Project Details	
Project Code	MRCPHS25Br JonesH
Title	Developing and testing novel methods to estimate prevalence of methamphetamine and cocaine dependence
Research Theme	Population Health Sciences
Summary	Drug-related harm from illegal supplies of drugs is changing, including a rise in deaths associated with stimulants in many countries. Estimates of the number of people dependent on methamphetamine or cocaine are fundamental for understanding the risk of drug-related harms and for planning or assessing the likely effectiveness of interventions to reduce harm. You will adapt and apply a statistical approach developed to estimate the extent of opioid dependence to stimulant dependence. You will benefit from training in Bayesian statistical analysis and analysis of large linked datasets. This is a highly interdisciplinary project with potential for national and global impact.
Description	Drug-related harm caused by and associated with stimulant use, including methamphetamine and cocaine, is rising. There is a rise in stimulant-related deaths in North America, and in the UK drug poisonings involving cocaine have continued to rise in the last decade (7-fold in England, 10-fold in Scotland). The largest recent HIV outbreak among people who inject drugs in the UK (Glasgow, 2015) was associated with cocaine and opioid use. People dependent on methamphetamine and/or cocaine are at risk from multiple other causes of morbidity and mortality, including suicide and self-harm, psychosis and cardiovascular disease. The risk profile of people dependent on illicit drugs is changing due to polydrug use and exposure to potent synthetic drugs in combination with opioids and/or stimulants. Policy makers in the UK and many other countries need robust estimates of the size of the population dependent on stimulants and the extent to which it overlaps with people dependent on opioids. These estimates are fundamental to efforts to monitor drug-related harm, estimate coverage of interventions and assess what may be required to reduce drug-related harm. There are few good estimates of prevalence of stimulant dependence in the UK or worldwide. Direct measures through population and household surveys underestimate prevalence for multiple reasons. Stimulant dependence is comparatively rare; it is stigmatized and people are less likely to report its use; and people in marginalized and underserved communities are less likely to be sampled. Instead, researchers are recommended to use "indirect" methods, such as multipliers and capture-recapture (also known as multiple systems estimation). However, methods are under-developed relative to methods to estimate opioid dependence, and there is considerable uncertainty and controversy over estimates of methamphetamine dependence in Australia and the US, for example. For estimating the prevalence of opioid dependence, we showed that both multipliers and capture-recapture can give biased results, and we developed an alternative approach called Multi-Parameter Estimation of Prevalence (MPEP). MPEP is a type of Bayesian statistical model that brings multiple linked data sources together to make inferences about the size of a population,

producing prevalence estimates that are consistent with "all available evidence", critically including measures of drug-related harm. The method's starting point is establishing a cohort of people known to be receiving drug treatment, linked to adverse outcome data such as overdose deaths or emergency and hospital admissions due to specific causes. Routine data records also provide information on numbers of these same outcomes that occurred among people not in this known cohort. Through fitting simultaneous regression models to adverse event rates and latent prevalence, MPEP estimates the number of "unobserved" and hence the total prevalence of drug dependence. There are several assumptions of the model, including: (1) the adverse events modelled are specific to the population; (2) the rates of these events in the "unobserved" part of the population are equal to rates among people in the cohort during periods not receiving treatment; (3) the baseline cohort includes everyone receiving treatment for dependence. These assumptions can be relaxed if there is other evidence that can be incorporated into the model.

This PhD project, which sits at the interface of statistical science and applied health, will adapt and develop MPEP for stimulant use. The student will receive training and develop skills in Bayesian statistical methods and evidence synthesis. We propose the following aims, which can be selected from and/or adapted according to individual interests:

1. Systematically review and critique evidence on prevalence estimation methods applied to stimulant dependence

2. Using cohorts of people dependent on stimulants – with and without opioid dependence – establish estimates of drug-related harms, and identify key adverse events that could be used in MPEP studies.

3. Determine what other evidence is required to test MPEP assumptions for stimulant dependence

4. Develop MPEP model for cocaine dependence in Scotland, to estimate prevalence of dependence on cocaine and the overlap of this population with people dependent on opioids.

5. Develop MPEP model for methamphetamine dependence in Australia

Through our rich network of national and international collaborations, the student will have the opportunity to work with leading research teams engaged with improving evidence on drug-related harms. The student will work closely with researchers in Scotland and have the opportunity to work with researchers in Canada, USA and Australia. This project has national and global implications, with potential to strengthen the public health response to stimulant dependence and drug-related harm. The PhD will result in high impact journal articles, with results being presented at expert meetings in England and Scotland and national/international conferences.

Selected References:
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Supervisory Team	
Lead Supervisor	
Name	Dr Hayley Jones
Affiliation	Bristol
College/Faculty	Faculty of Health Sciences
Department/School	Population Health Sciences, Bristol Medical School
Email Address	hayley.jones@bristol.ac.uk
Co-Supervisor 1	
Name	Dr Tom Freeman
Affiliation	Bath
College/Faculty	Faculty of Humanities & Social Sciences
Department/School	Department of Psychology
Co-Supervisor 2	
Name	Dr Andreas Markoulidakis
Affiliation	Bristol
College/Faculty	
Department/School	
Co-Supervisor 3	
Name	Professor Matt Hickman
Affiliation	Bristol
College/Faculty	
Department/School	