HESG Summer 2018
Abstract booklet

Health Economists' Study Group Summer 2018

Hosted by HEB at the University of Bristol

1. Multivariate linear and generalised linear mixed-effects models for analysis of clinical trials economic data

Authors: Achana, Gallacher, Oppong, Kim, Petrou, Mason, Warwick Evidence, Crowther

Economic evaluations conducted alongside randomised controlled trials are a popular vehicle for generating high quality evidence on the incremental cost-effectiveness of competing healthcare interventions. Typically, in these studies, resource use (and by extension economic costs) and clinical (or preference-based health) outcomes data are collected prospectively for trial participants with the aim of estimating the joint distribution of incremental costs and incremental benefits associated with intervention, whilst accounting for fixed and random sources of variation. In this paper, we extend the generalised linear mixed-model framework to enable simultaneous modelling of multiple outcomes of mixed data types, such as those typically encountered in trial-based economic evaluations, taken into account correlation of outcomes due to repeated measures and other clustering effects. We develop new functions to estimate the models in Stata and R by maximum quasi-likelihood and restricted maximum quasi-likelihood and compare the performance of the new routines with alternative implementations across a range of statistical programming platforms. Empirical applications are illustrated using observed and simulated data from clinical trials. We additionally highlight that, although the paper primarily focusses on applications to trial-based economic evaluations, the new methods presented can be generalised to other health economic investigations characterised by multivariate hierarchical data structures.

2. Measuring, valuing and including forgone childhood education and leisure time in economic evaluation: methods, challenges and the way forward.

Authors: Andronis, Petrou

Economic evaluations carried out to inform the allocation of finite public funds ought to take into account all relevant costs and benefits. When such evaluations adopt a societal perspective, it is important that they include 'time-related' costs arising from productivity and leisure time losses due to ill health or receipt of care. For programmes that relate to children, similar costs arise from forgone leisure time and, importantly, absence from formal education. Despite this, there is a lack of insight into how such costs should be identified, measured and valued. As a result, salient costs are usually excluded from assessments of interventions, programmes or policies related to children.

With this in mind, we set out to explore how forgone time — including absence from formal education and childhood leisure time — can be estimated and incorporated into economic evaluations. To do so, we sought to: (i) identify approaches proposed to value lost childhood leisure and education time in various disciplines (including education, welfare and labour economics); (ii) discuss the theoretical basis and empirical evidence underpinning them; and (iii) construct a conceptual framework for valuing children's time as part of economic evaluations.

We appraise approaches and 'schools of thought' with relation to their key characteristics, theoretical and empirical validity, data requirements and potential for use in economic analyses. We find that much of the identified literature comes from education economics and aims to assess the returns on investment in education. Although the cost of absence from formal education is typically derived through its impact on educational attainment and future earnings, evidence increasingly points to additional 'social' benefits of education, including crime reduction and social participation. We make the case for including foregone childhood education and leisure time-

related costs in economic evaluations and we propose a multidimensional approach to their measurement and valuation.

3. Demand and supply determinants of mental health care utilisation in England: evidence from national linked administrative data

Authors: Anselmi, Everton, Shaw, Suzuki, Weir

Introduction: Increasing the provision of mental health care and ensuring it is distributed equitably are priorities for many countries, including England. However, systematic and comprehensive evidence on the drivers of need and determinants of access is still missing. We build on previous work used to guide the allocation of the mental health budget by exploiting a new dataset comprising person level information from multiple datasets routinely collected in NHS England.

Data: We linked the NHS Master Patient Index with information on mental health care use, diagnoses and person characteristics from the Mental Health Standardised Dataset, the Improving Access to Psychological Therapies dataset, and data from the Secondary Uses Service. Using national unit costs for bed days in non-secure inpatient care and contacts with outpatient, community and IAPT services, we estimate the annual cost of mental health care for each individual. We link in over 30 variables capturing need and supply characteristics at the GP practice and small area level.

Methods: We relate annual costs in 2015/16 to the need and supply variables in 2013/14 and 2014/15, using two-part regression models. We estimate the probability of using services for the whole population using a logit model and the cost of services used, for users only, using a generalised linear model with a log link and Poisson distribution.

