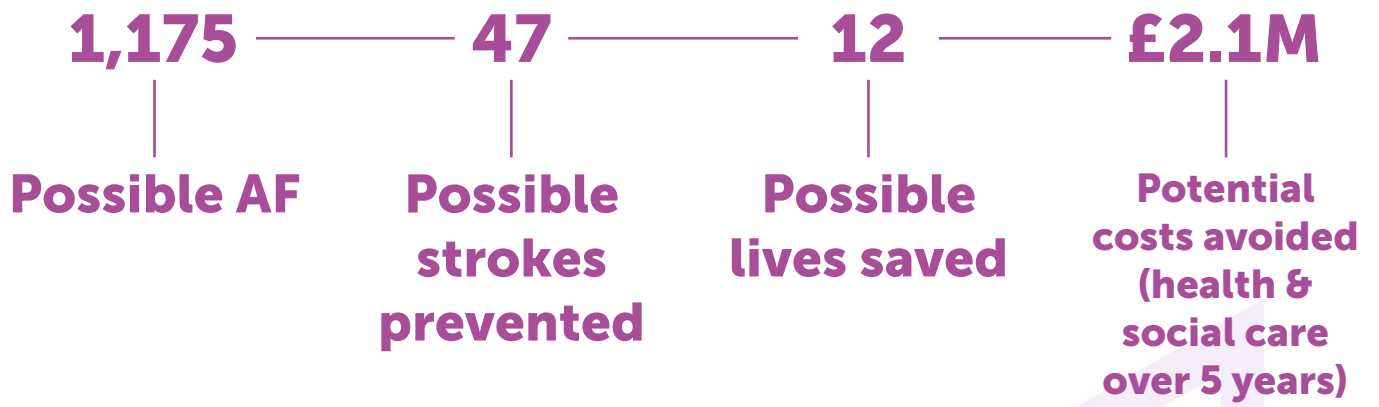
To achieve a reduction in AF-related strokes using AliveCor mobile ECG devices, there needs to be a clearly defined patient pathway allowing access to a 12-lead ECG for diagnostic purposes, followed by anticoagulation treatment. AliveCor needs to sit within the context of a whole patient pathway, rather than be seen as the entire solution to a reducing AF-related strokes.

Conclusion

By capturing the number of pulse rhythm checks and the number of possible AF detected, it is possible to estimate the impact of the project (figure 5).

It is estimated that for every 25 people found to have AF and appropriately treated with anticoagulants will prevent one stroke, and for every four strokes prevented one life is saved.[11] As well as the human cost of stroke, the financial burden is significant. The healthcare costs in the first year following the average stroke is £13,452, increasing to £22,429 for both health and social care costs at one year post stroke, and £46,039 in health and social care costs over 5 years.[9] The AliveCor mobile ECG device project detected 1,175 people with possible AF, preventing 47 possible AF-related strokes, with over £630,000 of potential healthcare costs avoided over one year, and over £2,160,000 of potential health and social care costs avoided over 5 years. Potentially, 12 lives have been saved.

Figure 5. Potential impact of AliveCor mobile ECG device project in NENC (1st January 2018 – 31st March 2019)

