

ATMOSPHERE

Artificial intelligence To Maximise and Optimise Seizure Prediction to Empower people with Epilepsy

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BACKGROUND

- Epilepsy is a **prevalent, serious** neurological condition which affects **50 million** people worldwide and **~600,000** in the UK.
- The **greatest obstacle** for PWE (People living With Epilepsy) is the **unpredictability^a** of their seizures (Figure 1). **Thus, unpredictability is a priority** for the research community^b (Figure 2).

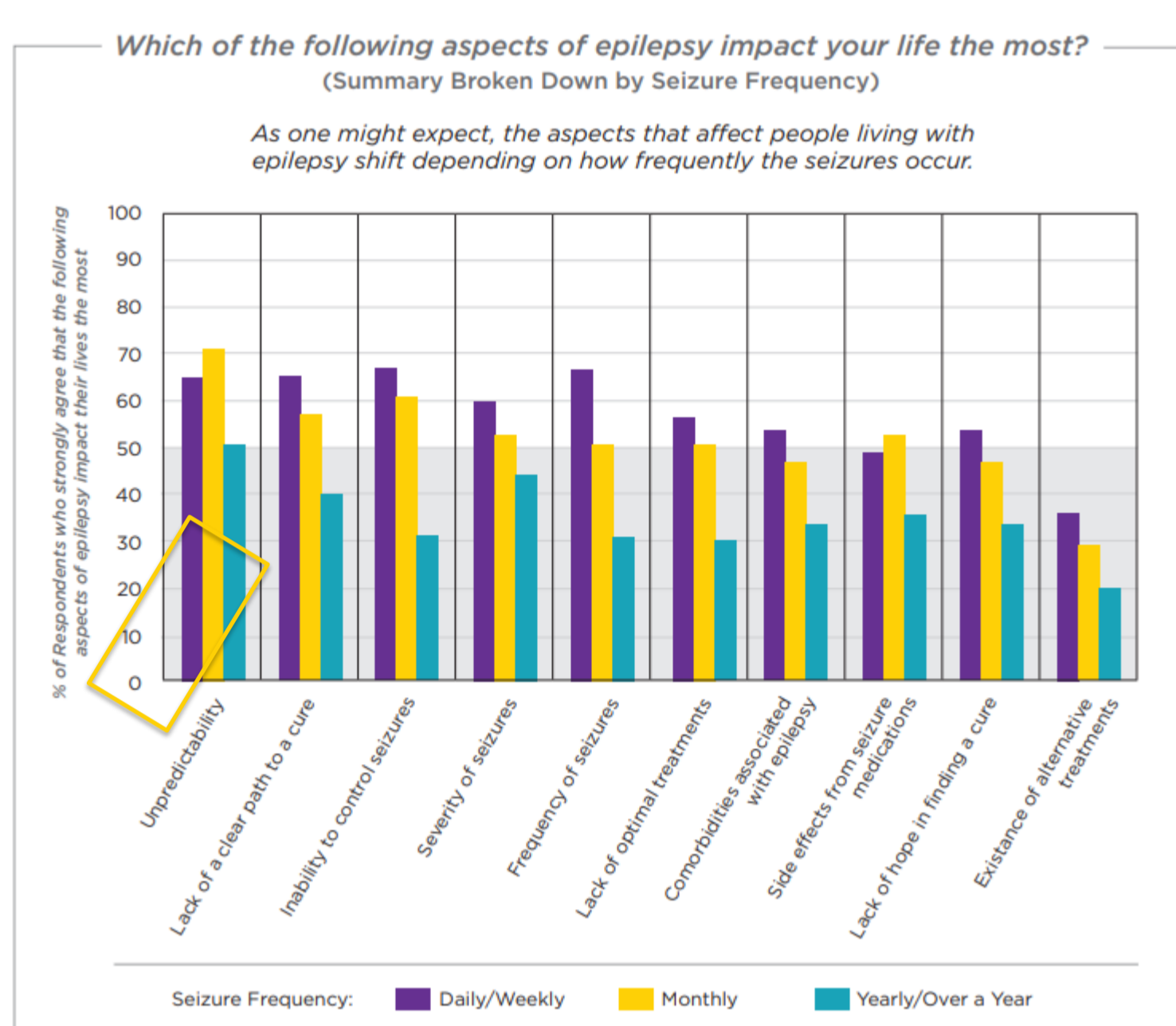


Figure 1. This graph represents the feedback from the 1062 respondents to a survey carried out by the Epilepsy Foundation^a. Note, 'unpredictability' of seizures is one of the major impacts of LWE. This project is focused on reducing this 'unpredictability'.

