A health economic evaluation of Vitacam as an Atrial Fibrillation screening tool

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January 2023

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1. Executive Summary

Atrial fibrillation (AF) is the most commonly occurring heart arrhythmia, and a major preventable cause of stroke, heart failure, and other cardiovascular complications. Many patients are only diagnosed with AF when they experience complications, with an estimated half a million undiagnosed AF patients living in the UK. Causing an estimated 20% of strokes in the UK, AF places considerable strain on the NHS, estimated at up to £2.5 billion in 2020. Improved early detection of AF therefore provides a significant opportunity to reduce the impact of AF on NHS and social care resources, as well as on patients and carers.

While not currently recommended in the UK, mass screening programs are being increasingly promoted to improve detection of AF, reducing morbidity and mortality through early intervention and treatment. A number of technologies have recently been developed to enable remote monitoring of heart rhythm: Vitacam is one such technology, offering a potential mass screening tool that is simple, safe, and well accepted by patients and carers. However, evidence of the cost-effectiveness of Vitacam in a screening program is vital in order to promote further research and clinical trials.

The aim of this health economic evaluation is to provide initial evidence of the cost-effectiveness of Vitacam as a screening tool for AF, compared to the current diagnostic approach. We built an adjustable Excel model, allowing users to understand the impact of different input parameters on the cost-effectiveness of the pathway.

Our analysis suggests that application of Vitacam as a screening tool for AF is cost-effective, providing over £82 million of net benefit in the first year with a benefit cost ratio of 1.40. This benefit may be further increased under certain circumstances, in particular with improved targeting of the screening population and reduced cost of Vitacam per person. Reduced morbidity through earlier detection of AF would continue to deliver benefit in future years, with an estimated £96 million of benefit per year across health and social care settings through avoided strokes alone.

While this work focused on the application of Vitacam in an AF screening pathway, a blend of technologies and approaches will likely be most effective. Future work should seek to understand the differentiators of these technologies to ensure the most appropriate populations are targeted, providing the greatest patient uptake and acceptance, and measurement accuracy.

2. Introduction

Atrial Fibrillation (AF) is the most commonly occurring sustained heart arrhythmia, affecting more than 1 in 10 elderly people. While not life-threatening itself, it is a major preventable cause of stroke, heart failure and other cardiovascular complications. Notably, AF increases the risk of ischaemic stroke by up to five times, with 20% of strokes in the UK caused by AF. However, up to 75% of these AF-related strokes (and an estimated 12,000 deaths[1]) could be prevented with timely detection and intervention[2].

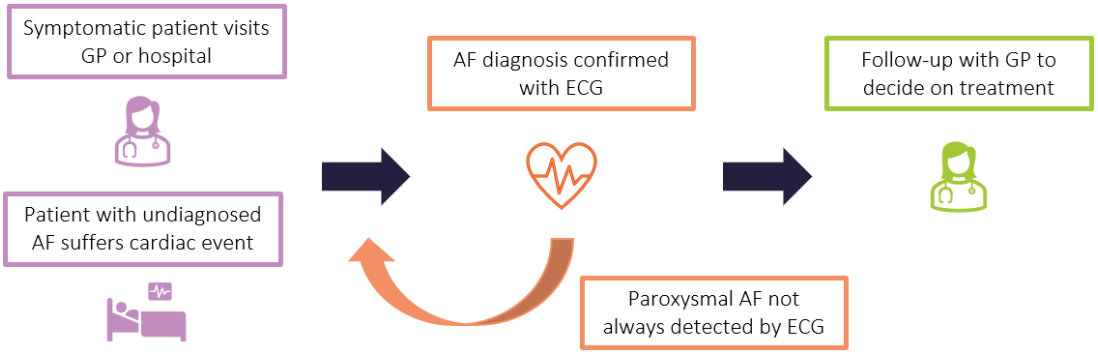
1.1 The impact of Atrial Fibrillation on the NHS

AF places a significant burden on health and social care systems. A recent study estimated the cost of AF to the NHS at between £1.4 billion and £2.5 billion in 2020 (0.9%-1.5% of NHS expenditure), mostly from primary admissions[3]. With the prevalence of AF in the UK rising year on year, this burden on the healthcare system is expected to rise: over the next two decades, the total direct costs of AF are estimated to increase to between 1.35% and 4.27% of NHS expenditure[3]. If complications and resulting hospitalisations could be avoided or reduced, these costs to the NHS would be substantially reduced.

