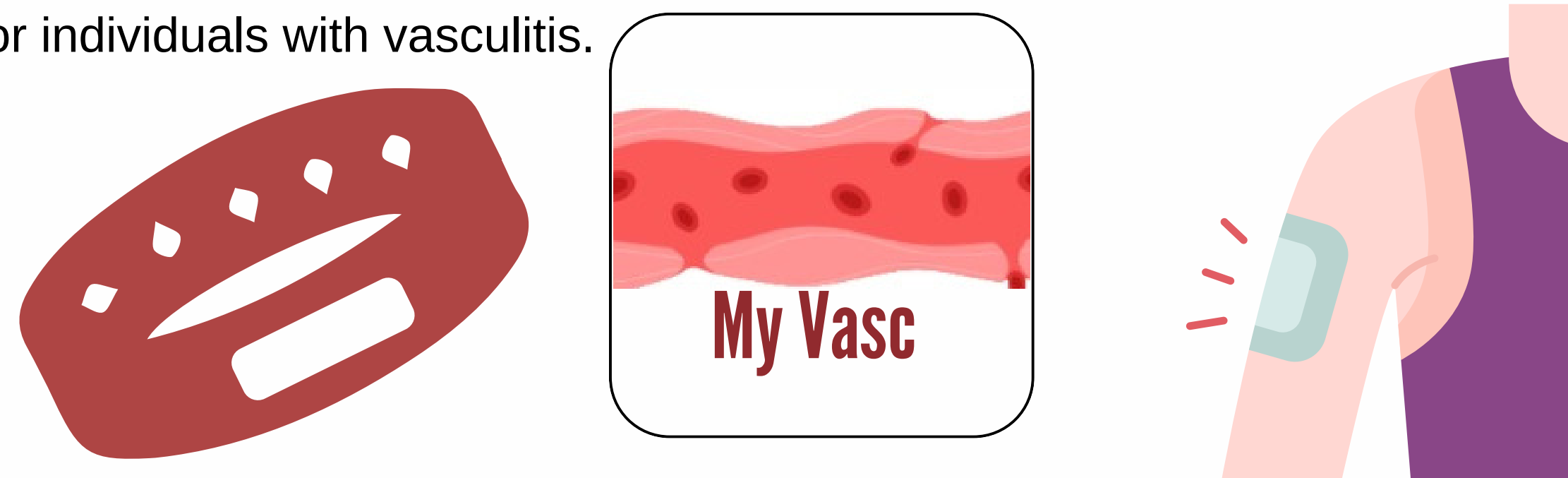


Our Proposal

Living with vasculitis can greatly impact physical health and mental well-being. My Vasc is an app designed to enhance quality of life for those affected by vasculitis through remote monitoring, aiming to mitigate associated challenges. Vasculitis involves unpredictable remission and flare-ups, necessitating frequent medical appointments, which can strain patients with travel difficulties or physical impairments. My Vasc allows patients to log daily symptoms and track health metrics conveniently via a user-friendly mobile app, accessible to specialists, GPs, and caregivers. Improved communication ensures timely updates and early detection of flares or complications, enabling prompt treatment adjustments. By extending appointment intervals based on remote monitoring data, My Vasc aims to reduce physical appointments. It supplements rather than replaces close medical supervision, empowering patients and healthcare teams with insights to enhance management strategies and quality of life for individuals with vasculitis.



The wrist band will monitor your temperature, breathing rate, heart rate. This will be used in combination with a patch that will measure your C reactive protein levels. All this information will be accessed on My Vasc.

What is vasculitis?

Vasculitis is a group of conditions characterised by the inflammation of blood vessels (arteries, veins, and capillaries). This inflammation can cause the walls of the blood vessels to thicken resulting in restricted blood flow and increasing the risk of organ and tissue damage. It is very rare with around 2000-3000 people being diagnosed with vasculitis every year in the UK.

There are several types of vasculitis, each with different features and causes. Vasculitis can occur in an acute form, which may be induced by infections, reaction to drugs or exposure to chemicals. This type often is presented as a localised rash, and typically requires no treatment.

