Project title: Mathematical formalisation of the programme theory for a complex healthcare intervention to promote smoking cessation

Background

Cigarette smoking remains a major threat to public health. Whilst considerable progress has been made in recent years, further reduction in cigarette use is an important area for future research. Innovative approaches are therefore required to improve outcomes of current care pathways. These approaches are complex in terms of intervention components, the way in which they are delivered, the people delivering interventions and their interactions with patients. Thus intervention design needs to take into account a large number of variables along complex causal pathways. Quantitative methods currently dominating medical and health research tend to focus on a single or limited number of cause-effect relationships and are not well equipped to handle the complexity of intervention design and implementation or to model the effects of contextual factors.

Mathematical models are widely used in fields outside health research to evaluate causal relationships in complex systems, but their application to health service delivery interventions is currently limited. This project aims to demonstrate applicability of mathematical models in the field of health interventions, initially by constructing a model network to represent causal relationships in the programme theory underlying a complex intervention for smoking cessation.

The work complements the NIHR funded STOP programme (https://tinyurl.com/zeyc24s) to develop and evaluate the intervention in a randomised controlled trial. Dr Yen-Fu Chen and Professor Robert Walton in the Population Evidence and Technologies group at Warwick medical school will supervise the work.

Objectives

(1) To identify data requirements and optimal techniques (eg Markov random fields, Bayesian) and construct a mathematical model representing the STOP programme theory

[2] To conduct simulations using parameters identified/supplied by experts currently developing and evaluating the intervention to estimate likely effects on health outcomes under different conditions

[3] To apply the techniques to model programme theory for a range of different interventions

[4] To identify potential barriers to use of mathematical models for developing and evaluating healthcare interventions, and to highlight areas for further research

[5] To develop a PhD proposal for future research in this field.

Deliverables

- A graph representing a “logic model” or “influence diagram” illustrating potential causal relationships between intervention components and contextual factors for smoking cessation, that is judged by experts to have face validity
- Graphs representing logic models for other health service delivery interventions
- Conditional probability tables/distributions that depict the relationships between variables
- The mathematical models using a software/package agreed by the supervisors/department

Real-life benefit of the proposed research

The model will directly inform development and evaluation of a smoking cessation intervention that could be widely implemented across the UK. This work will be one of the few early applications of these mathematical methods in programme theory for health service interventions, and thus could have profound impact on future uptake of this methodological approach.