It is estimated that there are up to 500,000 additional AF patients in the UK who are undiagnosed, with 25-30% of individuals being asymptomatic[1]. Many patients are only diagnosed with AF when they experience complications, for example one study found that nearly 1 in 5 AF-related strokes occurred without a prior AF diagnosis[4]. As such, identifying and treating these individuals earlier would reduce AF-related hospitalisations, morbidity and mortality, saving significant NHS and social care resources.

1.2 Current guidance on diagnosing Atrial Fibrillation

While there is some variation across the UK, currently AF is generally diagnosed when patients present with symptoms or experience a healthcare event. According to NICE guidance, patients presenting to primary care with suspected AF will be offered a 12-lead electrocardiogram (ECG) for diagnosis. However, this may not detect early-stage paroxysmal AF, where episodes of AF come and go. If paroxysmal AF is suspected and AF is not detected by standard ECG, an ambulatory ECG should be offered[5]. This pathway is outlined below.



[1] BHF comment, *Thousands of people undiagnosed with irregular heartbeat increasing risk of stroke*
[2] UCL Partners, *Detecting heart arrhythmias with FibriCheck app during the pandemic*
[3] Burdett and Lip 2022, *Atrial fibrillation in the UK: predicting costs of an emerging epidemic recognizing and forecasting the cost drivers of atrial fibrillation-related costs*
[4] Borowsky et al. 2017, *First Diagnosis of Atrial Fibrillation at the Time of Stroke*
[5] NICE Guidance: Diagnosis of atrial fibrillation

However, this approach is failing to detect significant numbers of AF patients in the population; detecting this undiagnosed AF remains a considerable challenge. As the risk of AF increases significantly with age, mass screening programmes among the elderly are being increasingly promoted.

1.3 Screening for Atrial Fibrillation

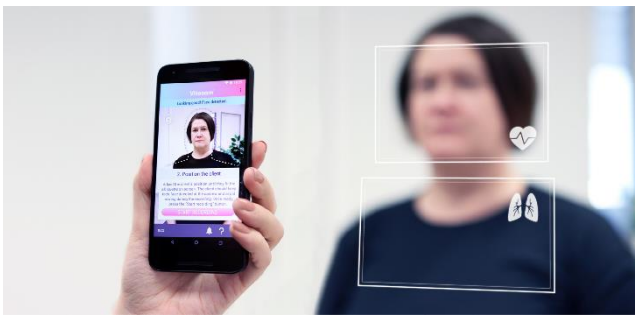
Screening is a systematic procedure to detect a target disease in an early, often pre-symptomatic phase of disease. The aim of screening is to reduce disease-specific morbidity and mortality through early intervention and treatment.

While screening for AF is not currently recommended by the UK National Screening Committee, the potential benefits of screening for AF are becoming increasingly recognised, and a review of this guidance is currently underway based on recent evidence.

The World Health Organisation has defined criteria to assess the effectiveness of a screening programme. Many of these criteria would be met for an AF screening programme, including: the target disease should be a substantial health problem, diagnosable in a pre-symptomatic phase with adequate sensitivity and specificity, and treatable. A number of technologies have recently been developed to monitor heart rhythm using smartphones and other portable devices, offering a simple, safe and potentially cheaper mass screening tool, and helping to overcome the challenge of adequately diagnosing early-stage paroxysmal AF by enabling continuous self-monitoring. However, evidence around the cost-effectiveness of a screening programme (including test, diagnosis and treatment), incorporating these new technologies into the pathway, is less well established.

