PenCHORD
The Peninsula Collaboration for Health Operational Research & Development

Optimising polypharmacy prescribing practice using Agent-Based Simulation modelling

Summary:

An ageing population has led to an increasing number of people with multiple comorbidities prescribed multiple medications (polypharmacy). This can be problematic because many people who have been prescribed multiple medications do not take all of their medication as prescribed, which can lead to potential safety issues, wasted medication and otherwise avoidable access to health care services. A better understanding of polypharmacy self-optimising behaviours could be very useful to better inform prescribing practice and improve adherence amongst those taking multiple medications.

We designed and built a proof-of-concept simulation model to be used as a tool to support polypharmacy prescribing for those with both Type 2 Diabetes and Asthma. The simulation uses a technique known as Agent-Based Simulation to model the complex interplay of factors that directly and indirectly influence somebody not taking their medication as prescribed and can be used to predict the adherence rates and state of health of a population prescribed a given combination of medications.

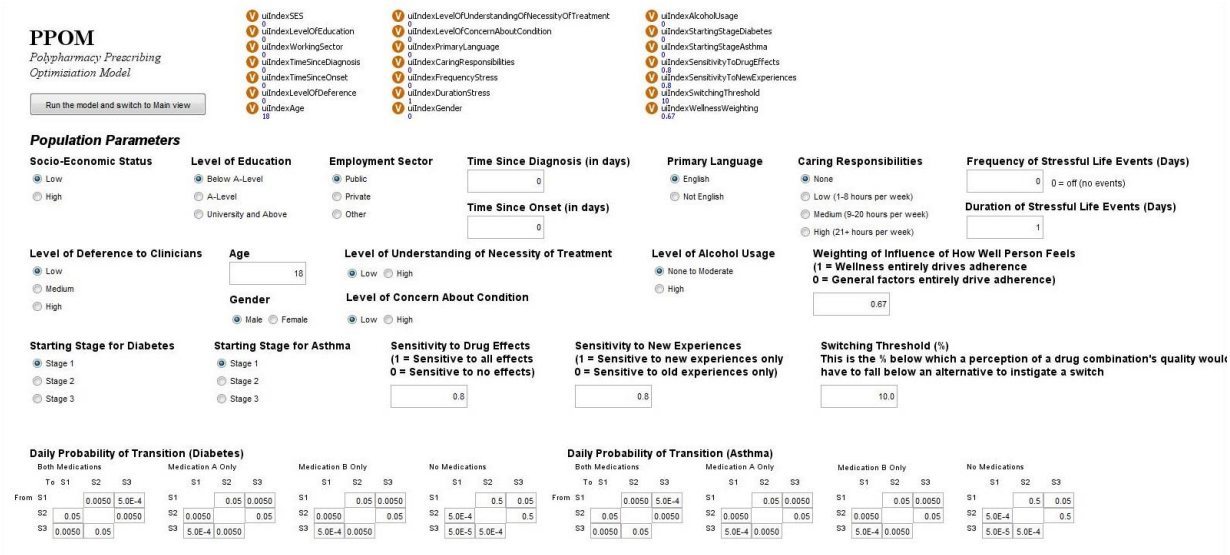
Context:

The project was undertaken with a collaborative working group formed of two PenCHORD modellers, two PenCLAHRC polypharmacy researchers, a prescribing GP, a pharmacist, a representative from the South West Academic Health Science Network (SW AHSN) and two members of the local patient involvement group (PenPIG) who were taking multiple medications for multiple long-term conditions.

Method:

Agent-Based Simulation is a simulation modelling method that models the behaviours, interactions and motivations of individuals within a population to better understand emergent population-level dynamics. We built an Agent-Based Simulation model here to capture the medication adherence behaviours of those with both Type 2 Diabetes and Asthma. The model captures 59 relationships that directly or indirectly influence adherence behaviours in such a population. These influences include the effects of medication, wellness and perceived wellness on adherence behaviours, as well as a multitude of other more “general” factors.

The tool allows the user to specify a particular combination of prescribed medications in terms of their effectiveness and adverse effects, and the model predicts the levels of adherence and “wellness” of the population prescribed this combination. In this way, different drug combinations can be compared in terms of both their clinical effectiveness and likely levels of adherence within a population, allowing trade-off decisions to be made.



Implementation:

The intention of this project was to demonstrate how a polypharmacy prescribing support tool could be developed that gives better insight into the adherence behaviours of those taking multiple medications. The tool could be used either to support individual prescriptions for such people or to support polypharmacy prescribing policy on a larger scale. There is also the potential to use the model to inform the cost-effectiveness analyses of interventions by gaining a better understanding of the likely adherence of a new intervention, alongside its cost and clinical benefits, if it were commissioned.

Contact and more information:

For further information about this project, please contact the Project Lead Dr Daniel Chalk (Research Fellow in Applied Healthcare Modelling and Analysis) at d.chalk@exeter.ac.uk or visit our project page: http://clahrc-peninsula.nihr.ac.uk/research/penchord-optimising-polypharmacy-using-agent-based-simulation.