Results: Preliminary results suggest that 1,120,606 (2.5%) out of the 45,728,755 adults in England used secondary mental health and learning disabilities services and 2,295,916 (5.0%) individuals used mental health or IAPT services in 2015/16. The average annual cost for those who used services was £8,820.

Discussion: The estimations are ongoing, but will inform the resource allocation formula used to distribute £8bnmental health budget in 2019/20.

4. The Efficiency-Equity Tradeoff for the Selfish and the Selfless

Authors: Arroyos-Calvera, McDonald, Covey, Loomes

Policymakers attempt to respect public preferences when making difficult trade-offs between policy options.Yet most estimates of the monetary value of policy outcomes such as fatalities prevented, or QALYs, reflect only individuals' self-interested preferences. This approach may neglect/misrepresent individuals' preferences over the distribution of societal resources(e.g., see review by Guth and Kocher (2014)). We conduct an experiment in which participants rate and choose between policy options that differ in terms of their efficiency (expected number of lives a policy would save or the cases of ill health it would prevent) and their equity (balance of risk reductions for different parts of the population). Participants considered several interventions to clean up a hypothetical city's water supply. Different options would reduce the risk of death or ill health for people in different areas of the city, and the size of the risk reduction varied across options. In order to see whether personally benefitting from the risk reduction would affect this tradeoff, we told half of our sample to imagine that they lived in a specified area of the city. Our

results suggest that efficiency is the most important factor in determining which policy option is preferred, but participants were almost as influenced by equity as by efficiency. When participants were included in the scenarios, they were significantly less influenced by efficiency and by equity than their impartial counterparts, favouring policies that particularly benefitted them. However, the effect was small so it was not sufficient to overturn the general preference for efficiency and for equity. Our findings suggest that preferences for efficiency and equity are barely affected by self-interest, and contribute to the growing evidence that the number of people helped is not all that matters to decision makers evaluating health interventions.

5. Exploring alternative decision making criteria for the economic evaluation of an obesity prevention intervention in primary schools: the Birmingham Daily Mile trial

Authors: Breheny, Adab, Passmore, Lancashire, Coast, Williams, Frew

Objectives:
Schools provide an ideal setting to deliver public health interventions targeting children. Evaluating their cost-effectiveness and communicating their value to schools are challenging as methods recommended for health and public sector decision makers may not be compatible with schools' priorities. The importance of achieving health compared to academic outcomes, and their opportunity costs remain unexplored.

This study assessed the impact of alternative decision making criteria when considering the cost-effectiveness of a school based public health intervention – the Daily Mile.

Methods:
The Daily Mile is a low-cost intervention that could potentially contribute to childhood obesity prevention and improve wellbeing. This globally adopted initiative aims to increase children's physical activity daily by 15 minutes. The Birmingham Daily Mile cluster randomised controlled trial compares the Daily Mile with usual activities in 40 primary schools. Outcomes include body mass index (BMI), wellbeing, fitness, quality of life and academic attainment.

Alternative decision making criteria for the economic evaluation will be informed by semi-structured interviews conducted with school staff. Themes include the costs of implementing the Daily Mile and the schools' decision-making priorities.

Results:
The trial will be completed in March 2018. The range of outcomes collected and insights obtained from the interviews provide an ideal opportunity to assess the Daily Mile's cost-effectiveness from three perspectives: the school, the local government, and health care. Preliminary interview findings suggest schools do not value changes in BMI, but value other outcomes such as academic attainment and wellbeing.

Discussion:
This trial is designed to evaluate an intervention that is currently being implemented globally, with little evidence for its cost-effectiveness or consideration of its opportunity cost. The study results will identify the evidence requirements for school decision makers, thus highlighting their different priorities compared to more traditional 'public health' settings. Implications for economic evaluation methods will be discussed.

6. Up in a puff of smoke: Understanding the social and economic determinants which makes a successful quitter

Authors: Brown, Robinson

Background: There are socioeconomic differences in smoking, with those in lower socioeconomic groups more likely to smoke. Those from higher socioeconomic groups that do quit smoking are more likely to be successful. In order to create successful smoking cessation programmes and reduce health inequalities it is important to understand the social and economic factors which can be targeted by interventions.