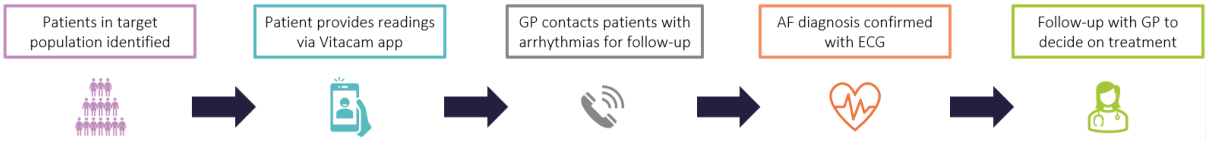
1.4 Vitacam as a screening tool

Vitacam is one of a number of these new heart monitoring technologies. It utilises video capture of a subject's face from a smartphone camera to monitor heart rhythm intermittently for short periods of time, using a method called remote photoplethysmography (rPPG). Pulsatile blood causes variation in skin colour that can be detected in Red-Green-Blue (RGB) channels, as used in digital imaging. Changes in the RGB channels are used to extract a pulse signal. With advanced processing, rPPG can be used to precisely measure intervals between heartbeats (i.e. ventricular contractions). The distribution of these heartbeat intervals can indicate AF, with AF distinguished by an 'irregularly irregular ventricular rhythm'.



Patients can screen themselves using their mobile phone, or receive assistance from a relative or carer. This means that readings can be taken while a patient is experiencing symptoms, improving detection of paroxysmal AF. However, PPG is currently not accepted as a diagnostic tool, and so an AF diagnosis would need to be confirmed by ECG (note that this guidance may change in the future, which would provide even greater benefit from the use of Vitacam).

The proposed Vitacam pathway, for mass screening of an identified at-risk elderly population, is outlined below. While we examine the use of Vitacam specifically, it is worth noting that a blend of technology and approaches, based on population and patient characteristics and acceptability of different tools in different home and care settings, will likely be most effective.



Early evidence suggests that Vitacam is easy to use, well accepted by patients and delivers accurate heart and breathing rate measurements[6]. However, initial evidence on its cost-effectiveness in an AF screening pathway, compared to the current diagnostic approach, is vital in order to justify investment in further research and clinical trials.

3. Aims and Objectives

This health economic evaluation aims to provide an initial estimate of the likely cost-effectiveness of Vitacam as an AF screening tool, compared to current methods of diagnosis.

As this is an early-stage evaluation, many parameters are yet to be determined through future research and clinical trials. The objective of the work is therefore to provide an indication of cost-effectiveness under different future scenarios, and determine the relative importance of different model parameter inputs on cost-effectiveness (i.e. to give an understanding of to which parameters the cost-effectiveness result is most sensitive). This work can therefore be used help inform decisions on target populations, pricing, and prioritisation of future research.

4. Methodology

We analysed the costs and benefits of using Vitacam as a screening tool, comparing the proposed Vitacam screening pathway outlined in Section 1 to the current ('do-nothing') approach.

To do this, we first carried out desk research to understand existing evidence on the current AF diagnostic pathway, the unmet need for improved detection of AF, and the impact of similar heart monitoring technologies. We gathered expert clinical input on where Vitacam would alter the current pathway, and the broad impacts that this would have across health and social care systems, as well as on individuals themselves and their carers. Based on this research, we developed a logic model, shown in Figure 1, to outline the key outcomes and impacts of using Vitacam as a screening tool, for quantification in the economic model.

