The Digital Health and Care Institute CDSS-related projects and abstracts

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1) **Designing (and evaluating) a Clinical Decision Support Transformational Platform to Support Complex Needs and Alignment across Care Pathways: Evaluation of the Evidence based medicine electronic decision support (EBMeDS) demonstrator project in NHSScotland (CDSS)**

(Proposal 1) One in five people in Scotland have a long term health condition that results in regular consultations with health care professionals (HCPs). When making decisions about medical treatment, HCPs must consider a number of factors including local and national guidelines that are based on the best available evidence, and the patient's individual needs and circumstances – for example, complex care needs such as multiple conditions. However, it has been shown that only half of all HCP's decisions are made in this way. Clinical decision support systems (CDSS) can improve HCPs decision-making by providing advice that is based on both the through clinical problem and the individual patient that they are dealing with. This advice is provided to the HCP through the existing computer system at the time of the clinical consultation. We have developed a CDSS that aims to improve the care of people with diabetes. We have implemented this system in NHS Tayside and plan to do the same in NHS Lothian in the near future. It is hoped that eventually the system will support HCPs providing care for people with diabetes throughout the whole of Scotland. This project is designed to assess how HCPs react to this way of working and find out ways in which the system could be improved to support safe, effective and person-centred care. We would hope that by improving care, the health of people with diabetes will improve and this project is designed to measure this also. This project will feed into the long term vision of implementing decision support in clinical and care management systems at scale, to support reliable and consistent care across health and social care settings, aligned with individuals' needs and local settings.

(Evaluation of this project, doc 2) Clinical Decision Support Systems (CDSS) have been shown to be one of the most consistently successful approaches to encourage clinicians to adopt evidence-based practice [1].

The Evidence Based Medicine electronic Decision Support (EBMeDS) system is an example of a CDSS and is currently integrated within the Finnish national electronic healthcare record (EHR). It provides decision support to healthcare professionals and members of the public on a wide variety of health-related issues. EBMeDS has been developed by the Finnish Medical Society, Duodecim [2]. This project arose via a collaboration between Duodecim and NHS Education for Scotland (NES),

whereby NES are actively exploring CDSS options for NHS Scotland, in accordance with the refreshed national eHealth strategy [3]. This strategy envisages that by 2020, healthcare professionals will have access to *"…increasing amounts of clinical guidance and decision support that is relevant to the specific patient context, including highlighting any substantial variation from expectations, and generating appropriate prompts and alerts."* NES and Duodecim entered into a service level agreement in March 2013, whereby EBMeDS was implemented and evaluated within SCI-Diabetes (Scotland's national informatics platform and EHR for people with diabetes), by way of a service improvement project assessing the feasibility and utility of such a system within the Scottish context. Funding and project support for the evaluation was provided by the Digital Health & Care Institute [4].

2) **Scottish Frailty Framework with Mobile Device Capture and Big Data Integration (eFrail):**
The innovation aims to detect the early signs of illness by gathering data from home visits and then integrated into a frailty framework which analyses both clinically focused assessments and socio-economic factors. The outcome will be the integration of existing frailty framework assessments and new assessors into a product which will roll-out across councils and health boards in the UK.

3) **COREMED Aid**:
Metix Ltd. is developing the first handheld and wearable vital signs monitor. Our device measures all the standard parameters that a bedside monitor measures (ECG, blood pressure, temperature, oxygen in blood, heart rate, respiratory rate) and includes up to 15 composite parameters. CM can store and transmit patient data in realtime while being designed to be operated in extreme conditions.

4) **Mental Health Clinical Collaboration Suite (MH-CCS):**
Without significant funding increases, improving the quality, safety and efficiency of mental health treatment and focusing on person-centred models is a major challenge for health care and public services, but Cohesion Medical's Clinical Collaboration Suite (CCS) has the potential to deliver on these challenges, and has proven itself in the management of physical long term conditions. We propose to adapt the CCS for the support and management of mental health problems by co-design and rapid prototyping, followed by robust user testing and evaluation of effectiveness, with the aim of revolutionizing the delivery of mental health care and mental health clinical research in Scotland and beyond.

5) Moletest Limited

Moletest has created a CE Registered Medical App for the iPad mini that addresses the problem of the growing number of unnecessary referrals of suspect pigmented skin lesions to specialists by helping primary care practitioners identify healthy skin lesions.

The over-referral problem is straining secondary care resources as only half the dermatology posts in the UK are currently filled and the rate of skin cancer cases is doubling every ten years.

Based upon many years of research and development a new set of algorithms are used in the Moletest App to analyse the digital images of the skin lesion captured on the iPad mini. Very recent innovations in edge-detection have enabled the App to perform with a level of accuracy that would significantly reduce healthcare costs.

