Mini-colloquium: Network models in the health sciences

Room L532, James Joyce Library, School of Mathematical Sciences

Friday, April 24th.

11am – 11:30am

Speaker: Jim McCann, Queens University Belfast

Title: Stochastic models of MRSA infection

Abstract: The mode of MRSA transmission is similar to many communicable diseases. The interventions such as improved hygiene, isolation and decolonisation of the patients, reflect this. Mathematical models of the spread of infection are well-established, including the venerable SIR model in its stochastic form. In this short talk, I will discuss models for the spread and control of antibiotic-resistant strains of infection within the framework of two models: the modified stochastic epidemic (SIR) model and the agent-based Monte Carlo model.

11:30am – 12pm

Speaker: Adrian Barnett, Queensland University of Technology

Title: Estimating the effect of MRSA infection on length of stay using a longitudinal model

Abstract: Healthcare-associated methicillin-resistant Staphylococcus aureus (MRSA) infection may cause increased hospital stay or, sometimes, death. Quantifying this effect is complicated because it is a time-dependent exposure: infection may both prolong hospital stay, and longer stays increase risk of infection. We show how use of a multinomial longitudinal model for estimating the daily probability of death and discharge can overcome these problems. We then extend the basic model to estimate how the effect of MRSA infection varies over time, and to quantify the number of excess ICU days due to infection. We find that infection decreases the relative risk of discharge (relative risk ratio $= 0.68, 95\%$ credible interval: $0.54, 0.82$), but is only indirectly associated with increased mortality. An infection on the first day of admission resulted in a mean extra stay of 0.3 days (95% CI: $0.1, 0.5$) for a patient with an APACHE II score of 10, and 1.2 days (95% CI: $0.5, 2.0$) for a patient with an APACHE II score of 30. The decrease in the relative risk of discharge remained fairly constant with day of MRSA infection, but was slightly stronger closer to the start of infection. These results confirm the importance of MRSA infection in increasing ICU stay, but suggest that previous work may have systematically overestimated the effect size.

12pm – 12:30pm

Speaker: Helen McAneney, Queens University of Belfast

Title: The role of Networks within Public Health

Abstract: Social network analysis (SNA), an area of graph theory and complexity science, is a field that has gained significant recent attention in many avenues of research. This talk gives an overview of the role that networks can play within public health, both to the individual through their social interactions, and in terms of knowledge amongst the various agencies. Some aspects of the theory involved in SNA will be illustrated by way of a few examples and demonstrated using the Netdraw software package. Following on from this, recent work that has been carried out to investigate the role and position that the newly formed UKCRC funded Centre of Public Health (NI) plays within the local public health sector is discussed, as well as a few examples of other applications of network analysis to public health related issues.