[6] Case study: *Monitoring the wellbeing of the elderly using Vitacam*, 2021

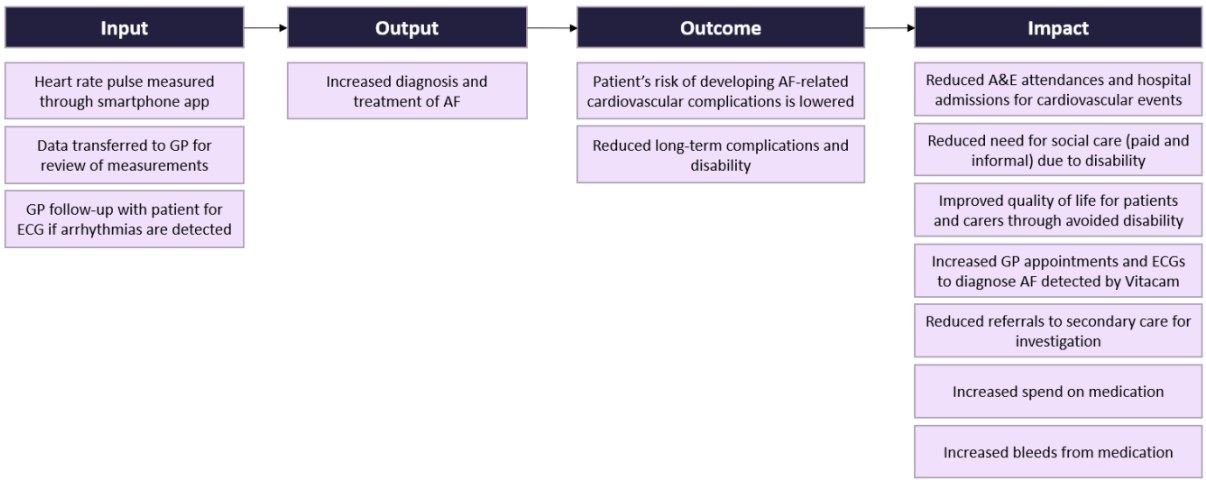


Figure 1. Logic model identifying the impacts of using Vitacam as a mass screening tool for AF on health care, social care, AF patients, and carers.

Based on this impact pathway, we developed an early economic model to allow users to gain an understanding of the likely cost-benefit of Vitacam under different future circumstances. To achieve this we built an adjustable model in Excel, allowing the user to choose values for key unknown parameters (but providing default values based on available evidence or clinical opinion) such as screening population size, Vitacam sensitivity and specificity, and cost of Vitacam per person. Key outputs were net benefit, benefit cost ratio, cost per case detected, and cost per stroke avoided.

Our model was based on undiagnosed AF in the over-65 population in England, and the impact of earlier detection of this AF, focusing in particular on avoided strokes. We first quantified the additional AF diagnoses that could be made using Vitacam as a screening tool, against the baseline AF incidence with the current approach. While the model provides dynamic outputs, for the analysis presented in this report we assume that:

- The screening population includes all over 65s without diagnosed AF, with hypertension since hypertension is a risk factor for AF. This equates to 50% of over 65s in England, with a targeting accuracy of 84% (i.e. 84% of over 65s with undiagnosed AF will be captured in the screened population) since the prevalence of hypertension among AF patients is 84%.
    - This gives a target screening population of 4.7 million, of which 360,000 have undiagnosed AF.
- Vitacam is used by all members of the screened population, identifying AF with a sensitivity of 92% and specificity of 98%.
    - This results in a total of 437,000 patients identified as having suspected AF.
- Diagnoses are confirmed at the GP by 12-lead ECG; if this is negative but paroxysmal AF is suspected then an ambulatory ECG is used. 12-lead ECG sensitivity and specificity are assumed to be 80% and 92% respectively, and for ambulatory ECG to be 96% and 97% respectively.
    - This gives a total of 327,000 AF diagnoses. Subtracting an estimated baseline incidence of 51,142 AF diagnoses (via the current approach) gives 276,000 new diagnoses.
- Treatment with anticoagulants is offered to eligible patients; we assume that 84% of AF patients at risk of stroke receive treatment.
    - This gives a total of 231,000 newly diagnosed AF patients receiving treatment, compared to baseline.

This pathway is outlined in Figure 2 below. For more detail on modelling assumptions and sources, see Appendix 1.