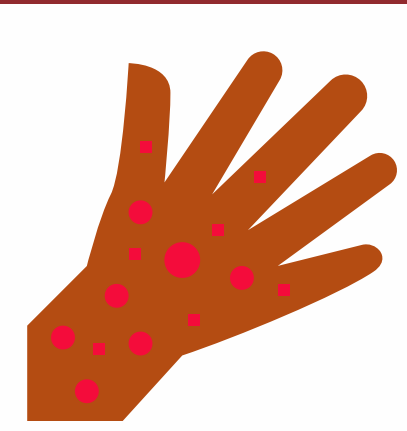
Other types may be caused by illnesses such as cancers or rheumatoid arthritis, this is known as secondary vasculitis. Finally, primary systemic vasculitis is an auto-immune disease, in which the body's own white blood cells start attacking the cells lining the blood vessels.

The most common types of vasculitis include Granulomatosis with Polyangiitis (GPA) (previously known as Wegener's Granulomatosis), Eosinophilic Granulomatosis with Polyangiitis (EGPA) (previously known as Churg Strauss Syndrome), Giant Cell Arteritis/Temporal Arteritis (GCA), Henoch Schönlein Purpura (HSP), Microscopic Polyangiitis (MPA). Currently, there is no cure for vasculitis but once you have found a treatment that manages your symptoms well you will enter remission (long periods without symptoms).

