



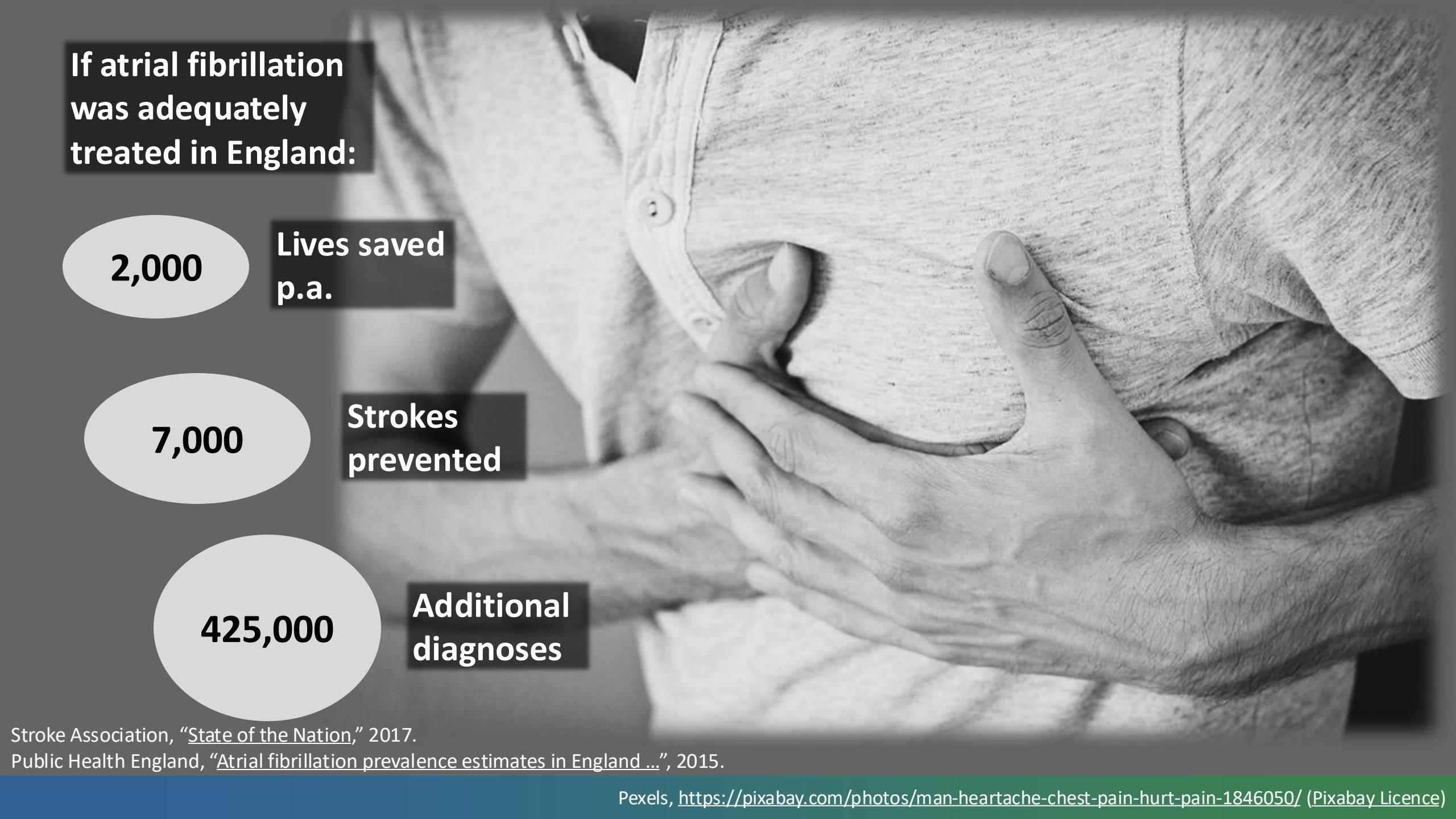
The acceptability of wearables for atrial fibrillation screening: Interim analysis of the SAFER Wearables Study

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City, University of London

Recorded in preparation for the
2024 Computing in Cardiology
Conference.



**If atrial fibrillation
was adequately
treated in England:**

2,000

**Lives saved
p.a.**

7,000

**Strokes
prevented**

425,000

**Additional
diagnoses**

Stroke Association, "[State of the Nation](#)," 2017.

Public Health England, "[Atrial fibrillation prevalence estimates in England ...](#)", 2015.





Detecting atrial fibrillation in daily life

1. Background



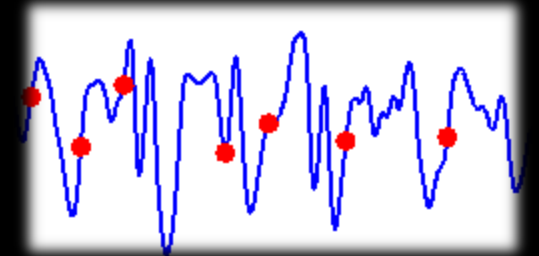
Photo by [Luke Chesser](#) on [Unsplash](#)

2. Acceptability in older adults



Photo by [Dario Valenzuela](#) on [Unsplash](#)