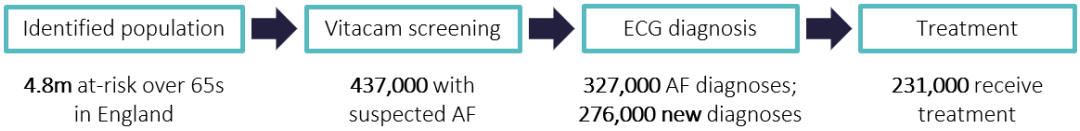


Figure 2. Outline of the Vitacam screening pathway on which the economic model is based.

The number of avoided strokes through treatment of these newly-detected AF cases was then calculated based on the risk of stroke among treated AF compared to un-treated AF (treatment with anticoagulants reduces the risk of stroke by about two thirds).

Costs and benefits were then calculated based on this pathway and associated patient numbers, comparing to the current diagnostic approach. These are outlined in Table 1; associated unit costs and modelling assumptions can be found in Appendix 1. We calculated benefits and costs over 1 year, but also estimated additional benefits that would be incurred in subsequent years through avoided prevalent stroke.

Table 1. Benefits and costs quantified in the economic model.

Domain	Benefits	Costs
Healthcare	Avoided stroke-related healthcare costs Avoided cardiology outpatient appointments	Vitacam screening costs Additional GP appointments and ECGs Costs of medication Costs of bleeds due to medication
Social care	Avoided stroke-related social care costs	
Societal	Avoided stroke-related informal care costs Improved quality of life through avoided stroke-related disability Improved carer quality of life through avoided stroke-related disability	

To ensure alignment with NICE best practice, we examined previously developed resource impact models for KardiaMobile and Zio. As these are both diagnostic tools, to be used as an alternative to Holter monitors, the patient pathway differs from that of Vitacam. However we ensured that our approach and modelling assumptions were aligned, in calculating the costs associated with a change in diagnostic pathway, avoided strokes through improved diagnosis, and medication costs and bleeds through increased anticoagulant prescribing.

5. Results

The proposed Vitacam screening pathway, including confirmatory ECG diagnosis as outlined in Figure 2, delivers the output shown in Table 2: based on the described target population of over 65s with hypertension, a total of 326,681 new AF diagnoses are made, of which 317,516 are true positives.

Table 2. Estimated outputs of the Vitacam screening programme.

	AF	No AF	**Totals**
Positive ECG	317,516	9,165	326,681
Negative ECG	42,402	4,399,589	4,441,991
Totals	359,918	4,408,754	4,768,672

An estimated 51,142 AF diagnoses would have been made at baseline (via the current approach). Subtracting these from the above identified AF cases, to find the additional cases detected by the screening programme, gives a total of 275,540 new AF diagnoses of which 266,375 are true positives.

Through diagnosis and treatment of these AF patients (with 231,000 new patients receiving anticoagulant treatment as outlined in Figure 2), we estimate that 4,166 strokes would be avoided. Benefits and costs associated with these avoided strokes, as well as the change in diagnostic pathway, are displayed in Table 3.

Table 3. Benefits and costs of a Vitacam screening programme, compared to the current approach.

	Description	**Total**
Benefits		
Healthcare	Avoided healthcare costs of incident stroke	£65,147,010
	Avoided cardiology outpatient appointments	£5,650,722
Social care	Avoided social care costs of incident stroke	£23,737,942
Societal	Avoided informal care costs of incident stroke	£123,005,697
	Improved quality of life through avoided stroke-related disability	£60,114,444
	Improved carer quality of life through avoided stroke-related disability	£8,858,971
Total		**£286,514,786**
Costs		
Healthcare	Costs of screening with Vitacam	£57,224,067
	Additional GP appointments and ECGs	£5,275,641
	Additional ambulatory ECGs	£8,753,548
	Costs of medication	£131,379,082
	Healthcare cost of bleeds due to medication	£1,826,555
Total		**£204,458,893**
Net impact		**£82,055,892**
Benefit cost ratio		**1.40**
Cost per case detected		£644
Cost per stroke avoided		£49,080

This gives a net impact of £82,055,892 a benefit-cost ratio of 1.40, a cost per case detected of £644, and a cost per stroke avoided of £49,080.