Aim: We utilise 11 years of data from the Household Income and Labour Dynamics of Australia Survey (HILDA) to determine what social and economic factors increase the likelihood of being a successful quitter, defined as not relapsing back into smoking for the remainder of the observed study period. Analysis will also be undertaken with those that lapse back into smoking, in order to investigate what social and economic factors relate to being an unsuccessful quitter and how this compares with successful quitters.

Methods: Survival analysis employing panel data techniques will be utilised that take account of sample attrition biasing the results. Robustness checks will be employed using linear and nonlinear regression techniques.

Results: Preliminary analysis suggests that life changing events such as formation of partnerships, children, dissolution of partnerships, and milestone birthdays (40, 50) are all indicators for successful quit attempts. Younger individuals are more likely to have unsuccessful quit attempts.

Conclusion: We highlight key economic and social factors that can be used by smoking cessation interventions to improve successful quit rates.

7. Does providing free universal access to the public leisure centre reduce health inequalities: a case study to inform a distributional costs-effectiveness model

Authors: Candio, Meads, Hill, Bojke, Bloor, Bojke, West

Background: Evidence on the effectiveness of population-level strategies to promote physical activity (PA) and reduce health inequalities in the general population is limited. Few evaluations have focussed on assessing the distributional effects of these initiatives.

Objectives: To estimate the differential impact of a universal strategy to promote PA in adults to inform a distributional economic evaluation.

Methods: Leeds Let's Get Active (LLGA) is a City Council-led programme that offered universal free off-peak access to 17 public leisure centres located in the most deprived areas of the city. Probit and Poisson models were specified to identify characteristics associated with service use (LLGA session attendance). A generalised ordered response model was applied to quantify the differential impact on self-reported PA category across IMD and baseline PA groups. Longitudinal selection effects were explored. From the ordered regression model, PA state transition probabilities were estimated for subsequent use in a decision analytic model that was developed to assess the distributional cost-effectiveness of LLGA strategy.

Results: 79,115 adults signed up to LLGA. Adjusted models indicated that living in highly deprived areas and being unemployed led to around a two times higher probability of higher access to the service. Unemployment status was comparably associated with higher frequency of service use.

Of the group of baseline inactive, 47% from non-deprived areas moved upwards by one, while 50% from deprived areas by two PA categories, after registration. Sensitivity and scenario analysis confirmed effectiveness results to be fairly robust to assumptions.

Conclusions: Evidence suggests that LLGA strategy can achieve intended distributional effects on PA outcomes. The impact on cost-effectiveness for different groups will be presented and discussed.

8. Socioeconomic Inequality in Community Based Health Insurance Premium Contribution in Rwanda

Authors: Chirwa, Suhrcke

Community based health insurance (CBHI) appears to have mushroomed in many low and middle income countries (LMICs), as the pro-poor health financing method. This is perhaps in response to policymakers calling for low-cost pro-poor health financing, to achieve universal health coverage (UHC), and sustainable development goals (SDGs). Existing CBHI evaluations have, tended to ignore the distributional aspects of the household contributions made to CBHI. In Africa, Rwanda, is the only country that has experimented with two types of CBHI within a decade. In this paper, the objective is to investigate the pattern of socioeconomic inequality in CBHI premium contributions (payments) in Rwanda. In addition to this we also assess gender difference in CBHI contribution (payments). The analysis methods uses three econometric approaches; decomposition of the concentration index of inequality, Blinder-Oaxaca mean-based decomposition, and unconditional quantile regression decomposition. The study uses two sets of cross-sectional data for the periods 2010/11 and 2013/14. The key takeaway message from the results is that the categorisation of CBHI premiums into different payment groups, may have led to the CBHI being financed by the richer individuals and reduces regressivity. In both the flat rate system, and the wealth based categorised system, inequality exists but it's much more pronounced in the flat rate system. By designing a new system based on wealth categorisation, inequality in CBHI payments improved to the advantage of the poor. In terms of gender differences in CBHI payments, female headed households are likely to spend less on CBHI than male headed households. The Blinder-Oaxaca decomposition analysis shows that the difference in CBHI payments is due to group differences in the distribution of individual characteristics between the female-headed households and the male headed households.