3. Next Steps



Detecting atrial fibrillation in daily life

1. Background



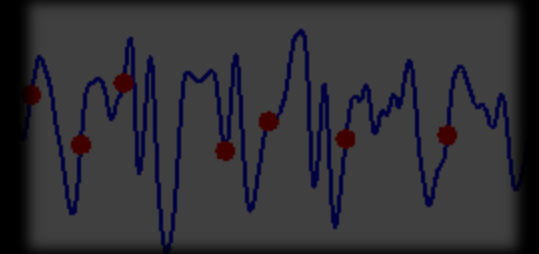
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2. Acceptability in older adults



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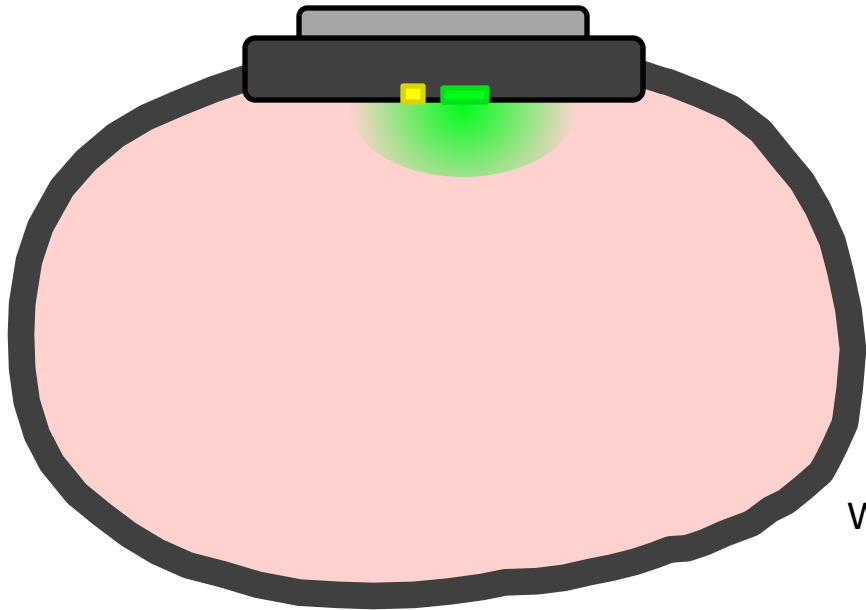
3. Next Steps