These figures capture one year of benefit from the point at which AF is identified, as well as one year of screening and medication costs. As such, the benefits incurred through avoided strokes capture the first year post-stroke only. However, avoided strokes will continue to deliver health and social care savings in subsequent years: prevalent stroke is estimated to cost an average of £23,175 per

year across health care, social care and informal care[7]. These benefits are displayed in Table 4 for the 4,166 strokes avoided, giving a total of £96.5 million of benefit per additional year among this patient group.

Table 4. Health and social care benefits delivered in subsequent years through avoided strokes.

	Description	Total
Benefits		
Healthcare	Avoided healthcare costs of prevalent stroke	£9,342,789
Social care	Avoided social care costs of prevalent stroke	£22,837,928
Societal	Avoided informal care costs of prevalent stroke	£64,361,433
	Total	**£96,542,150**

6. Discussion

6.1 Findings of the health economic analysis

Our early economic model provides an initial estimate of the likely cost-effectiveness of Vitacam as an AF screening tool. We demonstrate that a Vitacam-based screening programme is likely to deliver substantial benefits: under the core assumptions used in this analysis, the programme would deliver a net benefit of over £82 million, with a benefit-cost ratio of 1.40. These estimates may be conservative, for several reasons:

- Further benefits would additionally be incurred in subsequent years through avoided morbidity and disability; we estimate this at over £96 million for the screened population.
- Screening targeting could be improved, particularly as algorithms are developed to more accurately identify at-risk patients. Our model is sensitive to the screening population size, for example reducing it to 20% of over 65s, at a targeting accuracy of 90%, would deliver a net impact of over £153 million and a benefit-cost ratio of 1.80.
- Cost of Vitacam per person per year may be further reduced as it is rolled out to larger populations. Our model demonstrates that Vitacam costs have a significant impact on cost-benefit of the programme, for example reducing costs from £12 to £6 per person per year increases the net impact to £111 million.
- Some ECG and GP costs may be avoided in the future if PPG is accepted as a diagnostic tool, reducing the costs of screening.
- Our estimates of stroke-relate health and social care savings may be conservative: we used average figures on the cost per stroke, while AF-related strokes are often more severe, with greater mortality and disability[8].
- We focus on stroke-related health and social care costs only, as this is the most common complication directly caused by AF; considering all possible downstream impacts of AF on health would provide a greater cost benefit.

As Vitacam sensitivity and specificity have not yet been established, these model outputs are based on values for a similar rPPG technology, Fibricheck, for which a sensitivity of 92% and specificity of 98% have been reported. This provides an important target for Vitacam, to match or exceed the

[7] Stroke Association, 2015. *Current, future and avoidable costs of stroke in the UK.*
[8] Stroke Association. *Atrial Fibrillation: information and resources.*

accuracy of similar technologies to ensure it is well placed as a competitor. Lower sensitivity results in more false negatives (AF cases are missed), so fewer strokes are prevented; lower specificity results in more false positives referred for ECG diagnosis and potentially treatment. This reduces the net cost benefit of Vitacam as a screening tool.

The economic model can be used to assess the impact of varying these values. We identified a threshold for which the net cost impact remains positive of 82% for both sensitivity and specificity: these values give a net cost benefit of £3.2m and a benefit cost ratio of 1.01. If sensitivity and specificity drop below 82%, the screening programme would not deliver cost benefit under the current assumptions.