9. How to cost the implementation of major system change: case study using reconfigurations of specialist cancer surgery in the London Cancer area

Authors: Clarke, Vindrola-Padros, Ramsey, Wood, Perry, Darley, Melnychuk, Vallejo Torres, Boaden, Morris, Fulop, Hunter

Studies have been published on impact of major system change (MSC) on care quality and outcomes, but few evaluate implementation cost, or include it in cost-effectiveness analyses. This is despite large potential costs, e.g. planning changes, purchasing equipment, and staffing changes. Implementation cost can influence local stakeholders' decisions to implement change. Our aim is to provide principles for costing MSC implementation.

We outlined implementation stages, suggesting how to identify cost components and data sources, using a conceptual framework developed during previous work on stroke. Guidelines are

illustrated by and drew on RESPECT-21 mixed-methods evaluation of reconfiguring specialist cancer surgery services in London/Greater Manchester.

The analysis was led by a health economist in collaboration with qualitative researchers to identify key reconfiguration stages and specific expenditure points. Data sources included meeting minutes, qualitative interviews, and budget/financial documents. Clinicians were consulted regarding spending (e.g. equipment purchases, staffing costs), and conversations with NHS Trust staff furnished further details.

Principles and cost components relating to designing, planning and implementing MSC include:

- options appraisal, bidding process, external review
- engagement events
- planning/monitoring boards/meetings
- making the change: assets, new staff
- changes in payments to hospitals
- financial cost to patients
- patient population
- lifetime of changes.

In our case study, the majority of costs are likely to come from purchasing equipment, with some arising from staff opportunity costs, e.g. attending meetings. New-hire staff costs are likely to be relatively low here.

These principles can be used by funders/service providers/commissioners when planning MSC, and by researchers evaluating MSC. Health economists must be involved early in MSC planning, as retrospective capture risks loss of important information. These analyses are challenging, as many cost factors are difficult to identify, access, and measure. Inclusion of implementation costs in cost-effectiveness analysis is likely to make MSC appear less cost-effective, potentially influencing future decisions regarding MSC.

10. The importance of the choice of mathematical aggregation methods for estimating different model parameters generated through expert opinion

Authors: Diernberger, Gray, Hall

Absence of data is a common problem in economic modelling, therefore model parameters are frequently informed either by parameters from the literature or expert opinion. In a recent economic evaluation of a diagnostic test for delirium, scarce data necessitated extensive use of expert elicitation.

Objective: Elicit parameter estimates from clinical experts and subsequently test the sensitivity of a cost effectiveness analysis to the assumptions made in the expert elicitation study.

Methods: Based on expert interviews with the CI a questionnaire was constructed and distributed via a network of clinical experts in the relevant area. The questionnaire was fielded online using the Bristol Online Survey tool (BOS). Responses were pooled by mathematical aggregation. Several alternative pooling methods were investigated. Parameter point estimates were defined by either mean or median, with or without calibration, and uncertainty distributions by either between expert variance or individual's lowest and highest plausible estimates. CEA results were calculated with each set of parameter inputs from alternative mathematical aggregation methods.

Results: 47 clinical experts responded to the survey. Mean parameter estimates differed substantially from median estimates, range -10% to +100%, mean difference +20.3% (as a proportion of the mean). Mean/median differences substantially influenced the incremental cost-effectiveness ratio (ICER) in the CEA for QALY weights and some cost weights. Results, for all alternative aggregation methods, will be presented in tornado plots and in cost-effectiveness planes.

Conclusion: The results will allow us to understand the importance of the choice of mathematical aggregation method for estimating different model parameters in this setting. This may be an underappreciated source of uncertainty in economic evaluations when data availability is limited.

11. The Impact of an Adaptive Design on a Health Economic Analysis - A Simulation Study

Authors: Flight, Julious, Brennan, Todd

Introduction
A group sequential design (GSD) is a common adaptive study design. Interim analyses are performed after groups of patients have reached the primary outcome. The interim data are analysed and compared to pre-specified stopping rules to determine whether the trial can stop early. This can potentially save time and resources and prevent patients from being needlessly randomised.