Symptoms



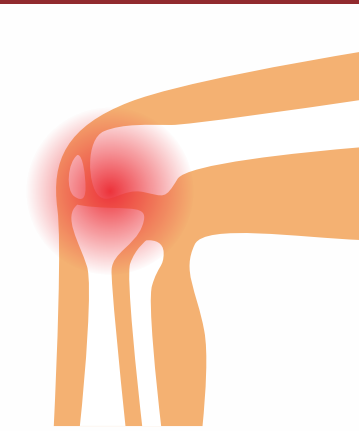
Coughing/breathing difficulties



A rash



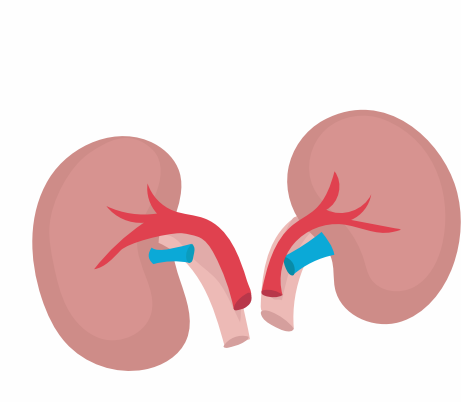
Fatigue



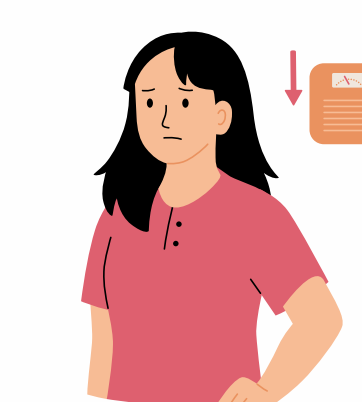
Joint/muscle pain



Fever



Kidney problems



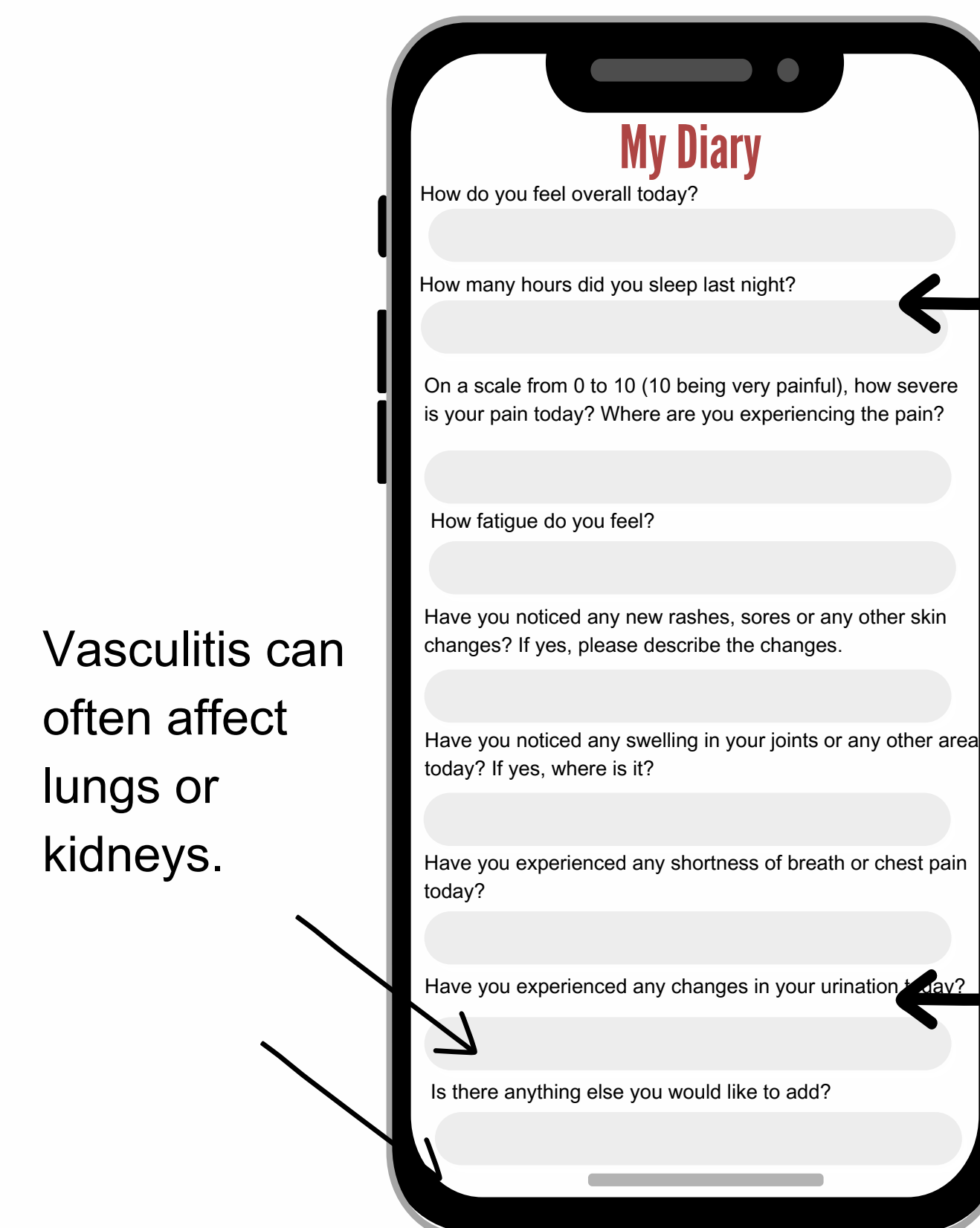
Unexpected weight loss



Stomach pain

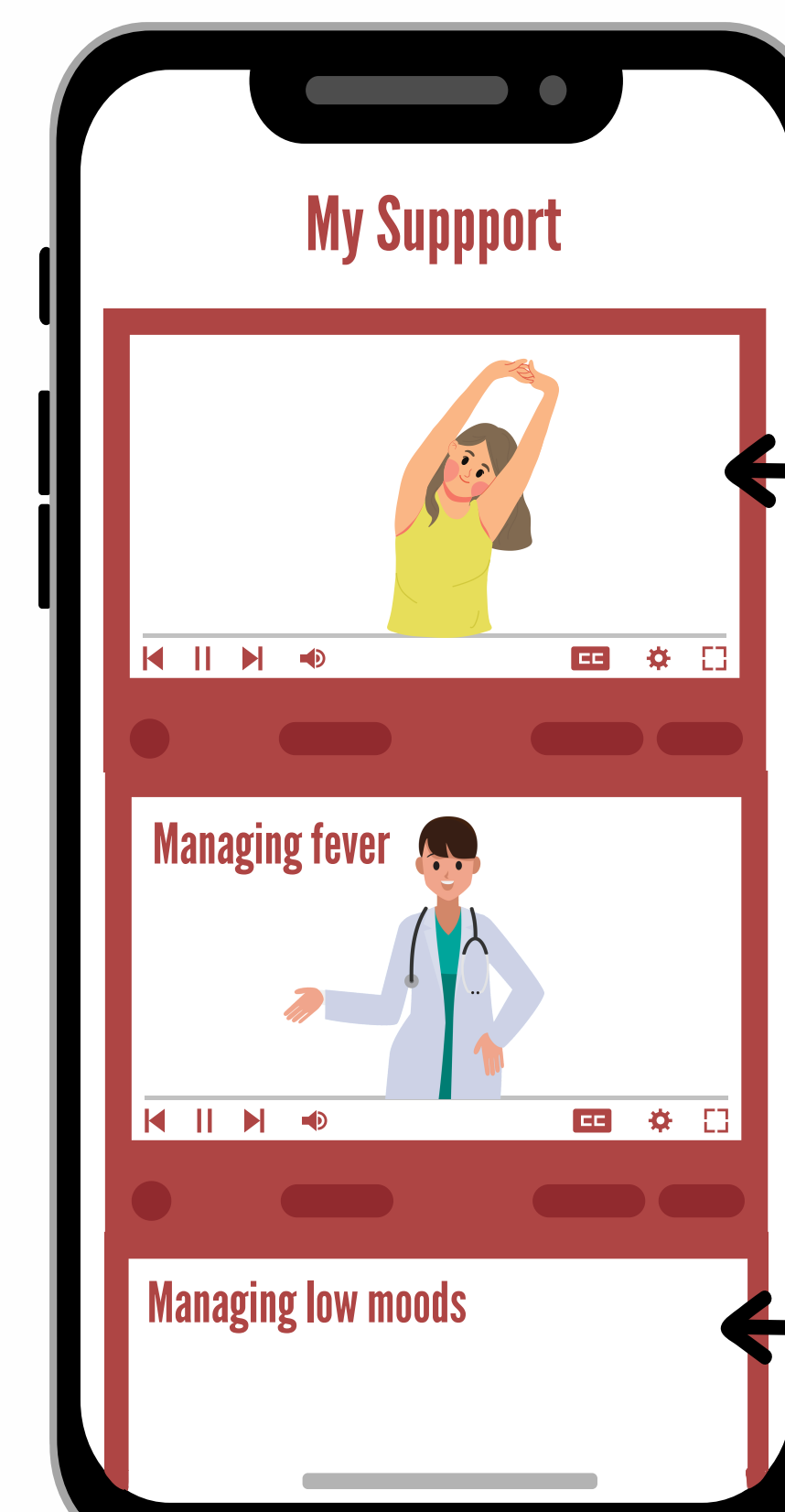
My Vasc

How it works

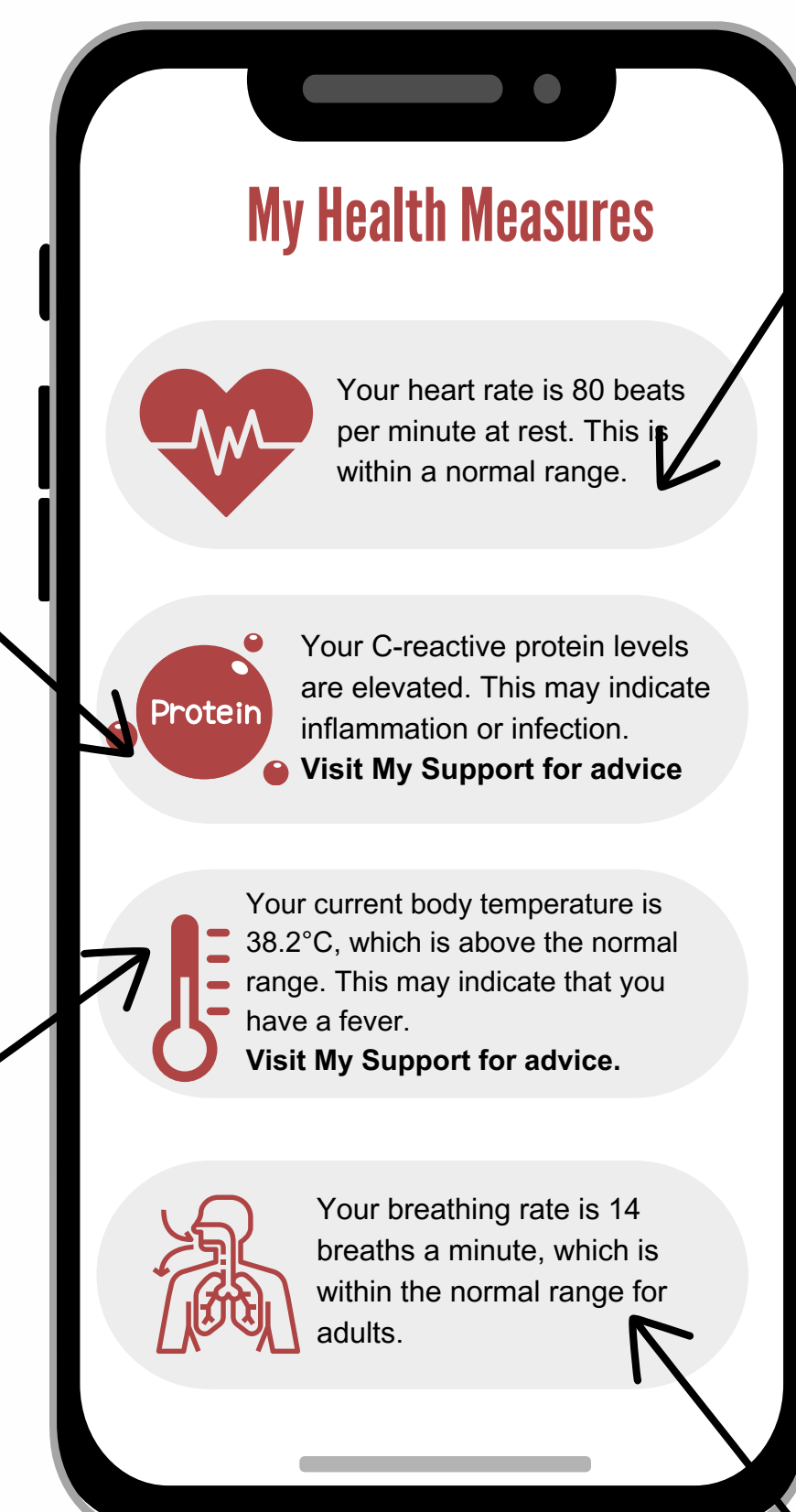


Vasculitis can often affect lungs or kidneys.

Health questions that help record symptoms and help specialist to assess if your vasculitis is affecting any other regions of your body.



My support is a section of the app that contains videos giving advice on how to manage vasculitis such as, videos with stretches for pain relief, how to manage flares, and general health advice.



A patch on your arm contains a tiny sensor attached via a small needle. A bioreceptor, such as an enzyme or antibody, binds specifically to C-reactive proteins (CRP). A transducer converts this chemical signal into an electrical signal proportional to CRP levels. A transmitter processes this signal into digital form and sends it to a receiver, which displays the CRP levels on an app. The patch can be worn for 14 days, after which you replace it with a new one.

Why?

CRP usually rises when there is an inflammation present. If levels are elevated then this may suggest that a vasculitis flare may occur. A high CRP level is above 10mg/L.

