

# PULSEGUARD™

A Pioneering New Heart Rate Monitoring System



[www.pulseguard.org](http://www.pulseguard.org)

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# Why PulseGuard™ was developed

PulseGuard™ was inspired by Adrian and Sue Perry one morning in 2012 whilst reviewing the previous night's video footage of their son Tom's seizure activity.

Tom suffers from Dravet Syndrome and generally only has his seizures whilst he is asleep.

Sue and Adrian had a seizure alarm under Tom's mattress that detected movements during a tonic clonic seizure and an audible monitor to detect any gasps or noises during a seizure. They also had a CCTV camera above his bed so that they could review the previous night's seizures, if any.

It was during the playback one morning, that they discovered they had missed quite a prolonged seizure that occurred during the night where Tom's movements were not enough to activate the under mattress alarm and he had his face buried in his pillow so no noise was picked up.

This was a great concern to them and they set about researching monitoring systems to see if there was something that could sufficiently meet Tom's needs.

After a great deal of research they discovered that there was no system on the market that could accurately detect the onset of a seizure in Tom so they decided to try and design their own.

They looked for one constant condition that existed when Tom had any kind of seizure and they remembered from a previous conversation with Tom's consultant after he had had a telemetry EEG, where she explained that when Tom had a seizure his heart rate increased dramatically.

They used this information and decided to develop a monitor that would detect Tom's heart rate and transmit it wirelessly to a device that would monitor and provide an alarm if Tom's heart rate increased or decreased, so that they would not only be alerted if Tom was having a seizure but also be given peace of mind in early detection of the onset of SUDEP, and give him the best chance of survival.

They tested several different sensors and methods of capturing and transmitting the data and settled on the current sensor device.

After discovering that PulseGuard™ had successfully alerted on every one of Tom's seizures within the first two years of trials and whilst talking to Tom's consultants, other Epilepsy professionals and parents. It was very clear that a lot of other people were very interested in having an alarm system that seemed to be as accurate as it was.

So they decided to set up Adris Technologies (A family run community interest company) to develop and market the system so that others could benefit from their technology.

# How does PulseGuard™ work?

- PulseGuard™ is a watch type sensor designed for use on young children right the way through to adults
- The strap is soft, pliable and breathable. Made from a non-allergen material that will not aggravate the most delicate of skins
- The completely wireless sensor transmits data via Bluetooth technology to our PulseGuard™ App downloaded to an iPad or iPad mini



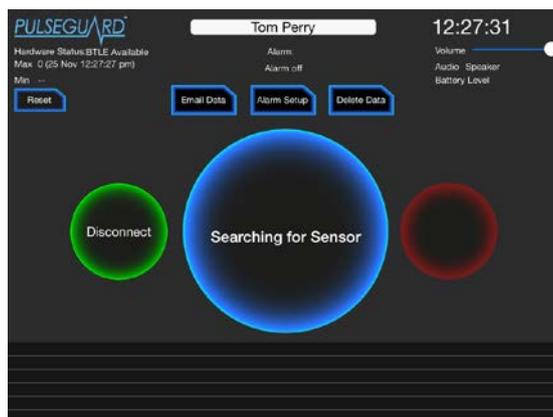
- The Heart Rate is accurately detected by reading the blood flow through the capillaries under the skin on the arm or leg, so no false alarms from poor peripheral circulation
- The rechargeable unit has 9 hours of battery life.  
A second sensor can pair up in seconds for continuation of monitoring for longer periods of time