The analysis following a GSD requires careful consideration and it is important to account for its adaptive nature. When a GSD stops early the analysis may be biased. This bias can extend to secondary outcomes, such as costs and health related quality of life, when they are correlated with the primary outcome. Methods to adjust for this bias are available in the literature, but are not commonly used in practice. Failing to consider appropriate adjustments could lead to incorrect decisions about an intervention's cost-effectiveness and the need for further research.

Methods
A simulation study is used to explore how a GSD impacts a health economic analysis. Within trial and model based analyses are conducted at the end of each simulated trial. We explore scenarios using different stopping rules, primary outcome effect sizes and correlations between the primary and health economic outcomes to assess their impact on the bias.

Results
The analysis for this work is ongoing. We will present the difference between adjusted and unadjusted estimates of the primary endpoint, mean estimate of the incremental net benefit, probability of cost-effectiveness and expected value of perfect information for each scenario. The results will be compared to a non-adaptive trial with the same characteristics.

Conclusions
We describe the circumstances where it is important to adjust the health economic analysis following a GSD. This will ensure that patients and the NHS benefit from the advantages of adaptive designs without compromising the accuracy of health economic analyses and decision making.

12. A review of methods used in the development of resource-use questionnaires.

Authors: Garfield, Thorn, Noble, Husbands, Hollingworth

Within randomised controlled trials (RCTs), self-complete resource-use questionnaires (RUQs) are often given to participants to collect information on the resources they use. Despite significant overlap in the resource-use data collected within RUQs, it is common that within each RCT a new RUQ is developed or an existing RUQ revised. Consequently, research efforts in the development of RUQs are often repeated, standardisation between RUQs is lacking and the validity of RUQs is rarely tested. While considerable research has been focused on outcome measurement, research on resource-use measurement has been relatively limited.

A recent Delphi study among 45 health economists identified 10 core items for a new generic modular RUQ. As part of a PhD project to develop these items into a RUQ our first objective is to establish what methods have been employed in the development of existing commonly used RUQs. The aim of this review is to identify whether authors describe the development of RUQs and if they do, to report on the methods which have been used.

To identify RUQs, the primary references of all RUQs stored within the Database of Instruments for Resource Use Measurement (DIRUM) will be reviewed for details on RUQ development. In addition, searches will be conducted in databases and grey literature to identify additional RUQs. Forward and backward reference searches of RUQs with details on development will be performed to identify further RUQs.

So far, references of RUQs stored in DIRUM have been screened for development details. Prior to the meeting, the proportion of RUQs with details on development will be estimated. From RUQs where development details are available, information on RUQ characteristics, development and testing will be extracted. This information will be used to identify development and testing methods that could be employed in the development of a new generic modular RUQ.

13. The effects of integrated care on health and care provision: evidence from a local experiment

Authors: Goldzahl, Sutton

The burden of disease worldwide is shifting to long-term conditions. Projected increases in populations aged 65 or older with multiple long-term conditions and the related increase in demand for healthcare are major challenges for health care systems. There is concern that current care provision is fragmented and unresponsive to the needs of people with multiple conditions. Integrating care through organisational changes aims at improving services in relation to quality, user satisfaction and efficiency, but there is little evidence that these aims are achieved in practice.

We evaluate the Salford Integrated Care Programme (SICP), which was introduced in 2014. This changed care organisation by introducing multidisciplinary (GPs, mental health professional, social workers, geriatrists, nurses) meetings every month to discuss individual patient cases. Using individual data from multiple waves of the national GP Patient Survey and Hospital Episode Statistics, we estimate the effect of the programme on health status (physical functioning and psychological well-being), experience of care, ambulatory case-sensitive admissions, emergency admissions and re-admissions within 90 days. We use triple differences, exploiting the targeting of the programme at people aged 65 years and over, in the Salford area, from 2015 onwards.

Preliminary results show the multidisciplinary meetings significantly increased the number of attendances and emergency admissions, particularly those referred from health and social care providers. We also find that fewer patients were discharged to their usual place of residence, suggesting that integration of health and social care resulted in more patients being discharged into care.