The Photoplethysmogram



Photoplethysmogram (PPG) Sensor

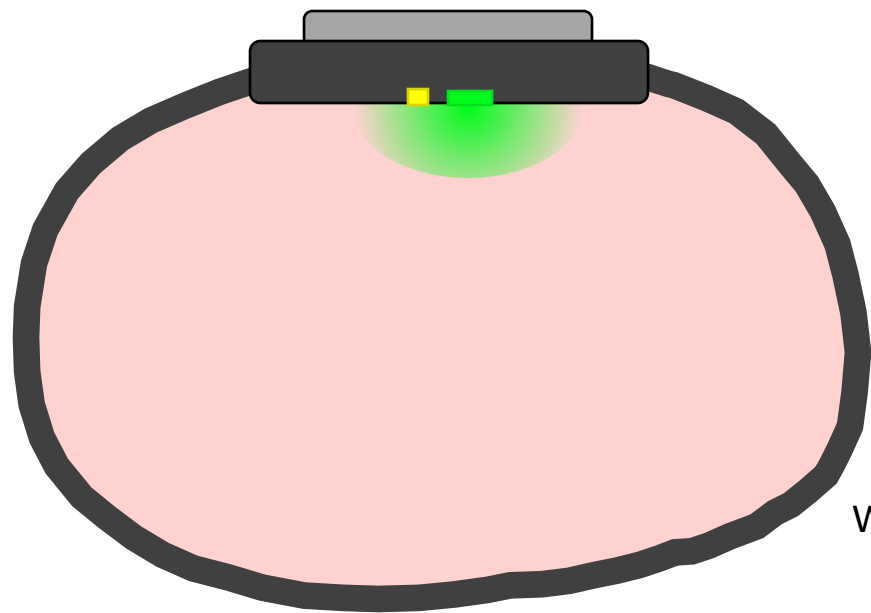


Wrist cross-section

The Photoplethysmogram



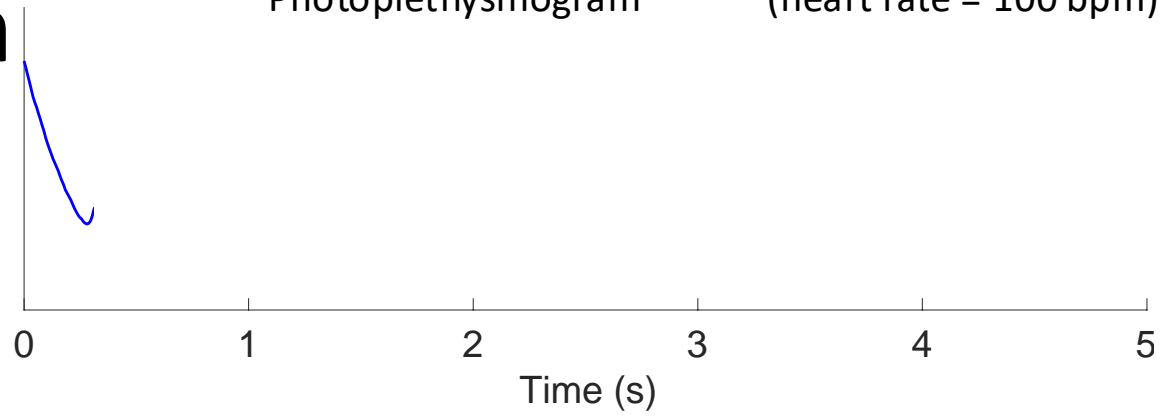
Photoplethysmogram (PPG) Sensor



Wrist cross-section

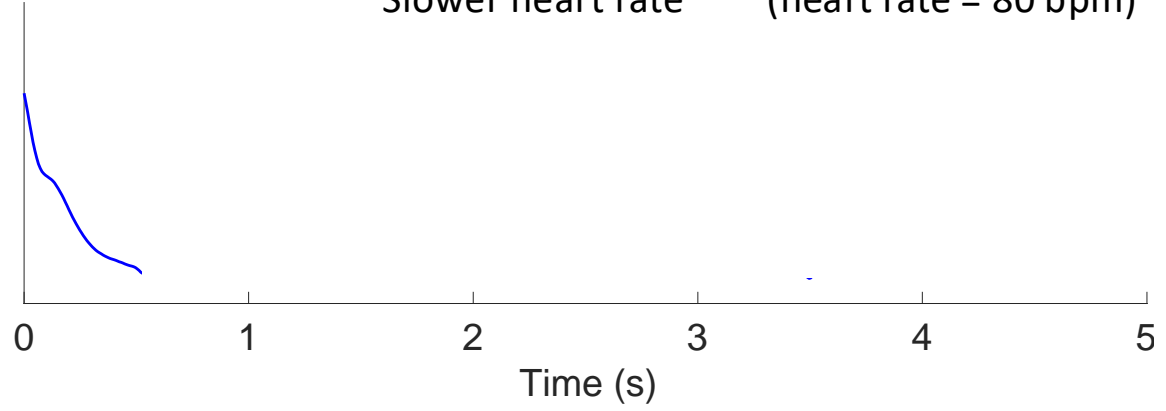
Photoplethysmogram

(heart rate = 100 bpm)



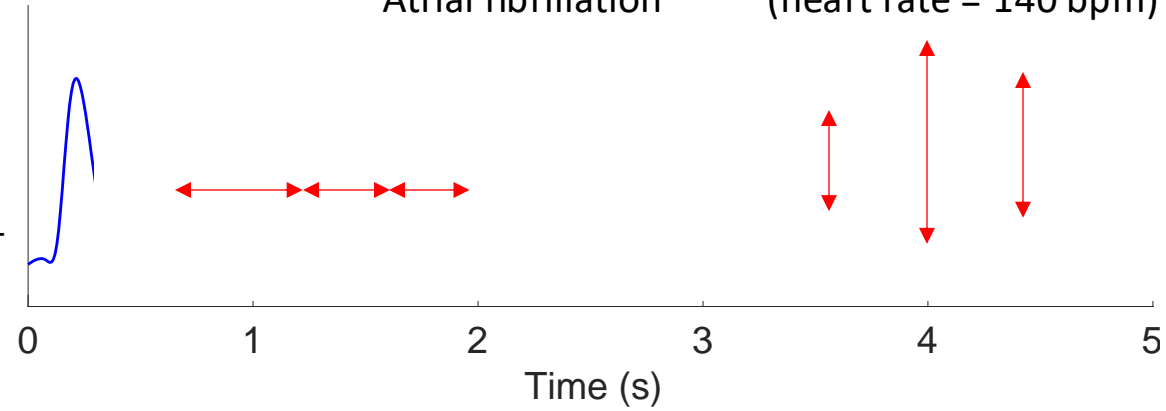
Slower heart rate

(heart rate = 80 bpm)