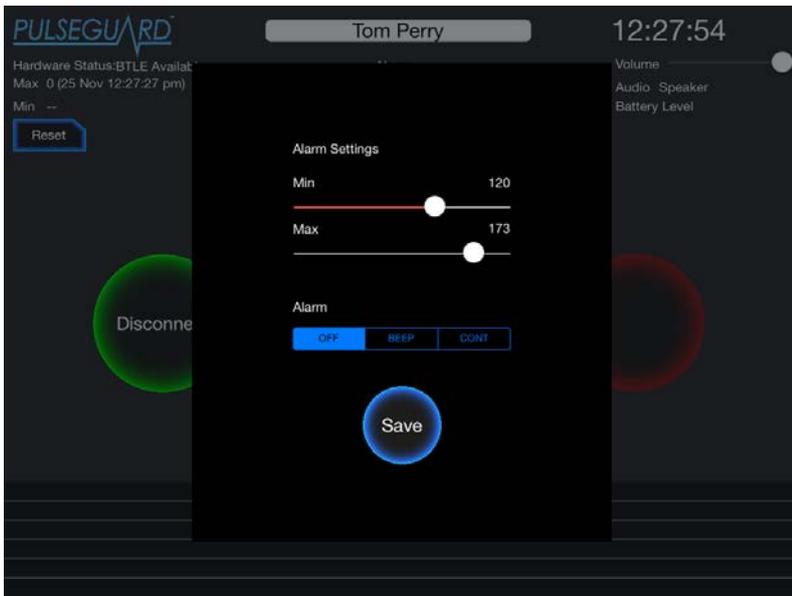
Main loading screen and PulseGuard logo



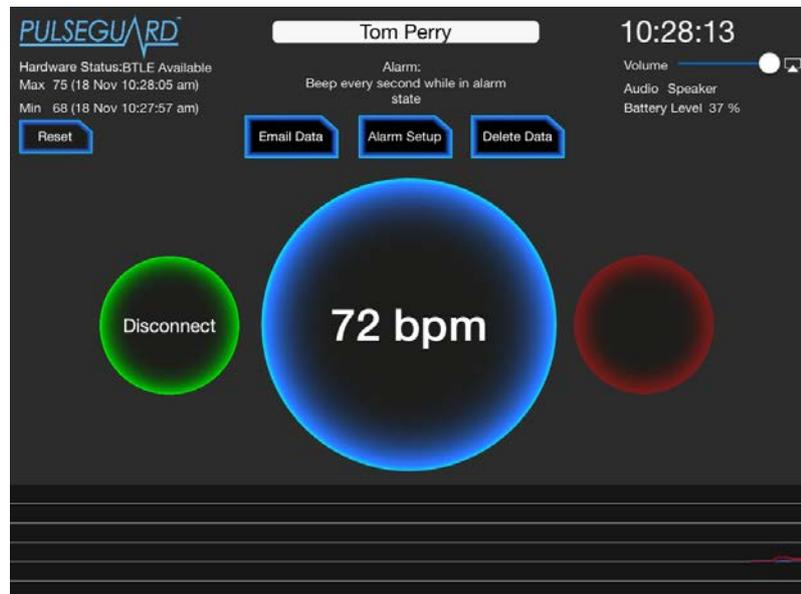
This is the main start screen which will be visible once the app has loaded.



This screen is displayed when searching for the sensor.



This is the main setup screen allowing you to set heart rate's maximum and minimum limits and what kind of alarm you would like to use.



This screen is what you will see 90% of the time, displaying regular heart rate with no problems detected.



This is what you will see when the alarm has been triggered.



This image displays what occurs when an alarm has been acknowledged, a 10 minute cool down timer is displayed as well as the option to re-arm the app now.

# Who can benefit from using PulseGuard™

Although PulseGuard™ was initially developed as a Seizure Monitor for Tom, it benefits a whole range of patients who suffer from complex medical conditions that cause a change to their heart rate.

Kate and Mike Farmer are tapping into their medical knowledge from their many years in the ambulance service, to now focus on putting extensive research into discovering who can benefit from PulseGuard™.

So far they have focussed their research on –

- Heart conditions
- Epilepsy
- Diabetes
- Postural Tachycardia Syndrome

# How PulseGuard™ can help patients with various Heart Conditions

**Abnormal Heart rhythms** – PulseGuard™ can monitor and record abnormal heart rhythms so that you can share this information with your consultant

**Arthelecerosis** – This is where fatty material called atheroma builds up in the lining of your artery walls and narrows your arteries. Over time it can grow bigger until your arteries become so narrow that they can't let enough blood through. This can lead to: Cardio Vascular Disease, Angina, Heart Attack, Stroke or Peripheral Arterial Disease. By using PulseGuard™ for continuous monitoring. If the arethoma builds up and leads to an onset of any of these medical complications you will be alerted immediately and able to get medical assistance without delay preventing further health complications.

