

## Research Outline

My primary research is concerned with automated monitoring of vital signs in children, to assist clinicians in identifying children with serious illness. By identifying these children at an early stage, it is possible to reduce their risk of complications, long-term disability or death.

Between 40 and 50% of children attending GP surgeries or emergency departments in the UK are suffering from infectious illness or respiratory problems. Most of these will have minor illnesses requiring minimal medical involvement, but a small percentage will have serious illnesses such as meningitis or pneumonia. It is vital that these children are identified as soon as possible, so that they can receive immediate definitive treatment. For these children, improving the time to treatment can make a significant difference to their chances of making a full recovery.

It is known that vital signs such as breathing rate, heart rate, temperature, and oxygen saturations can be used to assist in the identification of children with serious illness. (oxygen saturations are a measure of how well the blood is transporting oxygen around the body). However, time pressures mean that these are not always measured. This is particularly true of the breathing rate, which is difficult and time-consuming to measure manually in children, and for which there are currently no automatic monitoring devices that are suitable for use in short-term monitoring of children in an emergency care situation.

One part of my doctoral research has been to develop an algorithm for assessing the breathing rate from the signal from a pulse oximeter. This is a simple finger clip device that is frequently used in both GP surgeries and hospitals to monitor heart rate and oxygen saturations in patients of all ages. It is currently being tested in a clinical trial in Oxford, to validate its accuracy in children attending an out-of-hours GP centre. For this trial, we are using a wireless sensor, which allows more freedom for the child during the monitoring period.

The other part of my doctoral research has been to investigate data fusion techniques, so that the vital signs measured using the pulse oximeter, together with a temperature measurement, can be used to predict the severity of illness. Initial results have shown that it is possible to achieve accuracies of 70-80% in predicting which children will need to be admitted to hospital in the following seven days.

In the next few years, I would like to expand the applications of my research. This could include looking at longer-term continuous monitoring of children. In particular, the ability to monitor breathing rate, heart rate and oxygen saturations using a wireless sensor would allow continuous non-intrusive monitoring of mobile children in hospital wards. At the moment, these children are only intermittently monitored, as existing systems do not allow for continuous monitoring of patients who are moving around the ward. This would allow hospitalised children to engage in more normal behaviour and play activities, without compromising medical care.