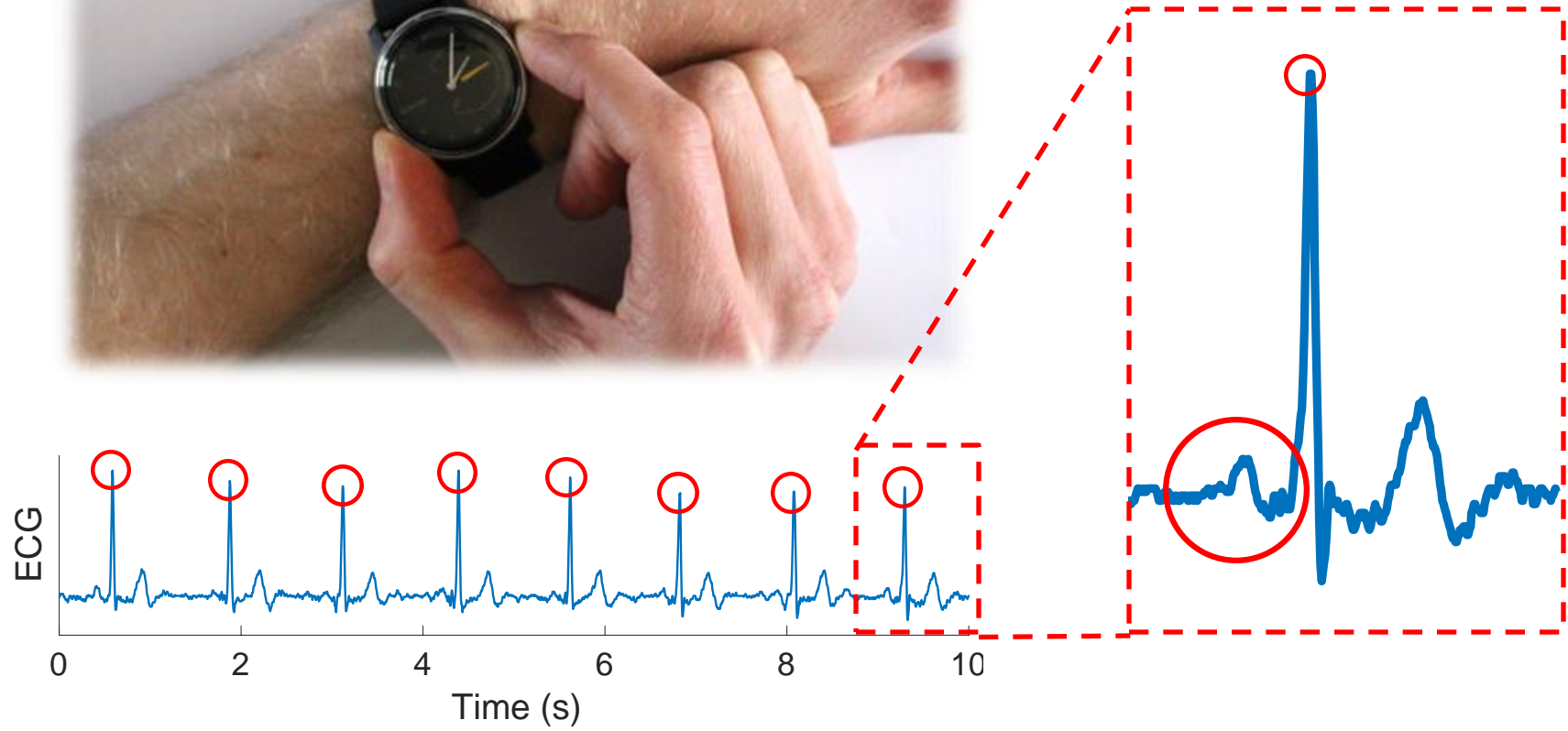


Atrial fibrillation

(heart rate = 140 bpm)



Single-lead ECG



Using photoplethysmography to prompt single-lead ECG



Detecting atrial fibrillation in daily life

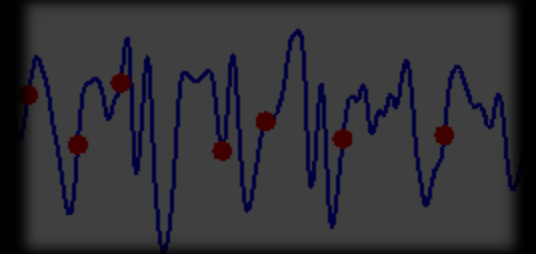
1. Background

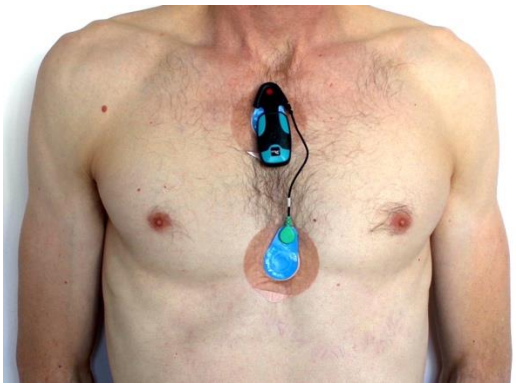


2. Acceptability in older adults



3. Next Steps





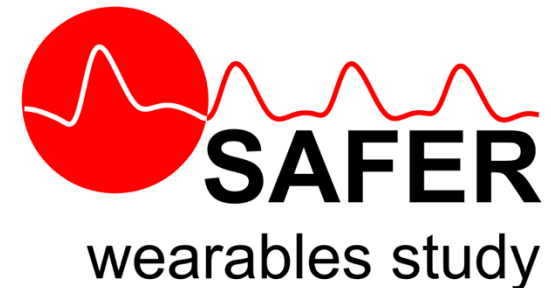
Aim: To identify factors influencing the acceptability of wearables in older adults.

Methods:

- In 130 older adults, aged 65+, half of whom have AF
- Devices delivered by mail, and instructions provided via leaflet and telephone call.
- Asked to wear three devices for one week.
- Two wrist-worn devices:
 - **PulseOn Arrhythmia Monitor:** Continuous PPG. Vibrated 4 times per day and upon irregular pulse to prompt ECG recording.
 - **PulseOn OHR (Optical Heart Rate Tracker):** Intermittent PPG
- Reference ECG chest patch:
 - **Bittium Faros 180** chest patch: Continuous ECG
- Questionnaire provided formal feedback
- Informal feedback collected via telephone calls.

Progress:

- 21 out of 130 participants to date.