Future work will examine heterogeneity in the effects of the programme and will use a linked panel dataset for 4,500 persons within Salford, combining postal survey responses on health-related quality of life and behaviours with administrative data on patterns of care utilisation in primary, secondary and social care.

14. Exploring the factors that influence workforce participation of people with multiple sclerosis: a discrete choice experiment

Authors: Goodwin, Hawton, Green

Objectives
Evidence indicates that employment is beneficial for many people with multiple sclerosis (MS). However, the proportion of people with MS in employment decreases over time following diagnosis. Estimates suggest that as few as 35% of people with MS may be in full or part-time work. Here we explore which factors are most important in influencing employment choices of people with MS, using a discrete choice experiment (DCE).

Methods
Attributes and levels for the DCE were informed by a review of the literature describing relevant qualitative research and were developed using public involvement techniques with people with MS. In an online survey, respondents were asked to choose between two hypothetical job scenarios described using six attributes. We used a large, high quality, national register of people with MS (the UK MS Register), to recruit participants aged 18-64 years with a diagnosis of MS. A conditional logit model was used to assess the relative importance of attributes.

Results
Analyses were based on responses from 2410 people with MS. Overall, respondents gave greatest weight to the impact of employment on other aspects of life, with a coefficient size of 1.75. Relative to this, the next most valued attributes were the attitudes of employers and colleagues (1.39), job flexibility (1.05), ease of travel to the workplace (0.90) and adaptations in the workplace (0.49, 0.84).

Conclusions
Initial analysis points to the importance of the impact of work on other aspects of life and of attitudes in the workplace, relative to job flexibility, ease of travel and workplace adaptations, to people with MS when making employment decisions. Further analysis will calculate a willingness to pay (in terms of salary foregone) for each attribute, investigate alternative model specifications and explore whether the relative importance of attributes differed between subgroups, using latent class conditional logit models.

15. The impact of structural assumptions on decision uncertainty: a case study on the prevention of neonatal infections in preterm babies

Authors: Grosso, Faria, Bojke

Objective: Early modelling coupled with value of information (VOI) typically incorporates parameter uncertainty but there is little guidance on how to include the uncertainty from structural assumptions. This study shows the impact of failure to consider structural uncertainty in the VOI results.

Methods: This study was conducted as part of the PREVAIL project, which evaluates the effectiveness and cost-effectiveness of Anti-Microbial Impregnated Peripherally Inserted Central Catheters (AM-PICCs) to prevent neonatal infections in preterm babies. In the model, the two key structural assumptions are: (i) infection increases the risk of disability and death later in life, based on observational studies; (ii) AM-PICCs reduce infection risk, based on a trial in older children. Sensitivity and VOI analyses with bias adjustment explore the impact of uncertainty and the value of future research.

Results: Avoiding disability in babies is associated with a lifetime gain of up to 10 QALYs and £19,009 in savings per infant for the NHS. If neonatal infections cause disability and death as suggested by the observational evidence, AM-PICCs have a probability of being cost-effective of over 90% at all thresholds above £2000/QALY even for small reductions in the risk of infection. The value of additional research is £235,000 per year and it is mostly related to the uncertainty around the effectiveness of AM-PICC. If the uncertainty on the effect of infection on disability and death is increased to reflect the structural uncertainty, AM-PICCs are still cost-effective but the value of additional research increases to £560,795.

Conclusion: The cost-effectiveness of AM-PICCs depends not only on its effectiveness but also on the link between infection and disability. Failure to consider structural uncertainty in the VOI analysis risks underestimating decision uncertainty and the value of future research. More research is needed on methods to include structural uncertainty in VOI analysis.

16. What were they thinking? A qualitative investigation of what influences respondents' preferences when answering time trade-off questions.

Authors: Hawton, Goodwin, Davey, Green

Objectives
Cost-effectiveness analysis relies heavily on the preference elicitation techniques that provide the basis for estimating health state values. However, as recent experiences with the EQ-5D-5L have shown, the valuation of health states is not straightforward and can produce contentious results. This could be rooted in the ways that respondents interpret and respond to preference elicitation tasks, however little is known about this.