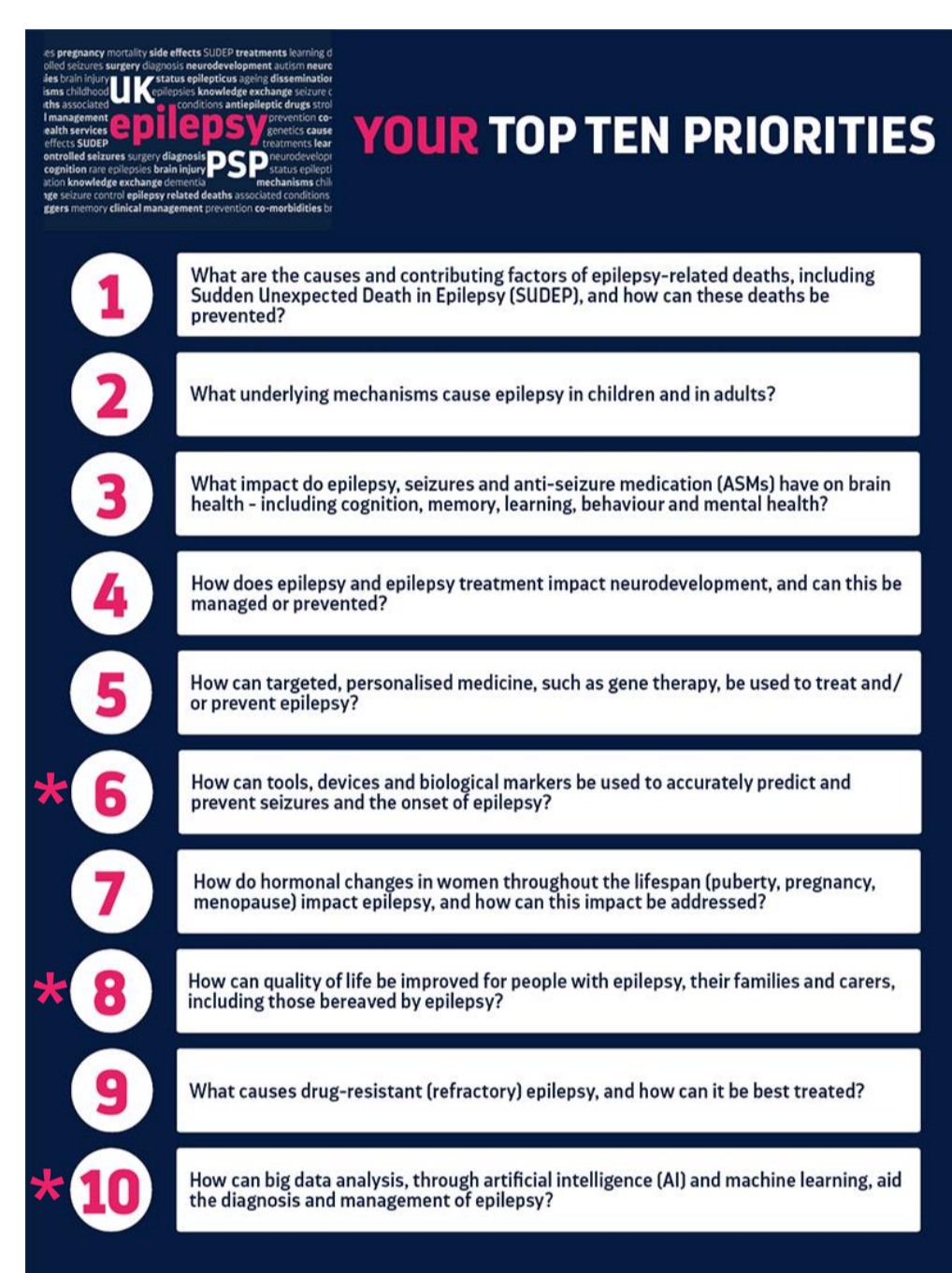


Figure 2. This figure depicts the top ten research priorities specified by the John Lind Alliance^b. Note each area where the Atmosphere project is contributing (indicated by the asterisk*).

VISION

The **Atmosphere project** exploits a **machine learning** algorithm, coupled with an intuitive **smartphone app**, to **forecast** an individual's **risk** of experiencing a **seizure**. It is made up of three areas of development (1)the **machine learning** algorithm, (2) the **wearable** data recording **device** and (3) the companion **smartphone app**.

All development within the project is carried out with clinicians and people recruited from the Epilepsy Research Institute's Shape Network and Epilepsy Action. Currently, focus is on participants from this and our PPI user group.

1. MACHINE LEARNING

- Machine learning techniques depend heavily on substantial quantities of **input data** to produce **accurate** predictions.
- Real data is not available. Thus, like many other research projects, Atmosphere uses **synthetic seizure diaries** from an open-source simulator called CHOCOLATES^c.
- CHOCOLATES represents the **most realistic** seizure occurrence simulator to date, based on observations from thousands of patients in different contexts.
- Using the synthetic data from CHOCOLATES, the balanced **accuracy** of the **ML algorithm** used in Atmosphere is currently **~80%**; this is dependent upon how **model parameters** are set (Figure 3).