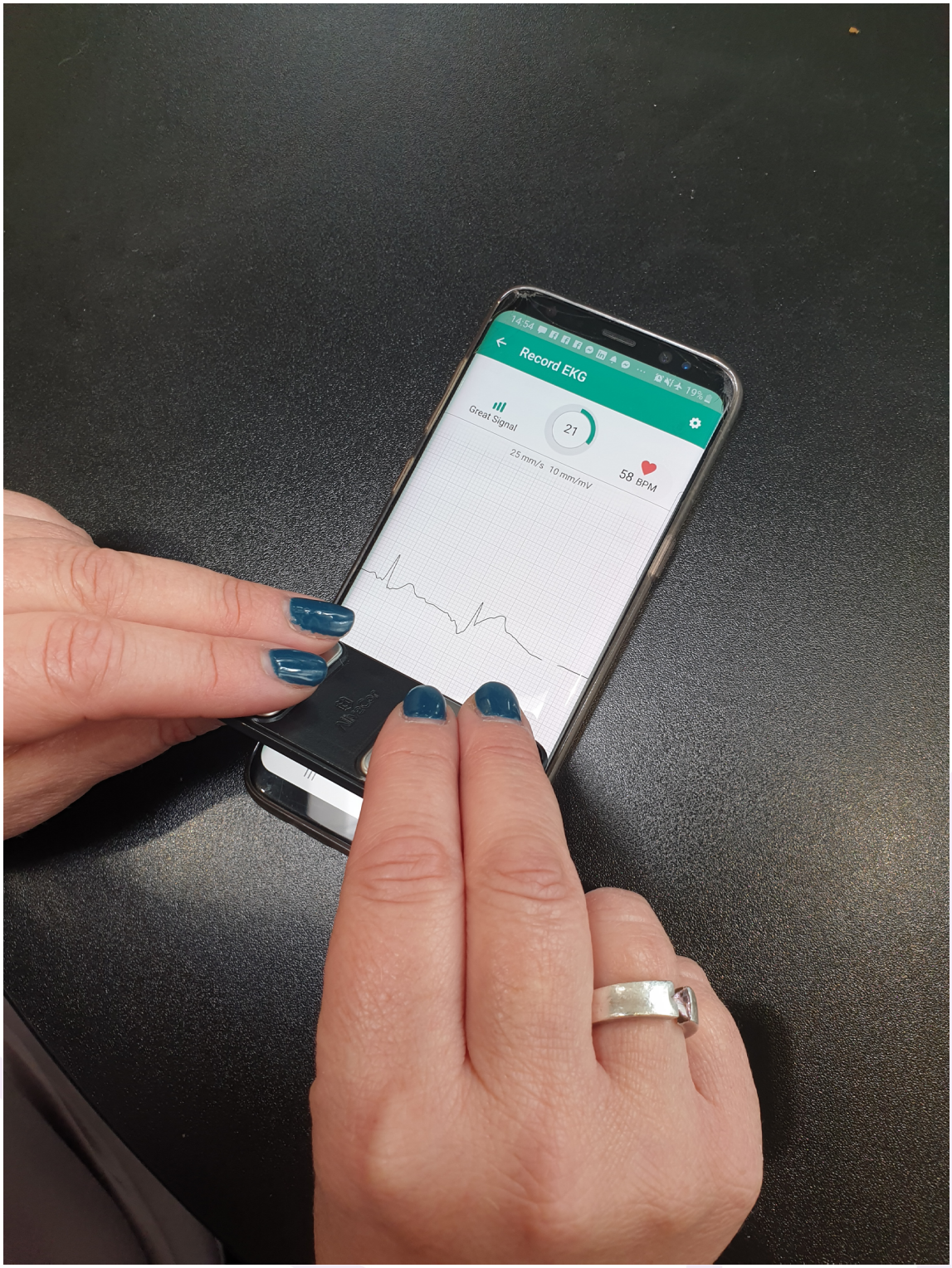


To achieve the local and national ambition of detecting 85% of the population who have AF, these results support further examination of pulse rhythm checks in different settings across NENC. This approach will benefit the people of NENC, helping to reduce the suffering and costs caused by AF-related stroke.

The NHS Long Term Plan encourages work with community pharmacists, the voluntary sector, and GP practices to provide more opportunities for the public to tests for high-risk conditions. The results of this project highlight

additional settings and organisations that are viable and proved successful testing for AF, and that merit further exploration.

The findings support the implementation plan followed by NENC who, as an AHSN, performed significantly more (n = 10,331) pulse checks than any other AHSN in England. Key learning for implementation of similar technologies should be heeded to support success.



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