Results:

Recruitment and participation

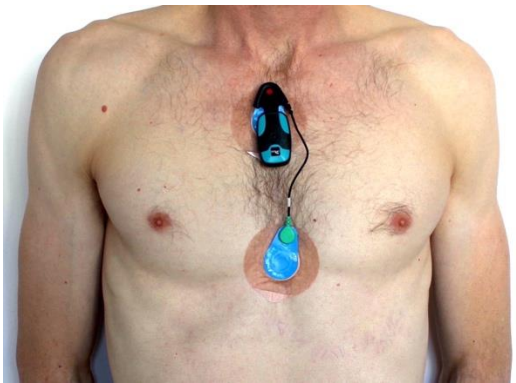
- 75 potential participants invited
- 42 consented to take part (56%)
- 21 had taken part at the time of this analysis



Device removals

Removals:

- 5 (24%) removed Faros 180 due to skin irritation
- 4 (19%) removed PulseOn OHR (3 due to battery running out, 1 due to skin irritation)
- 1 (5%) removed PulseOn Arr due to night-time vibrations

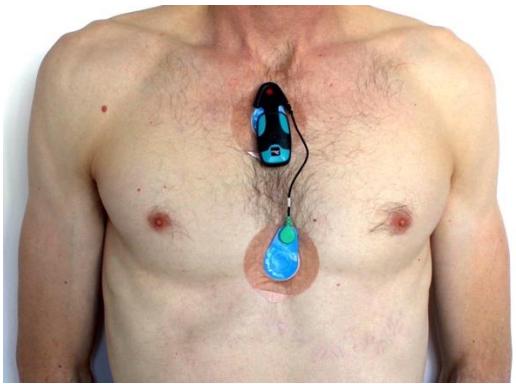




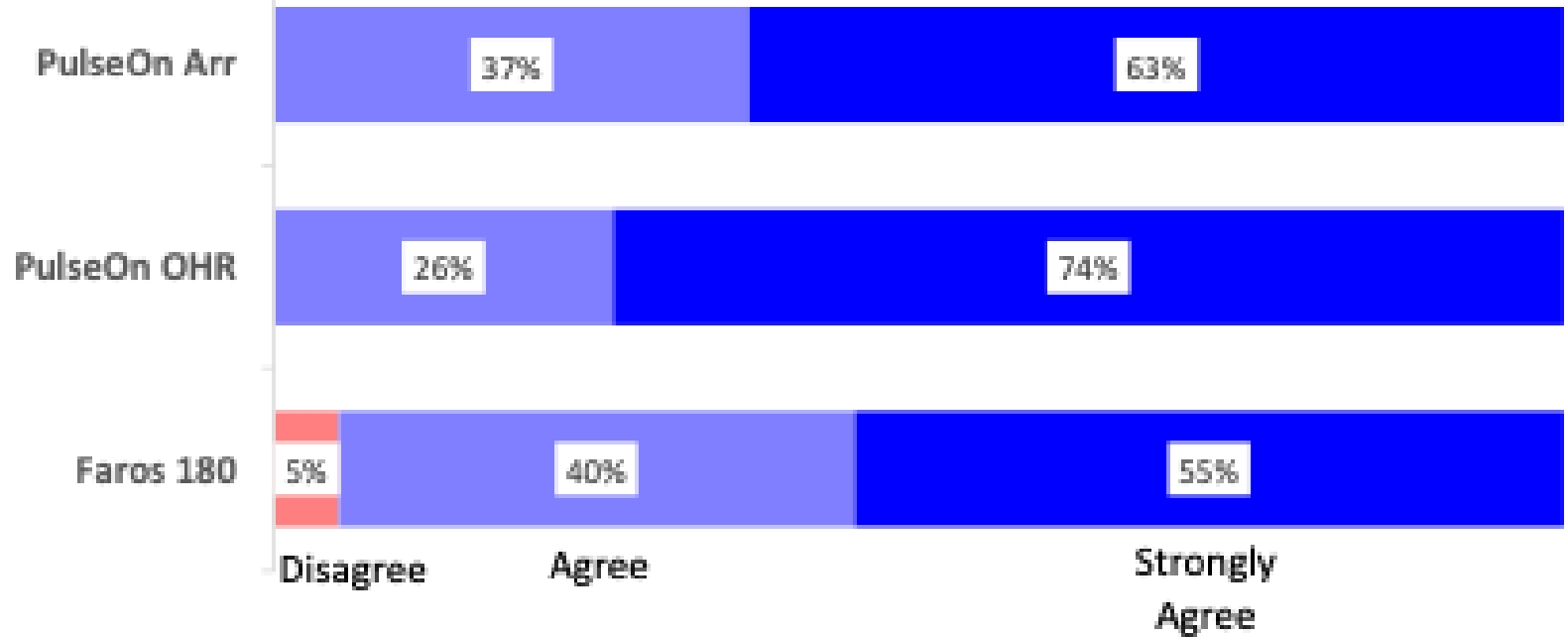
Results:

Feedback

Most respondents would be happy to wear any device for a week:



If the device was regularly used to check people's health then I would be happy to wear it for a week.