**Atrial Fibrillation** – Otherwise known as AF. People with AF have an irregular and sometimes fast pulse. AF can increase the risk of a blood clot forming inside the chambers of the heart, which can lead to a stroke. AF increases the risk of someone suffering a stroke by around four to five times PulseGuard™ can detect and alert to AF so that you can monitor and get appropriate treatment, as well as detecting the onset on a blood clot causing a change in the heart rate at the onset of a stroke.

**Brugada syndrome** – This is a rare inherited heart rhythm disturbance that restricts the flow of sodium ions into the heart cells. As a result, the flow of electrical impulses through the heart is disrupted, which can lead to life-threatening heart rhythms. PulseGuard™ will alert to the heart rate increasing or decreasing So that you can get treatment immediately before it becomes life threatening.

**Cardiac Arrest** – PulseGuard™ will alert to the onset of a cardiac arrest. As soon as the heart rate starts to slow down or stops or in some cases escalate and then suddenly stop, PulseGuard™ will alarm allowing for immediate medical intervention to be given. Coupled with the BLS training that Adris Technologies offers for all customers, it is proven that if effective CPR is started immediately, the patient has up to a 70 % chance of survival which drops by 10% for each minute that passes without CPR commencing.

**Cardiomyopathy** – This is the disease of the heart muscle that can be inherited. There is no treatment or cure for this condition and patients have a higher risk of SADS (Sudden Adult Death Syndrome) so nocturnal monitoring with PulseGuard™ would alert to the onset of SADS and allow for early emergency medical intervention.

**Congenital Heart Defects** – This is where a heart condition develops while a baby is still growing in the womb. There are many different defects which can develop and treatment can range from medication through to surgery. For parents it is a particularly worrying time, so having continuous monitoring of the heart in a non-invasive way allows for early detection of any problems arising to the heart rate giving parents peace of mind.

**Heart Attack** - During a heart attack heart rates can vary from too slow or fast to palpitations and even skipped beats. Where the blockage in the heart occurs, it often has a direct effect on the type of heart rate during a heart attack. PulseGuard™ will alert to any of these changes and allow for immediate medical intervention which can prevent further damage to the heart or Cardiac Arrest

**Heart Valve Disease** – The main causes of heart valve disease are: being born with an abnormal valve or valves (congenital heart disease), having had rheumatic fever, Cardiomyopathy - a disease of the heart muscle, damage to the heart muscle from a previous Heart Attack or anyone who has had a previous infection with Endocarditis. Patients who have previously be diagnosed with any of the above conditions or the elderly are at a risk of developing Heart valve disease. The heart will pump harder and faster to compensate for the disruption to the Valves and PulseGuard™ monitoring particularly in the elderly who are vulnerable will alert to the onset of Heart Valve Disease and allow for early intervention and treatment.

**Long QT Syndrome** – Long QT Syndrome can cause blackouts and palpitations due to the disturbance in the heart rhythm. Strenuous exercise or severe exertion can increase the risk of sudden death for many people with LQTS. If you have sodium channel LQTS, you have an increased risk of sudden death whilst sleeping. For LQTS patients PulseGuard™ monitoring can alert to potentially life threatening changes to the heart rate and allow for immediate emergency medical intervention.

**Progressive Cardiac Conduction defect-** The most common symptoms of PCCD are unexplained dizziness and blackouts. There is also a small risk of sudden death in PCCD. If your heart rate becomes so slow that the heart doesn't pump enough blood over a period of time, your heart could stop (cardiac arrest). Should your heart rate start to slow down PulseGuard™ will alert you at the onset of a fall in your heart rate before you end up in cardiac arrest allowing for emergency medical intervention quickly.

# How can PulseGuard™ detect seizures?

A clinical study by *Montreal Neurological Institute and Department of Neurology and Neurosurgery, McGill University, Montréal, Québec, Canada in 2002* discovered that 93% of patients suffered from a rise in their heart rate by at least 10 beats per minute at the onset of a seizure.

