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Public Health 2018: Smart textile wearable and digital healthcare - Yi Li - The University of Manchester

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With a global trend of ageing population, health systems in many countries are under substantial budget pressure to meet the future needs. Reduction of hospital bed days by achieving earlier discharge after surgery becomes inevitable to cut down the NHS expenditure. However, without appropriate healthcare, patients are at the risk from isolation, depression, strokes and fractures caused by falls in the home, as well as the post-operative complications, which will result in increasing hospital readmission rates. It has been identified that 80% of face-to-face interactions with the NHS are unnecessary if appropriate technologies could be developed to mitigate these problems. To address the healthcare grand challenge of "Transforming community health & care", there is an urgent to develop advanced smart functional e-textile wearables for creating innovative ultimate personalized e-healthcare technologies. This could be achieved by developing advanced techniques to engineer advanced materials (e.g. graphene) into and/or onto textile fibers, which will be interfaced with human body and internet mobile devices and cloud computational modelling and simulation of physiological and biomechanical behaviors of human body, as well as its interactions with clothing and external environment. Thus, smooth real time healthcare monitoring, advices and risk/emergency warnings to patients and their medical doctors could be provided in a invasive and invisible fashion. To achieve the goals, there are a number of key scientific and technical challenges to be addressed, including: 1. Establish scientific understanding and engineering principle to fabricate advanced nano-scale functional materials such as graphene into flexible and strong smart fibers with sensing, energy harvesting, energy storage and/or actualization functions; 2. Develop advanced manufacturing techniques to produce advanced wearable smart textile materials (fabrics) using the smart fibres; 3. Develop science of design and engineering principles of system integration of smart fabrics with micro-electronics to produce smart devices; 4. Derive technical solutions to integrate smart devices with wireless data communication technologies to transfer data to cloud servers; 5. Develop cloud-based database, data analysis techniques, as well as computational modeling and simulation of human biological behavior, material functional performance and their interactions with external environments to establish digital biological health avatar for individuals; 6. Develop technical solutions to provide real-time medical professional guidance and feedback to individuals and/or healthcare workers. Careful consideration of the ethics, risks and regulation of such technology is vital from its inception, as the success of this work will challenge both individual patients' healthcare and wellbeing and the organization of timely medical intervention to save lives and reduce healthcare expenses. In this lecture, the scientific foundations are reviewed and the principles are illustrated by examples.

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