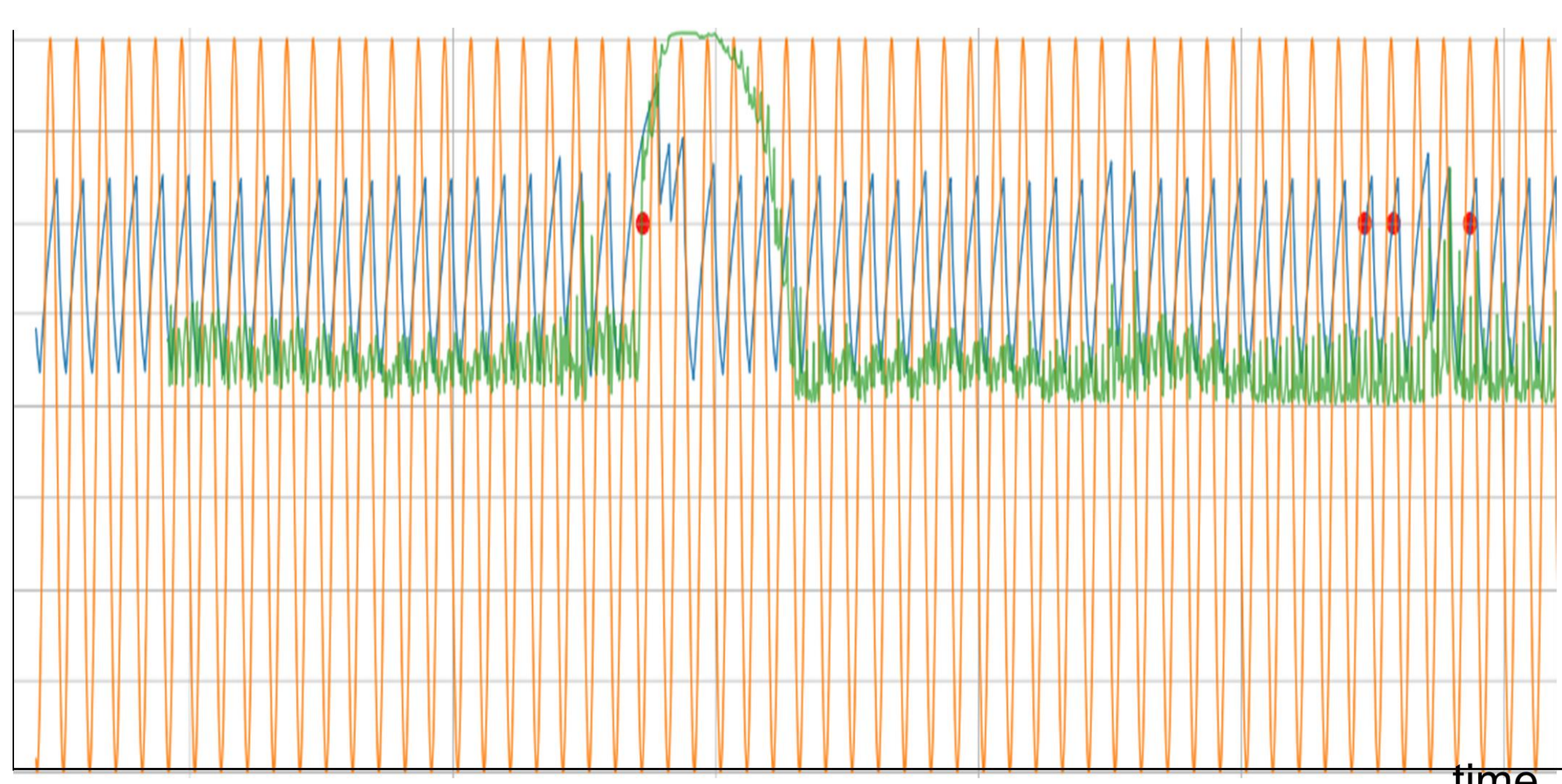


Figure 3. This graph shows **Body cycles** and **Sleep pressure** and the corresponding **Seizure scores** plotted over time. The **red shapes** denote the time point at which the algorithm predicted the person LWE would have a seizure.

2. DATA RECORDING WEARABLE



Figure 4. GARMIN Forerunner 255S music sports watch

- Initially, research focused on developing a state-of-the-art prioritised **list of seizure precipitants**.
- Subsequently, co-design work focused on how to **capture** the seizure precipitant **data** in a **reliable** way, which is **tolerated** well by people LWE.
- Currently, an **'in the wild'** usability evaluation is running using a Garmin smartwatch, such as shown (Figure 4).
- This is the wearable device that is used to capture the user data.

