Project Title: Developing an Optimal Maternal and Fetal Monitoring ICT System for Capturing and Integrating Complex Data during Induction of Labour

Supervisors:
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Level: PhD

Background to the project
Induction of labour is a common obstetric procedure that is carried out in over 20% of pregnancies in developed countries (Mealing et al 2009). BirthChoiceUK reports an induction of labour rate of 27% in England for 2014/2015, with N Ireland reporting a rate of 33.4%. During induction of labour women are attached to a wide range of medical devices. Managing a technological birth is an increasingly common aspect of the clinical work of midwives, doctors and pharmacists who support pregnant women during the induction of labour process. A woman who is to be induced will normally require pharmacological preparations such as a prostaglandin pessary to ripen the cervix for labour, artificial rupture of the membranes (ARM), intravenous syntocinon delivered using a mechanical infusion pump, epidural analgesia, monitoring of the maternal contractions and fetal heart rate using the CTG machine, measurement of maternal blood pressure using the Dinomapp machine, temperature measurement and urinary output measures. A crude classification of technologies used for induction of labour was first developed in 1999 by Sinclair:

Low technology devices: includes ‘mechanical’ devices such as the pinard stethoscope that demand skill and expertise in interpretation and use by the midwife
Medium level technology devices for delivering medication such as the IVAC pumps and Graseby pumps used to deliver syntocinon and epidural analgesia
Higher technology devices characterised by their electronically controlled automation (electronic/artificial intelligence) and these include the CTG and dinomapp machines that are essentially monitoring devices for visualizing the maternal pulse, blood pressure, uterine contractions and the fetal heart rate.

Problem: From a data linkage perspective none of the technologies used in the birthing room are connected although each one provides a stand-alone data output. This is problematic when it comes to providing robust and integrated data for evidence-informed decision making and for interpreting the longer term impact of induction of labour on maternal and fetal outcomes. Therefore, this research is designed to explore the potential for data linkage and data capture of all information available in the birthing room.

Unique value of interdisciplinary PhD
The unique contribution of this cross faculty PhD is the combination of expertise from computing and academic midwifery to enable the development of a highly valuable and clinically relevant optimal data visualisation tool (ICT system) that will be of immense value in interpreting individual and combined factors influencing maternal and birth outcomes from a range of induction technologies.

Theoretical considerations: The main theoretical underpinnings for this study are the Technology Acceptance Model (TAM Davis (1989a; 1989b) and Roger’s (1975a; 1983b) Protection Motivation Theory.

Aim: To develop an effective method of capturing and integrating different forms of data from the birthing room and developing a computational visualisation tool for achieving optimal maternal and fetal monitoring during induction of labour.

Objectives
The objectives of this project are to observe and analyse current data capture processes to develop a system for multiple data integration and analysis; to test the system in the clinical environment and to evaluate the technology acceptant model in labour monitoring from key stakeholders.

Method
This study will begin with the development of a tentative theoretical framework that will conceptualise the optimal relationships between pregnant women, healthcare professionals and childbirth technologies. This framework will determine the choice of methods but is likely to include:
- Clinical observation of behaviours of those supporting women and their partners in induced labour including monitoring of the data collection processes, interpretation of these and their impact on decision-making
- An online survey to explore knowledge, skill and attitudes of health professionals towards optimal use of technology in childbirth
- Interviews with parents about improving the data interface between persons and machines
- Design of a prototype system able to capture and integrate clinical data from multiple devices used in the labour monitoring process
- Testing and evaluating the prototype with key stakeholders

Data analyses
Qualitative data from the observation of clinical practice will be captured using video technology, field notes and stored data from electronic devices such as the CTG machine. This will be analysed using NVivo software. The online survey will be set up on Qualtrics and data will be downloaded directly into SPSS for descriptive statistics and factor analyses of attitudes. The data synthesis from these three methods will be used to design an integrated data set that will be tested for functionality, user-friendliness and effectiveness in a clinical setting. Data output from the multiple devices will be transferred and integrated to the proposed system. A computational system will be developed to provide an integrative visualisation of the data.

Skills required of the applicant
Essential: Master’s Degree in science, computing or healthcare and excellent ICT skills plus competence in statistics and qualitative data analyses
Desirable: Clinical background in midwifery, obstetrics, pharmacology or ICT systems design

References
BirthchoiceUK (2016) accessed 23rd May 2016
http://www.birthchoiceuk.com/Professionals/BirthChoiceUKFrame.htm
http://www.birthchoiceuk.com/Professionals/statistics.htm