6.2 Targeting Vitacam at appropriate populations

As noted in Section 2, there are a number of other technologies that have been developed to enable remote monitoring of an individual's heart rhythm. Fibricheck is one such solution, similar to Vitacam in that it uses a smartphone application to measure heartbeat intervals, but instead by placement of the finger over the camera. Fibricheck has successfully gained market share in some areas of the UK, demonstrating recognition of the value that these technologies could bring to local populations. However, differences in monitoring approach may impact target populations. For example, there are some groups of individuals where Fibricheck is not an appropriate solution, such as:

- Those with conditions causing tremors or the inability to hold their hand still for at least 60 seconds (e.g. Parkinson's or dementia) as, in this case, the device cannot process an accurate measurement.
- Those with reduced blood flow in the fingertips (e.g. perniosis or callus formation) as FibriCheck will not be able to detect the significant intensity variations induced by the blood flow.
- Those that have a disability to perform the measurements according to the instructions for use, or who do not find the behaviour intuitive such as dementia patients.

Understanding the differentiators of these technologies, and how to best target them to appropriate populations, will be important in ensuring accurate AF identification, patient and carer acceptance, and cost-effectiveness. For example, Vitacam may be particularly suited to carer or care home settings as the user of the Vitacam application can be a professional or informal carer, and not only the patient themselves as with Fibricheck. This would also enable a carer to act based on the results, rather than relying on the patient only, and could provide a model for reducing Vitacam costs by sharing accounts across groups of patients. While our economic model enables selection of the size of target population, further developments of the work could seek to integrate differentiators of Vitacam from other devices and model impact among more targeted patient populations.

Case study: Use of Vitacam amongst a patient peer support group

Vitacam was tried out by a patient peer support group in Cornwall during November 2022 to January 2023, as part of a broader study led by Dr Leonie Cooper and a team of researchers and academic clinicians from the University of Plymouth. There was high acceptance of Vitacam, with users reporting that it gave them reassurance and a feeling of empowerment. The group found the app easy to use. Further details will be published in due course by the University of Plymouth researchers.

6.3 Vitacam and skin tone: an important consideration

Finally, while Vitacam provides an opportunity to reduce health inequalities by improving access to AF screening technology in at-risk populations, it is important to consider its potential limitations. In particular, some research suggests that variations in skin tone may impact accuracy of PPG measurements, likely because darker skin contains more melanin which absorbs more green light than lighter skin[9]. Other evidence indicates that PPG measurements, including by smartphone video, are accurate across a range of skin pigmentations[10,11]. Future research and trials should therefore take skin tone into consideration and evaluate its impact, to ensure that health inequalities are not widened and patients are reassured.

7. Conclusion

We present initial evidence on the cost-effectiveness of Vitacam as a screening tool in a diagnostic pathway, demonstrating that significant savings could be made particularly through avoided health and social care costs of AF-related strokes. Identifying and treating more individuals with AF would continue to deliver benefits in subsequent years through avoided complications and disability. Furthermore, there is opportunity to deliver greater cost-benefit by adjusting certain parameters, in particular by accurate targeting of the screening population and reducing the cost of Vitacam per person per year.

8. Acknowledgements

This study was funded by the National Institute for Health Research under grant award NIHR204741. Thanks to Dr Ramesh Nadarajah for his insights into the current standard of care in Atrial Fibrillation screening, diagnosis and treatment.

9. Declaration of Interest

The funding was awarded to Vitacam Ltd, who sponsored Edge Health to carry out the study.

10. Author contributions

Catriona Mackay and George Batchelor led in the investigation, methodology, interpretation and analysis of the data in this publication. Both performed the drafting and critical revising of the manuscript content, including the final approved version of the manuscript. Catriona and George are

[9] Bent 2020, *Investigating sources of inaccuracy in wearable optical heart rate sensors.*
[10] Addison et al. 2018, *Video-based heart rate monitoring across a range of skin pigmentations during an acute hypoxic challenge.*
[11] Sañudo et al. 2019, *Pilot Study Assessing the Influence of Skin Type on the Heart Rate Measurements Obtained by Photoplethysmography with the Apple Watch*.

health economists at Edge Health Ltd, a leading consultancy specialising in health economic and operational analysis for both public and private sector clients in the UK and Canada.

Moyeen Ahmad of Vitacam Ltd led the conception and funding acquisition of the study. He provided inputs and reviewed the manuscript.

