Sources, Seasonality, Transmission and Control: Campylobacter and human behaviour in a changing environment

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Abstract: Diarrhoeal disease is an important global killer that causes major health and economic problems. Many organisms that cause it are zoonotic. They are widely distributed in the environment and there are several pathways to human disease. Research into diarrhoeal disease to date has been largely biomedical and focussed mainly on transmission through contaminated food or water. Fundamental gaps in our knowledge remain, namely the contributions of human behaviour and human-environment interactions influencing exposure to organisms and risk of disease. We propose a ground-breaking programme, bringing together scientists from a wide variety of disciplines in a "one health" approach to tackle these fundamental knowledge gaps using Campylobacter spp. as an example. Important in its own right, Campylobacter is the most common bacterial cause of diarrhoeal disease in the developed world. It caused an estimated 700,000 cases in the UK in 2010 with ~200 deaths. Extreme outcomes include irritable bowel syndrome, arthritis and paralysis. The current, underestimated, annual UK cost of Campylobacter infection alone is £600m, exceeding that from Salmonella, Listeria and E. coli O157 combined. The transmission pathways for ~50% of human cases are unknown. Seasonal dynamics are central to the disease burden because ~40% of cases occur during the 'spring peak', yet the relative roles of environmental and food pathways, and their interaction, in this seasonal emergence are poorly understood. To make major progress we face two important challenges. The first is to develop new methods that incorporate environmental and social systems to understand how they interact with Campylobacter. Secondly, since the behaviours of both humans and Campylobacter involve processes that play out over different temporal and spatial scales, the new methods we develop need to capture this. The challenge of analysing systems and data at different scales, whilst minimising loss of information in so doing, will be generally applicable to research on the interaction of social and ecological systems and zoonoses.