Your skin temperature is measured using an infrared sensor. The infrared light travels to your skin, bounces off, and detects the radiation emitted by your skin. The sensor then determines the temperature based on this radiation. After 5 days, the wrist band can establish your baseline temperature. Temperature changes are assessed relative to your individual baseline.

Why?

Vasculitis can cause a fever as part of the body's inflammatory response.

Using photoplethysmography, LED light penetrates the skin to the arteries, which expand during systole and contract during diastole, creating an oscillating response. The photodetector captures the reflected photons and converts them into an electrical signal, producing the PPG signal. This signal's frequency correlates with the heart rate; for example, 1Hz corresponds to 60 beats per minute (bpm). A normal resting heart rate ranges from 60-100 bpm.

Why?

Some forms of vasculitis such as Takayasu arteritis can disrupt the normal function of the heart, potentially leading to abnormalities in heart rate.

Breathing rate can be measured using heart rate by analyzing variations in the heart rate pattern. This method relies on the physiological relationship between breathing and heart rate, known as respiratory sinus arrhythmia. Heart rate varies with respiration, increasing during inhalation and decreasing during exhalation. Therefore breathing rate can be measured using the same technology as heart rate. AI will analyse the heart rate data and estimate the breathing rate.

Why?

Vasculitis can often affect the lungs, resulting in breathing issues.

Evaluation

Advantages

- Minimally invasive
- Will reduce hospital admissions and appointments
- Empowers patients with vasculitis as they have access to their health data
- Enables integrated care (Specialist, GP's, carers and patients have access to My Vasc)
- Comprehensive care monitoring improves the accuracy of flare predictions
- App is tailored to meet the needs of vasculitis patients

Disadvantages

- Wristband sensor and CRP monitor may be less accurate than medical grade equipment
- Those who are not digitally enabled may be excluded from using it
- Storing and transmitting health data puts patient privacy at risk
- Incorrect usage or interpretation of data by patients can lead to unnecessary anxiety or incorrect self-management.

Meet the team

Daisy Ward: Created the poster, researched how to measure CRP and how trials would be conducted.

OreOluwa Adetiba: Researched the symptoms, what vasculitis is, and how to measure breathing rate.

Maria-Magdalena Covasa: Researched the how to measure breathing rate, the types of vasculitis and its epidemiology.

Ava Larkin-Williams: Researched how to measure temperature and questions for the My Diary section of the app.

Cost effectiveness

Early detection of flares and proactive management can prevent complications that would otherwise require costly hospital admissions and intensive treatments. Reduced hospital admissions and clinic visits translate to significant cost savings for healthcare systems like the NHS, making resources available for other critical needs.

Trials

Phase 1: Create a prototype of both C reactive protein monitor and wristband. When making the wristwatch, comfortable material must be sourced. We also must ensure that data collected by both wristwatch and CRP can seamlessly connect to My Vasc app. Once both prototypes are assembled, they will be tested for sensitivity, specificity, accuracy, comfort, and precision.

Phase 2: A group of volunteers are used to assess the CRP monitor's and wristband's performance. The objective is to compare their results against established measurement standards. For example, does the CRP monitor achieve comparable accuracy measurements to a blood test? How does the temperature sensor operate comparably to a thermometer? Ultimately, this phase focuses on safety and initial efficacy.

Phase 3: After initial testing, broader implementation will involve testing the device on a diverse range of individuals, encompassing variations in age, race, height, and weight. The device will be tested on thousands of volunteers.

Phase 4: Both the monitor and wristband are then given to vasculitis patient to trial at home for a year. During this time, we will measure how effective the device was at detecting flares and reducing appointments. Gathering feedback from vasculitis patients on their experience with the app and its associated devices is crucial. Their input on usability, comfort, and perceived empowerment with managing their condition will inform adjustments needed to finalise the product.

Phase 5: My Vasc is then ready to be registered with the Medicines and Healthcare Products Regulatory Agency (MHRA). We expect My Vasc to be classed as a 2a medical device.



Scan here for references