11.Appendix 1: Modelling assumptions

11.1 Estimating the AF population

Assumption	Value	Source
Population in England	56.55m	UK Population Data 2022
Proportion of population that is age 65+	18.6%	ONS Census 2021
Prevalence of AF among over 65s	13.4%	STROKESTOP Study
Incidence of AF among over 65s	1.2%	https://bmjopen.bmj.com/content/10/12/e042518
Prevalence of hypertension among over 65s	50%	Age UK: high blood pressure
Prevalence of hypertension among AF patients	84%	https://bmjopen.bmj.com/content/8/7/e021704
Proportion of AF that is undiagnosed	30.4%	NICE: Atrial Fibrillation
Proportion of undiagnosed AF that is paroxysmal	82%	https://www.journalslibrary.nihr.ac.uk/hta/hta21290#/full-report
Proportion of paroxysmal AF that is symptomatic	84%	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3402179/
Proportion of persistent or permanent AF that is symptomatic	81%	As above (weighted average of persistent and paroxysmal AF)
Prevalence of palpitations among elderly	7.7%	https://pubmed.ncbi.nlm.nih.gov/8818746/

11.2 Screening pathway

Assumption	Value	Source
Vitacam sensitivity	92%	Fibricheck numbers
Vitacam specificity	98%	
GP 12-lead ECG sensitivity	80%	SAFE study
GP 12-lead ECG specificity	92%	
Ambulatory ECG sensitivity	96%	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3437373/
Ambulatory ECG specificity	97%	

11.3 Stroke pathways

Assumption	Value	Source
Annual incidence of stroke among AF patients	2.6%	Framingham Study
Annual incidence of stroke among AF patients on treatment	0.8%	Stroke Association, 2018. AF: How can we do better?
Proportion of stroke survivors with moderately severe or severe disability	28%	Stroke Association, 2018. AF: How can we do better?
Anticoagulation prescribing rates for AF patients at risk of stroke	84%	https://www.nice.org.uk/media/default/about/what-we-do/into-practice/measuring-uptake/nice-impact-stroke.pdf
Proportion of AF patients administered Warfarin	25.5%	KardiaMobile model
Proportion of AF patients administered DOACs	74.5%	KardiaMobile model
Increased risk of major bleed with Warfarin	1.4%	KardiaMobile model
Increased risk of major bleed with DOACs	0.9%	KardiaMobile model
Average QALY-decrement due to ischemic stroke	0.19	https://academic.oup.com/eurheartj/advance-article/doi/10.1093/eurheartj/ehac547/6806218
Average carer QALY-decrement due to ischemic stroke	0.1	https://www.sciencedirect.com/science/article/pii/S1098301520321379

11.4 Unit costs

Assumption	Value	Source
Average health care cost of incident stroke per person	£15,638	Current, future and avoidable costs of stroke in the UK, 2015. Inflated to 2022 using the ONS GDP deflator
Average health care cost of prevalent stroke per person	£2,243	
Average social care cost of incident stroke per person	£5,698	
Average social care cost of prevalent stroke per person	£5,482	
Average informal care cost of incident stroke per person	£29,527	
Average informal care cost of prevalent stroke per person	£15,450	
Cost per GP appointment	£30	https://www.england.nhs.uk/2019/01/missed-gp-appointments-costing-nhs-millions/
Cost per ECG	£9	Table 8: https://www.nice.org.uk/guidance/ng45/documents/guideline-appendices-13

Cost per ambulatory ECG	£165	KardiaMobile model
Cost per cardiology outpatient appointment	£157	2020/21 National Tariff Payment System
Cost per QALY gained	£75,949	Department of Health 2009: Quantifying health impacts of government policies Inflated to 20200 using the ONS GDP deflator
Cost of Warfarin per patient per year	£199	KardiaMobile model
Cost of DOACs per patient per year	£694	
Major bleed cost	£785	
Cost of Vitacam per person per year	£12	