Moletest has established a Scientific Advisory Board of experts in Primary Care, Dermatology, Cancer Research, Digital Signal Processing and Photography to help specify the contents and design of the App. A survey of dermatologists undertaken by Moletest has helped define the performance and accuracy needed for a diagnostic aid (categorised as a Medical Device by MHRA and FDA) to be used within a clinical environment.

6) Safer Opioid Prescribing Tool

A novel tool to reduce high-risk prescribing errors, morbidity and mortality in patients prescribed opioids.

The product under development is an opioid conversion tool, using the Scottish opioid prescribing guidelines, in website, non-native app format. There is currently no validated opioid prescribing tool in Scotland, using Scottish guidance.

7) Technology Evaluating and Measuring Emotional Dysregulation (TEAMED)

The project will develop, integrate and assess a variety of technologies to establish a patient's emotional state. The desired outcome is for patients with emotional problems to receive better care, to achieve a better quality of life, and to self-manage their conditions better.

8) Generating consistent decision support for diabetes in service user and practitioner systems from a common source of patient data. (CDSDB)

This project will address the challenges to safe and consistent patient care presented by disconnected information and knowledge systems in diabetes. It will create and test a prototype which uses data in the SCI-Diabetes integrated patient record and real-time patient monitoring systems to generate consistent, shared decision support in systems used by service users and practitioners in Scotland – EMIS and My Diabetes My Way. This will provide a model of how to translate the benefit of decision support associated with a single source of integrated patient data across multiple systems and settings.

9) Developing a Rapid Route-to-Market for Digital Solutions for Managing Information in Medical Emergencies (MIME)

A Health Inequalities Impact Assessment carried out as part of the recent NHS Scotland Resilience report highlighted 3 strategic priorities for Health Boards: (i) **communication** so that everyone is given appropriate information, (ii) **access to services** and (iii) **staff training** so that emergency responders understand how procedures followed and decisions taken in emergency situations may impact on injured or sick patients and their relatives, particularly in the recovery phase of an emergency [1]. In many rural areas of Scotland ─ where currently one fifth of the Scottish population lives ─ these 3 key strategic priorities will represent significant ─ if not insurmountable ─ challenges. The Scottish Ambulance Service (SAS) has worked to develop a network of Community First Responder (CFR) schemes for early intervention in order to improve the survival and recovery chances of those affected by medical emergencies in remote areas. A CFR is a member of the public who volunteers to help their community by responding to medical emergencies while an ambulance is on its way. CFRs can play a vital role in patient care before an ambulance arrives, sometimes delivering life-saving treatment while having to manage a patient in isolation, with minimal back-up. Emergency situations can be highly stressful ─ and occasionally traumatic ─ events, particularly if the CFR feels helpless or unsure of what action needs to be taken to manage the emergency [2].

Through the `Managing Information in Medical Emergencies' (MIME) project, we have carried-out research and development activities at the University of Aberdeen dot.rural Digital Economy Hub and the Centre for Rural Health in order to design, test and evaluate digital solutions to support CFRs. This has resulted in a MIME prototype, which consists of lightweight, wireless medical sensors, and

a tablet computer that facilitates the recording of sensor data, actions and observations by CFRs. The system also generates a handover report using a technique known as 'Natural Language Generation' (NLG) (*see appendix for our vision of how MIME could transform pre-hospital patient care*) and gives some basic decision support. The system is novel as it is able to deal with a very large volume of inputted data and sensor data and *make sense of it* in plain and simple language. This makes it distinct from other pre-hospital medical monitoring systems. It is essential to identify abnormalities in physiologic data as it can indicate the lead-up to a major, life-threatening event [3,4]. Our vision of the future is that every CFR in Scotland (and many in other countries) will have access to this technology, facilitating the capture of a larger, more accurate body of medical data, expediting the timely input of actions and observational data, summarising data quickly and accurately for a variety of groups, whilst not distracting the CFR from the patient. We contend that MIME can enhance patient care, but only if it reaches the stage of being deployed.

10) RESBOSK (Remote Sensing of Blood Oxygen Saturation using the Kinect)

A remote sensing pulse oximeter using camera based technology has been developed with the initial DHI funding. This application has been shown to reliably measure the heart rate of healthy adults in a laboratory setting.

11) SMART COUGH - Continuous intelligent cough detection and identification based on smartphones

This project aims to expand the capabilities of telemedicine in the context of respiratory illness. To this end, we will study and evaluate advanced signal processing and pattern recognition techniques to achieve continuous real-time automatic detection, severity assessment, and identification of cough episodes. A smartphone application featuring these functionalities will be developed for patient monitoring. The use of seamless affordable add-ons will also be explored to achieve full diagnostic capability at high specificity and sensitivity rates. Finally, the development of new solutions featuring advanced power management for intense computing using smartphones, as well as high quality sound processing with active noise cancellation will also be investigated. These solutions will pave the way for new generations of smartphones ready to incorporate state-of-the-art connected health applications.