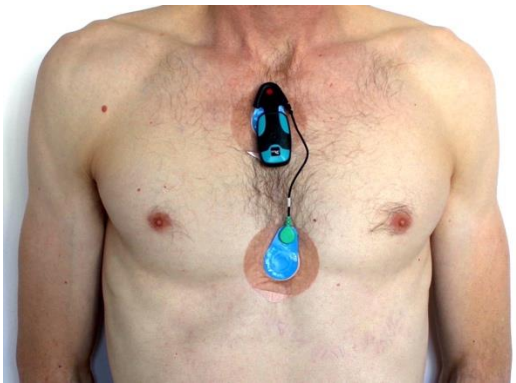
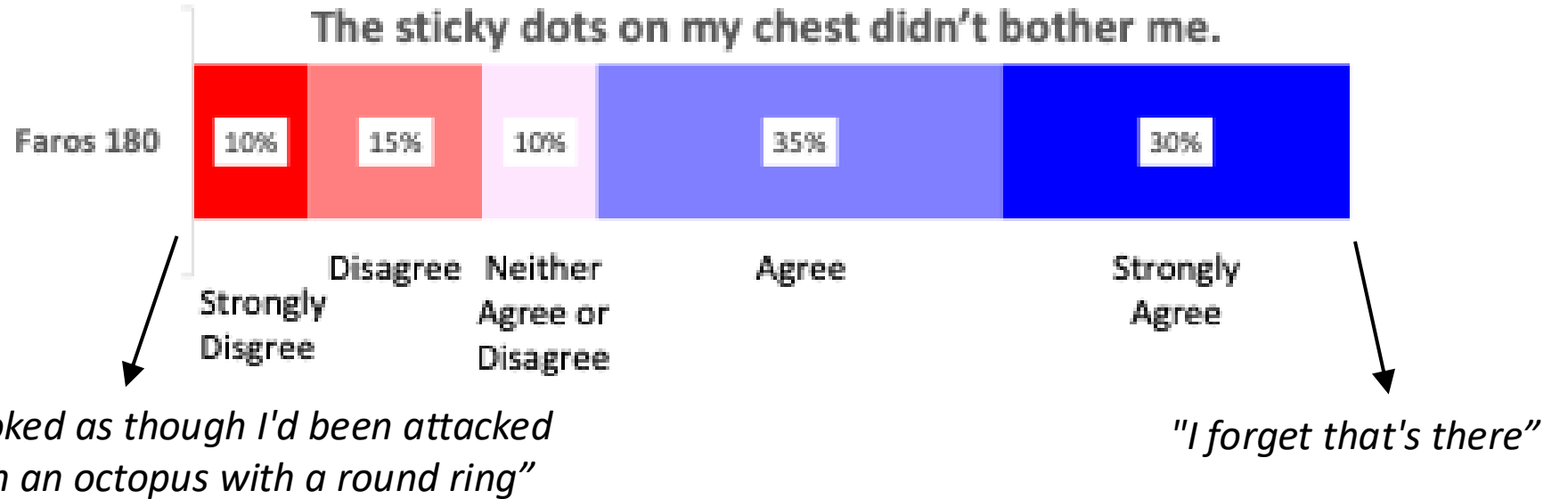




Results:

Feedback

But the chest electrodes irritated participants, with 8 (38%) participants reporting irritation during telephone calls.



Other issues:

- Faros 180: electrodes detached, form factor used not suitable for women.
- PulseOn Arr: night-time vibrations.
- PulseOn OHR: battery running out.



Discussion:

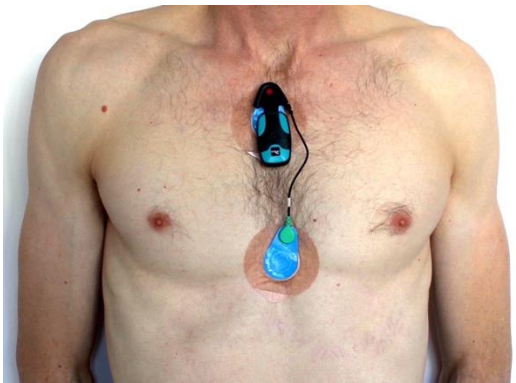
Possible strategies to improve acceptability:

- Use different chest patch electrodes or locations.
- Inform participants that accidental activation of PulseOn Arr can produce night-time vibrations.



Limitations:

- One-week duration
- Devices worn simultaneously



Detecting atrial fibrillation in daily life

1. Background



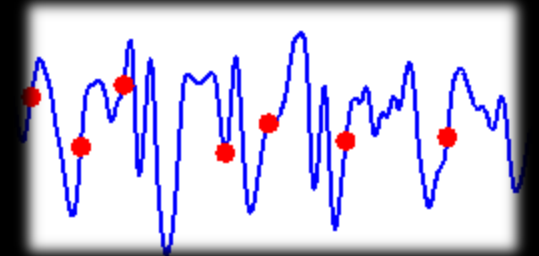
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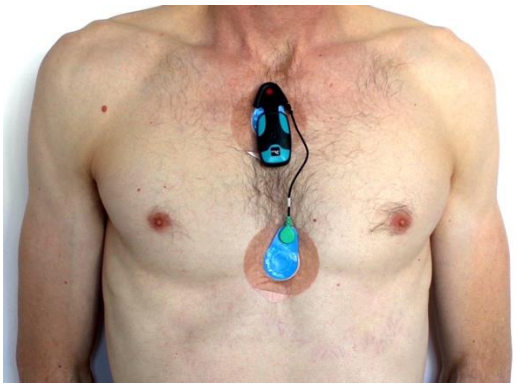
2. Acceptability in older adults



Photo by [Dario Valenzuela](#) on [Unsplash](#)

3. Next Steps





Next Steps:



Complete SAFER Wearables Study:

- Target recruitment: 130 participants (65 AF, 65 non-AF)
- Assess performance of wearables for detecting AF.