## ***Conclusions:***

***Heart rate changes occur frequently and occur around the time or even before the earliest electrographic (ECG) or clinical change. The change can clarify the timing of seizure onset and the specific rate pattern may be useful for seizure diagnosis and for automatic seizure detection. ECG abnormalities occur often and repeatedly in several seizures of the same patient.***

Patients who suffer from ictal tachycardia or ictal bradycardia at the onset or just prior to a seizure, will benefit from PulseGuard™ Monitoring. These patients will be alerted to seizure activity whether it is Tonic seizure (silent with no movement) Tonic Clonic seizure (Shaking of limbs) or in some cases complex partial seizures.

This is approx. 93% of all patients who suffer from Epilepsy.

For parents and carers of those who suffer from nocturnal seizures. PulseGuard™ also alerts to any fall in the heart rate (potentially in the onset of SUDEP) and will allow for immediate medical intervention to be given, allowing the parents or carers to sleep better at night knowing that they will alerted to seizures and Cardiac difficulties.

# How PulseGuard™ can help diabetic patients

The central nervous system relies entirely on glucose as its energy source. If glucose levels fall, the brain is affected and a change in mental status occurs. Hypoglycaemia is defined as a serum glucose level below 4.0mmol/L.

Normal blood glucose is between 4.0mmol/L and 8.0mmol/L  
Hypoglycaemia is the most common endocrine emergency.

In the insulin-dependent diabetic population, hypoglycaemia can result if too much insulin is taken, if the patient eats too little or if the patient is developing the onset of an infection.

Studies estimate 30% of diabetics experience serious hypoglycaemic episodes every year.

Early Symptoms of hypoglycaemia include:-

- Tachycardia (Increased heart rate)
- Altered mental status
- Confusion
- Sweating
- Shaking
- Feeling of extreme hunger.

Epinephrine (Adrenaline) is secreted as the body enters into “fight or flight” mode as a result of the brain receiving inadequate glucose thus causing the heart rate to increase quickly.

If glucose continues to be unavailable, a change in the patient’s mental status results. Patients become confused, experience headache, and then progress into semi-consciousness and unconsciousness, progressing to brain damage.

Seizures may also occur. Hypoglycaemia can present as alcohol intoxication, and patients could become combative and aggressive, with slurred speech and lack of coordination.

For many Diabetic patients, Hypoglycaemia happens more commonly at night when the body's blood sugars naturally drop. This is a worrying time for patients as well as for parents and family members. Patients may be unaware that their Blood Sugars have dropped dangerously low during the night and if they sleep on their own their symptoms may be missed by friends or family resulting in the more severe stages of hypoglycaemia.

This is where PulseGuard™ can help. By monitoring the heart rate continuously at night and setting the parameters to suit each individual patient, as soon as the patient's heart rate starts to increase due to the onset of Hypoglycaemia the alarm will trigger and the data will be recorded. This benefits the patient, family, carers or friends as they will be able to check the Blood Sugar Levels quickly and administer oral carbohydrates or glucose, reversing the onset of hypoglycaemia and avoiding a hospital admission. You will also have the data recorded from the onset to the end which can then be passed onto your Consultant or Diabetes Nurse to determine any patterns developing to drops in your Blood Sugar Levels and adjustments that may need to be made to your medication.

Diabetic patients are also more likely to develop Heart problems due to their condition. So heart monitoring and early detection is crucial to safeguarding especially as Diabetics are more likely to suffer from silent heart attacks where they have no pain.

PulseGuard™ would give an early detection to diabetic patients who have an onset of a Heart Attack preventing a delay in emergency treatment.

# How PulseGuard™ can help those who suffer from Postural Orthostatic Tachycardia Syndrome (PoTs)

PoTs is a debilitating condition where the autonomic nervous system doesn't function properly.

There is a drop in the blood supply to the heart and brain when you go from a seated or laying down position to upright.

In an attempt to compensate for this, the body produces lots of the hormone noradrenaline (one of the hormones that prepares you for "fight or flight").

This causes the heart to race by an increased 30 beats per minute or more (40bpm in those aged 12 to 19) after a 10 minute period of standing, or if your heart rate increases to more than 120 bpm.

PoTs usually causes no drop in blood pressure but can cause a range of symptoms such as –

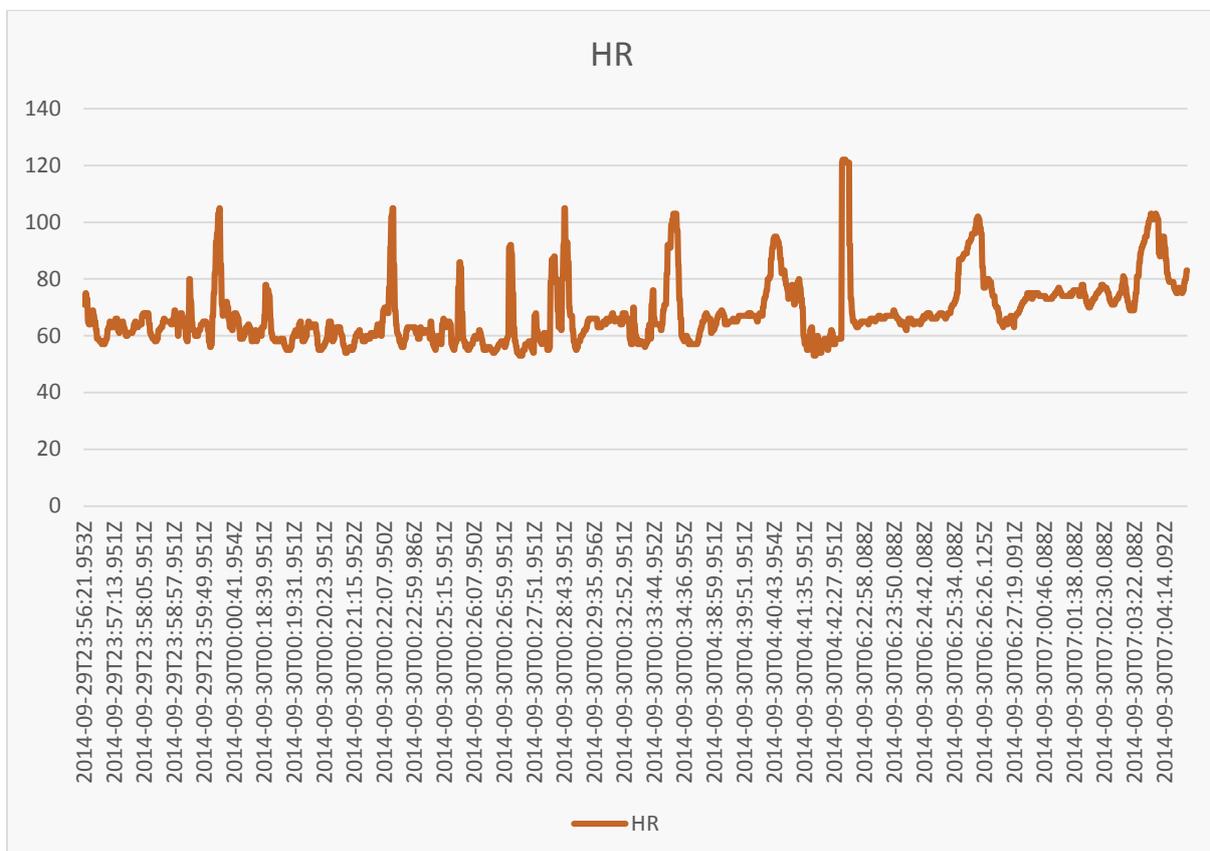
- dizziness
- fainting
- headaches
- sweating
- nausea
- poor concentration and memory
- purple hands and feet
- a feeling of anxiety
- chest pains
- bowel problems
- poor sleep
- weakness
- blurred vision
- shaking
- palpitations
- neck or shoulder pain

By using PulseGuard™ for continuous daytime monitoring, the patient would have an early warning that they are about to suffer a PoTs attack as soon as the heart rate starts to increase and reverse the onset of the symptoms quickly by returning to a seated or lying position until the heart rate has returned to normal ranges. It will also help prevent injury from patients suddenly collapsing due to PoTs as they are unaware of the onset of the symptoms.

# How is PulseGuard™ different from other monitoring systems?

**PulseGuard™ is a unique package of monitoring and personal family based aftercare and support, rather than just a monitoring system:**

- PulseGuard™ provides continuous monitoring throughout the night or day.
- Every time the alarm is triggered, the data is collected and stored. This can then be turned into a graph (as pictured below) and shared with your consultant to help with future treatment.



- We offer 24/7 help and support for our customers
- Free Basic Life Support Courses run by a dedicated team of Paramedics throughout the year at different locations across the country so that our customers can learn how to deal with an emergency situation and how to give their loved one the best possible chance of survival prior to ambulance arrival.
- Additional training for staff in care homes where PulseGuard™ is installed
- An exclusive member's area on our webpage provides customers with a series of videos which reiterate the skills they learn on the courses so that they can continue to feel confident in an emergency situation.
- Ongoing customer relations make sure that our customers feel special and cared for, with face to face meetings and support wherever we can.

## Current Clinical Trials

For the past year, Young Epilepsy at Lingfield has been using PulseGuard™ for Tom in their Residential House.

After seeing how accurate PulseGuard™ was at detecting seizures and drops in Tom's Heart Rate, they volunteered to undertake free clinical trials for PulseGuard in their Telemetry Suite.

These trials are currently underway on a range of different age groups and patients suffering from different types of Epilepsy.



The trials are open ended until enough data has been collected so that Young Epilepsy can publish a white paper with their findings.

We aim to clarify in these studies, the fact that during a seizure or in the event of a patient stopping breathing for any length of time, the heart rate actually increases rapidly to supply the remaining oxygen to the vital organs before slowly dropping off and eventually stopping. Due to this fact, we have found that the SATS levels remain unchanged for a longer period of time, therefore being slower to indicate a problem over a heart rate monitor.

# Who is supporting our work

Since launching on the 24<sup>th</sup> September 2014. We have received incredible support from charities, organisations, consultants and families.

Below is a list of some of the people who have shown continued support for our ongoing work into better monitoring and detection of seizures:-

- ***Young Epilepsy***
- ***Dr Hilary Jones (ITV)***
- ***Epilepsy Action***
- ***Epilepsy Society***
- ***The Enterprise Foundation***
- ***Telecare 24***
- ***Epilepsy Here***
- ***Epilepsy Today***
- ***Epilepsy Ireland***
- ***Epilepsy Scotland***
- ***EKS Childhood Stroke***
- ***UK Epilepsy Nurses***
- ***Fledglings***
- ***Dravet UK***
- ***Several local authorities across the country***
- ***Life for a Kid Charity***
- ***Rose Blossom Trust***
- ***Daisy Garland***

# Customer feedback

Our customer feedback is important to us as it helps us establish how PulseGuard™ is working for other families.

We have loved hearing from our customers and the gratitude they have for PulseGuard™

We have contacted all of our customers who have purchased a PulseGuard™ to find out how they are getting on.

Several patients have detected Heart Conditions they were unaware of before using PulseGuard™ which they are now receiving ongoing treatment and monitoring from a Cardiologist.

Another customer has been able to move their daughter into her own bedroom for the first time since she was born as they have learnt that PulseGuard™ has successfully alerted them to their daughter's seizures and they feel confident in the product.

## How is PulseGuard™ moving forward?

We are working with several Local Authorities, Occupational Therapists, Nurses, Consultants and Charities across the UK to help raise awareness and funding for PulseGuard™ units, making our product and service more readily available to a whole range of patients.

We hope to then be able to provide our product globally in the not too distant future, so that families in every country can benefit from our product without having to find someone in the UK to purchase it for them and ship it over.

We are working on our Basic Life Support Courses and Videos to provide to all of our customers in the near future.

PulseGuard™ Lite is in its 2<sup>nd</sup> phase of Beta Testing. This is our version of PulseGuard™ which has been developed by Adrian and Chris for use on the Apple iPhone and iPod touch and has different features to PulseGuard™ that will hopefully be beneficial for more independent customers and those who suffer from drop attacks seizures so that they can have an early warning which will allow them to make sure they are safe and prevent serious injury as well as any patient who needs daytime Cardiac monitoring for their medical conditions.

PulseGuard™ is a continually evolving product and we strive to take advice and listen to what our families want in the future. We are currently researching and working on some exciting new features that our customers will benefit from in the next update as well as new products to add to the PulseGuard™ range.

*For more information on  
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*Or email:  
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*Thank you for reading*