3. COMPANION SMARTPHONE APP

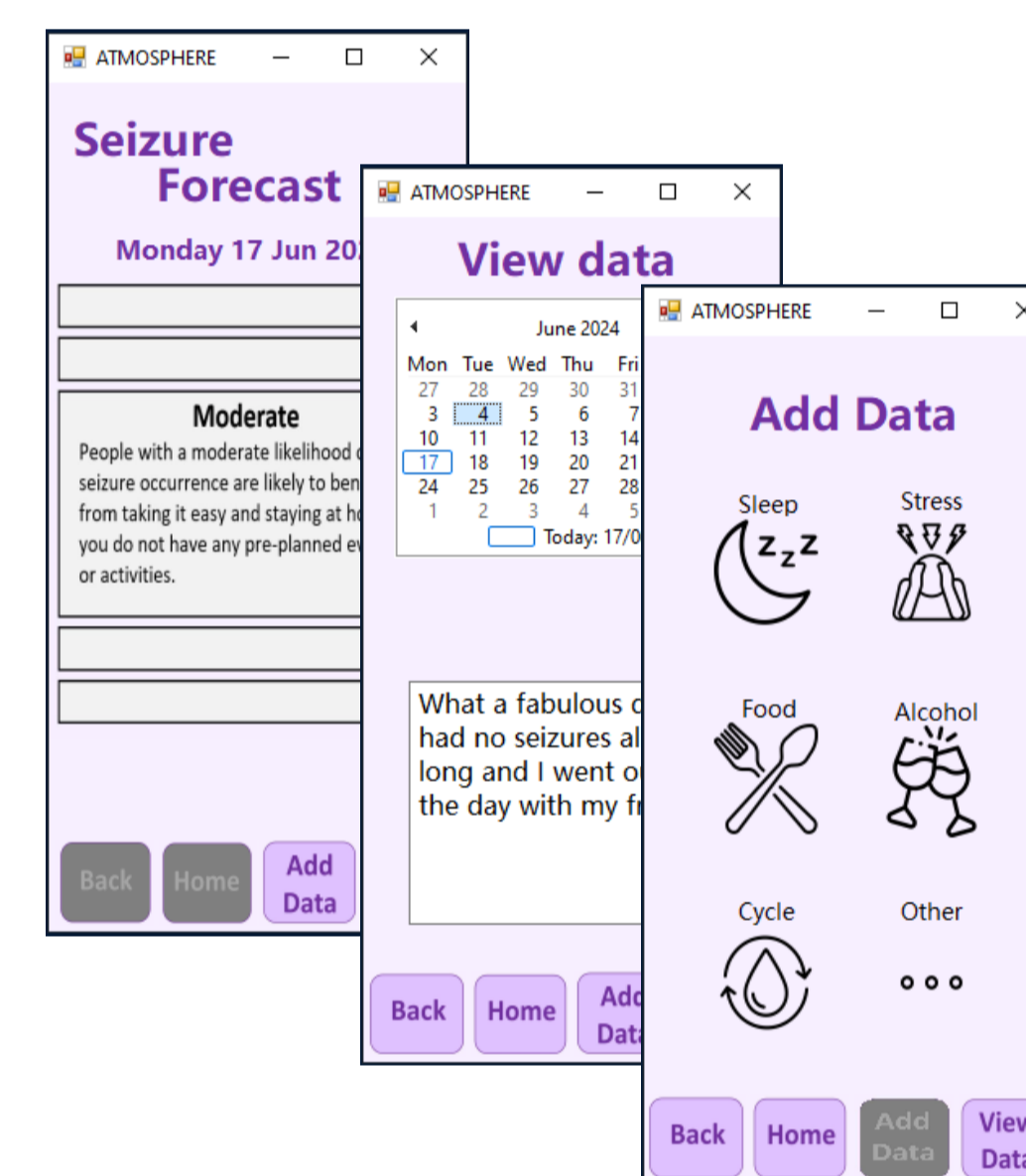


Figure 5. Interactive prototype of Atmosphere smartphone app.

- Initially, **requirements** specification was carried out in collaboration with people LWE.
- Interviews** were conducted to derive the **functional** specification of the smartphone app.
- Subsequently, **cognitive walkthroughs** were carried out using Figma designs.
- Most recently, an **interactive prototype**, coded in C#, is used for user evaluation.
- Throughout, an agile software development methodology is used.

FUTURE

Refinement of the ML algorithm will continue with a view to moving to real data when it is available. The smartphone app will continue to evolve adopting a user-centred software development methodology throughout. This will come together in a 'Real world' study to validate the algorithm and test the usability of the app, both from input/gathering of data and its output. Once the technology is deployable, the vision is to work with the NHS to see it deployed supporting people LWE and their Clinicians.

REFERENCES

- Epilepsy Foundation, "Ei2 community survey". Landover, MD: Epilepsy Foundation. 2016.
- Priority Setting Partnership, "Epilepsy PSP Top 10, James Lind Alliance.": Available at jla.nihr.ac.uk/priority-setting-partnerships/epilepsy/top-10-priorities.htm . Accessed 16/06/2024.
- Goldenholz DM, Westover MB. Flexible realistic simulation of seizure occurrence recapitulating statistical properties of seizure diaries. *Epilepsia*. 2023; 64(2): 396–405.

GET INVOLVED

We would be genuinely delighted to receive your thoughts about this project. Please email all feedback and/or suggestions to the Principal Investigator Amberly Brigden (amberly.brigden@bristol.ac.uk).

THANK YOU TO OUR FUNDING PARTNERS