Improve the reliability of AF diagnoses based on single-lead ECGs acquired from wrist-worn and handheld devices:

- Guidelines state that AF diagnoses should be made based on manual interpretation of ECGs.
- However, we have recently observed that when screening for AF using handheld ECG devices in SAFER: for every 100 participants diagnosed with AF by two cardiologists, the cardiologists would disagree on the diagnosis of a further 70 participants.
- See: K. Hibbitt *et al.*, 'Reliability of single-lead electrocardiogram interpretation to detect atrial fibrillation: insights from the SAFER feasibility study', *EP Europace*, vol. 26, no. 7, p. euae181, 2024, doi: [10.1093/europace/euae181](https://doi.org/10.1093/europace/euae181).

With thanks to...

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Jonathan Mant

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City, University of London

King's College London

British Heart Foundation

NIHR

EPSRC



Wearable devices were tolerated for one week by older adults.

However, the chest patch's electrodes caused skin irritation leading to some participants removing it.

There is much work to be done to optimise acceptability and performance, and make wearables as reliable as a climbing rope.



The acceptability of wearables for atrial fibrillation screening: Interim analysis of the SAFER Wearables Study

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Slides available at:

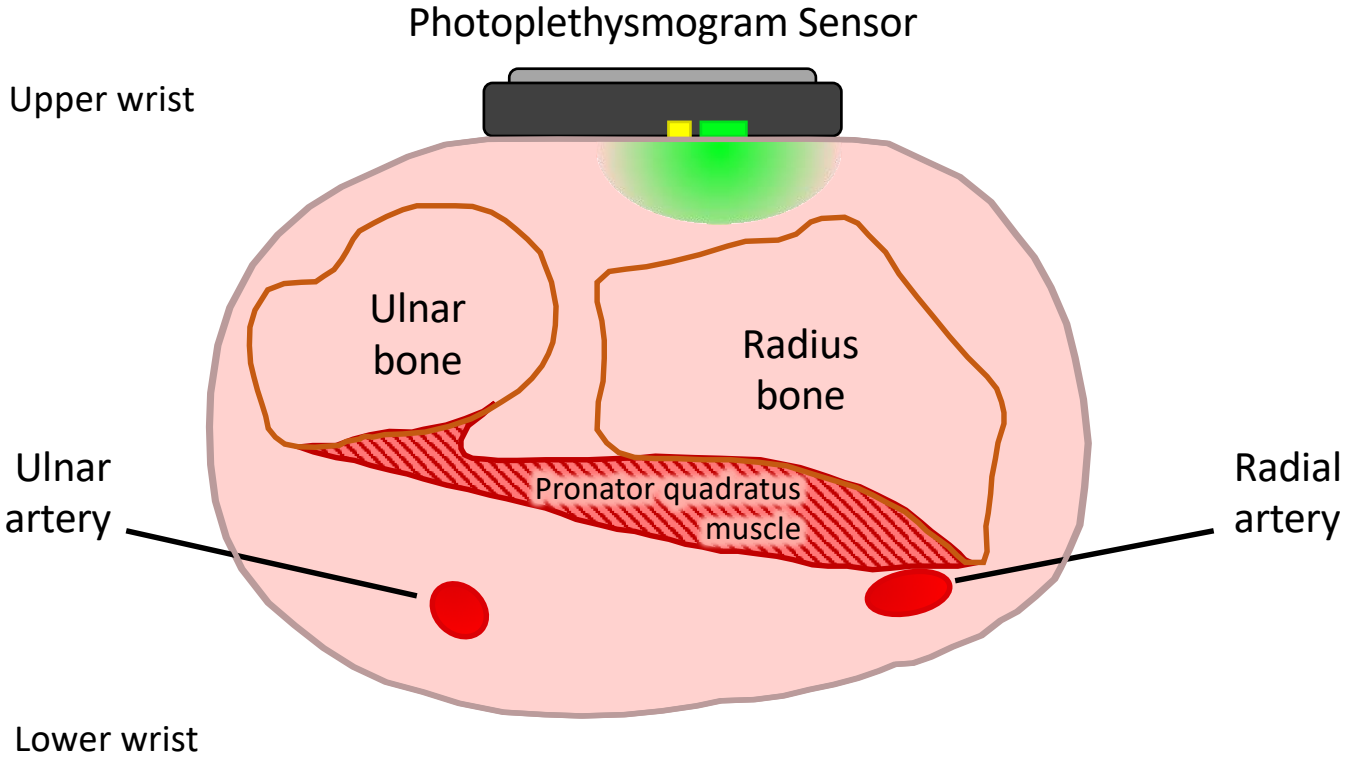
<https://doi.org/10.5281/zenodo.13692217> (CC BY 4.0)

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Wrist photoplethysmography: limitations



