

# Lessons learnt from Long-Term Chronic Condition Monitoring

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Essential to the future development of wearable and implantable sensors is the consideration of how and where they will be used, along with the level of user acceptance, effectiveness and usability. Intertwined with this are the commercial, regulatory and ethical considerations that will drive final take-up of these solutions. Lessons can be learnt from the home based monitoring of patients with Hypertension over a prolonged period.

Through work supported by an EU Framework 5 funded project, the authors have been involved in the design, development and trials of a Home-Based monitoring service for patients suffering from chronic illness, in particular the monitoring and management of patients with Hypertension. Various trials have run between 2000 and 2003 and have involved patients across the UK, Finland, Germany and Estonia. More recently, trials have started involving patients with Asthma, Diabetes, Heart Failure and Respiratory Failure (COPD).

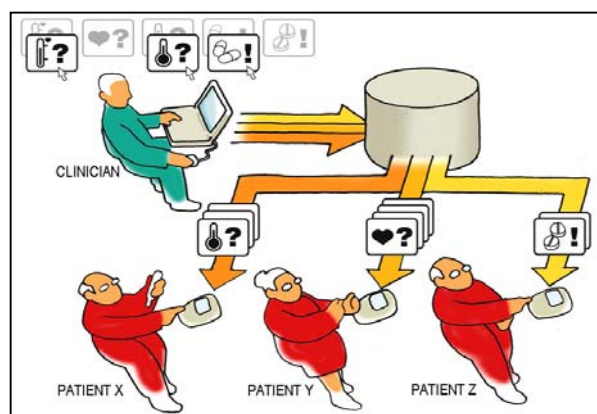
The trial provided a “sea of data”, upon which various hypothesis were applied to enable navigation through this data, in order to highlight the many benefits of continuous monitoring of chronic conditions. Areas such as usability, frequency of use, usage based on age range have been investigated in addition to looking for improvements in medication compliance and reduction in blood pressure. In terms of frequency of use, the system required a moderate level of voluntary cooperation by the patient; on average, this was found to be provided every 2 – 3 days. Medication compliance was one particularly successful area, with average compliance increased by over 104%, with associated reduction in blood pressure of up to 4mmHg. The trials provided a very comprehensive and relatively high-resolution picture of blood pressure variation for a broad patient population over a prolonged period. From this interesting patterns were observed, including weekly cycles and clear linear increases between clinician consultations.

Whilst the benefits of monitoring multiple parameters are seen, another issue is raised that considers the level of invasion into a patients life verses the value gained, with either too much or inappropriate invasion leading to a reduction in compliance. Some of the findings in this area are relevant to wearable and implantable sensors. The ability to measure several parameters concurrently proved to be extremely beneficial and kept the users perception of invasion to a minimum.

In addition, whilst there is a lot of clinical evidence relating

to improved outcomes from increased compliance and control of parameters such as blood pressure, it has been generally found that both Clinician and Public Health providers understanding and recognition of the benefits of this new technology driven solutions are limited, and funding mechanisms very resistant to change and to support this technology. This attitude will limit the acceptance and take-up of any form of remote technology, and clearly-defined research into the overall health gain of remote monitoring is essential to overcome purely subjective negative responses to this brave new world.

The methods of encryption and data security used in the trial are discussed, along with the regulatory requirements for devices that collect and store medical data. The need for data security when medical data is transferred between devices in the home drives a requirement for data transfer standards for medical devices. Such standards will also allow the development of a range of interoperable devices from a range of manufacturers, helping to drive down costs of ownership and spawning the provision of a wide range of sensors types. Co-operation is key to this development, allowing small and medium enterprises to offer commercially viable and innovative products.



**Figure 1.** Block diagram showing the architecture of the home based monitoring system used in the trials

For information or enquiries related to the trial and the results found, please contact:

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