

CAF/NM/26/70 - Exploring the intersection between environmental factors and the risk of malignant ventricular arrhythmias

Abnormal heart rhythms, known as ventricular arrhythmias, are a major cause of sudden cardiac death. These abnormal heart rhythms can occur without warning, even in people who are otherwise stable. In Scotland, individuals from deprived areas are more likely to experience such events. Traditional risk factors such as smoking, high blood pressure, and diabetes explain part of this difference, but not all of it. Growing evidence suggests that our surrounding environment, particularly the air we breathe and the temperature we live in, may also play an important role. Air pollution and temperature extremes can affect the heart and circulation. On days when air pollution levels are higher, hospitals see more people attending with breathing or heart problems. Similarly, very cold or very hot weather can put extra strain on the heart. However, it remains unclear whether these environmental factors can contribute to trigger dangerous heart rhythms, especially at pollution levels commonly seen in the UK. We also do not yet understand whether some groups, such as those from deprived areas, are more vulnerable than others.

This project aims to find out whether short-term changes in air pollution or temperature can trigger potentially life-threatening heart rhythm disturbances. To do this, I will link environmental data with detailed health information and conduct three complementary studies. The first study includes patients who have had an out-of-hospital cardiac arrest (where emergency resuscitation was attempted). The second study includes patients who have cardiac defibrillators fitted, devices that automatically record and treat dangerous heart rhythms, and thirdly I will investigate individuals from a large national cohort who have a diagnosis of ventricular arrhythmia. By linking these health records with hourly and daily measurements of air pollution and temperature, we can study if changes in the environment influence the timing and risk of potentially life-threatening heart rhythm events. By studying data across different communities in Scotland and the UK, we will also examine whether social and economic factors influence who is most at risk. Understanding these patterns will help identify vulnerable groups of people who might benefit from additional support or early warnings during high-risk periods, such as days with poor air quality or episodes of low or high temperatures.

The results of this research will be shared widely. Findings will inform public health guidance on environmental risks, help clinicians give better advice to patients with heart conditions, and support policymakers in developing strategies to reduce pollution exposure and protect those most at risk. In the longer term, this work aims to reduce sudden cardiac deaths and narrow health inequalities between communities. It will also help raise public awareness of how environmental factors affect cardiovascular health and highlight simple actions individuals can take, such as following air quality alerts or avoiding outdoor activities during high-risk days, to protect themselves and their loved ones.