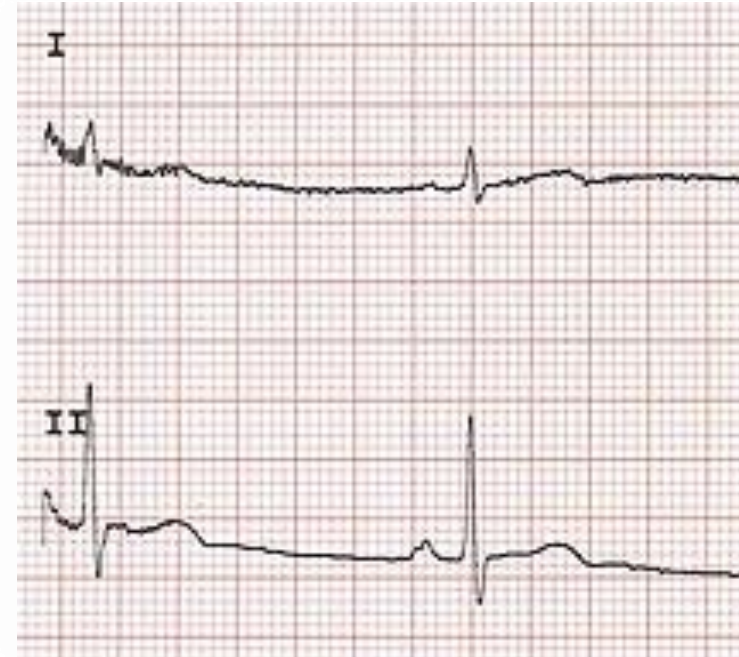
Photoplethysmogram (PPG) Sensor



Single-lead ECG: limitations



- Dry electrodes
- Recorded without clinical supervision
- Lead I

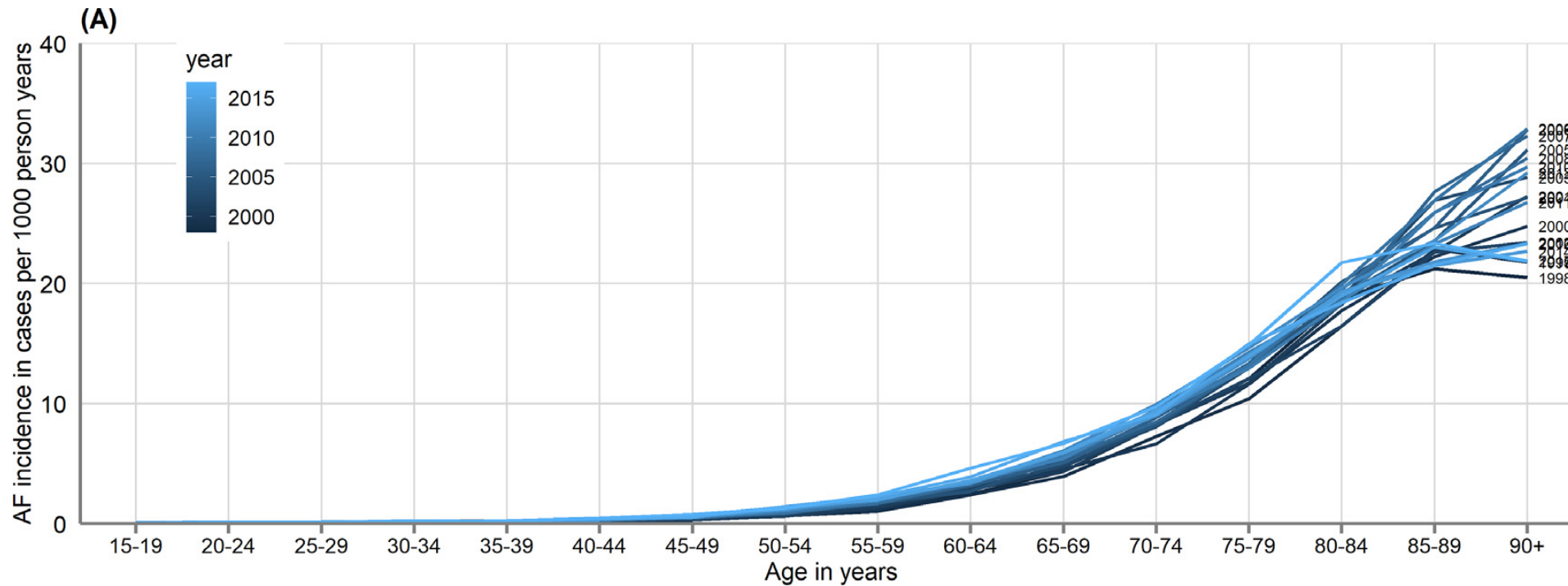


“Sinus P waves are usually most prominently seen in leads II and V1”

Meek S and Morris F, 'ABC of clinical electrocardiography: Introduction. II—basic terminology', <https://doi.org/10.1136/bmj.324.7335.470>

Older adults because:

- AF incidence increases with age



From primary and secondary electronic health records of 3.4 million individuals in England

In daily life because:

- AF can occur infrequently

Smartwatch ownership

Not everyone has a smartwatch, particularly older adults

An electronic survey of 1,368 patient advisory group members:

