Researchers at the University of South Florida have developed a system and method for monitoring heart rate variability, which is capable of early detection of various blood gas related conditions, including hypercapnia.

Hypercapnia is a condition in which there are abnormally elevated carbon dioxide (CO2) levels in the blood. This condition can occur in divers who use rebreathers when the rebreather fails to absorb the CO2 from the diver’s exhaled breath. It can also occur in cases in which high levels of CO2 are present in the ambient air and in cases of extubation failure in which case a previously intubated patient cannot get sufficient oxygen. Furthermore, as CO2 is odorless and colorless, such a person may not realize he or she is breathing in excessive levels of CO2 and extended periods of hypercapnia can lead to injury or death.

Given the potentially grave consequences of hypercapnia, it is critical to detect its onset as early as possible, preferably before symptoms appear. Currently, the most accurate way in which hypercapnia is detected is by performing an arterial blood gas panel. While such a procedure is effective, it is invasive, time-intensive, and requires specialized equipment to perform chemical analysis of the individual’s blood.

Our scientists have developed a simple, non-invasive, real-time, continuous means for determining when an individual is experiencing hypercapnia by monitoring an individual’s heart rate variability. This approach is applied through the use of a wearable device or garment and can monitor other conditions including hyperoxia, and hypoxia as well.

**ADVANTAGES:**
- Non-invasive
- Real time
- Easily applied

**Real Time Monitoring for Abnormal Heart Rates**

Poincaré plots that plot R wave intervals for healthy (left) and unhealthy individuals (right)

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