This study aims to investigate the mental processes employed by respondents as they answer time trade-off (TTO) questions, and to compare these between patients and members of the general population.

Methods
We undertook cognitive interviews with 14 members of the general population and 12 people with multiple sclerosis, asking them to think aloud while completing TTO questions. Health states

were described using the Multiple Sclerosis Impact Scale-8D (MSIS-8D) classification system. The interviews were recorded and transcribed, and were analysed in NVivo using a thematic approach.

Results
Participants showed a good understanding of the TTO questions. Both groups drew on their own experiences of suboptimal health when appraising health states, and most placed higher weights on those dimensions of health that affected their participation in valued activities. Three strategies were evident when making TTO choices: prioritising length of life, prioritising quality of life, and explicitly trading-off between the two. Some participants consistently used the same strategy, while others switched strategies depending on the severity of the health state. Age and family composition were key factors in decision-making. Analysis is continuing; further results will be reported in the paper.

Conclusions
This study provides important insights into what influences people's responses to TTO questions and how this may differ between patients and the general public. These findings will contribute to understanding how respondents construct their preferences, which are central to cost-effectiveness analysis and hence to healthcare decision-making.

17. Home is where your health is: the impact of internal migration on health and wellbeing.

Authors: Higgins, Walker, Hollingsworth

OBJECTIVES
There exists a large body of evidence around the issue of internal migration, with most considering the labour market implications of relocation. Less attention has been paid, however, to the health implications of migration. This paper contributes to that literature by considering the causal effect of internal migration on health and wellbeing, using rich data from the UK.

METHODS
We use data from all waves of the British Household Panel Survey (BHPS), from 1991-2008, and five waves of Understanding Society (USoc), from 2010-2015, with access to local area-level data in each. We follow individuals over this period, including if, when and where households move. There are around 6,700 individuals who are in both data, and our full sample size (N*T, for those in BHPS, USoc, or both) is 342,488.

We model the decision to migrate and the health production function jointly, using a recursive bivariate probit model. For identification, we use the age of the youngest child in the household as an instrumental variable for internal migration. The General Health Questionnaire score (GHQ), self-assessed health, and whether or not the individual has a heart problem, are used as dependant variables.

RESULTS
Once we account for the endogeneity of migration, we find there are negative health consequences of moving. In particular, we find that individuals who move are around 5.9 percentage points less likely to report good health ($p<0.01$); with respect to having a heart problem, we estimate the average treatment effect of moving to be 4.3 percentage points ($p<0.05$).

DISCUSSION
Preliminary results show that internal migration has a negative effect on health. These findings suggest that there may be unintended negative consequences of policies that, for example,

remove barriers to internal migration. Further work will consider differential effects by housing tenure, and between tied and non-tied movers.

18. Exploring the determinants of cancer waiting times in England: A patient-level study using Hospital Episode Statistics

Authors: Karlsberg, Paling, Gonzalez-Esquerre, Kendell

Background
Rapid diagnosis and access to cancer treatment are vital for both clinical outcomes and patient experience. However, waiting times in England are increasing and the NHS is now consistently breaching the target for cancer treatment to be provided within 62 days of referral. This research explores the determinants of cancer waiting times, with particular focus on the operational aspects of the patient pathway.

Method
We use 2016/17 Hospital Episode Statistics to construct pathways for individual cancer patients across outpatient and admitted care, from referral on a two-week wait (2WW) pathway to possible treatment. We use negative binomial and logistic models to analyse the relationship between waiting times and factors including time to first appointment, being referred straight-to-test and attending a one-stop diagnostic clinic. We include several patient and trust-level characteristics, and robustness checks for endogeneity.

Results
We find that time to first appointment has a disproportionate effect on the pathway length/probability of breaching. For example, if instead of being seen in six days, a patient waits 7-9 days for their first appointment, they are 27% more likely to breach the 62-day treatment target, all else equal. Attending a one-stop clinic and/or going straight-to-test lower the probability of breaching. Pathways that contain patient and/or hospital cancellations, and those that are shared by multiple providers, are more likely to breach.

Conclusion
To our knowledge, this is the first study using national data to identify pathway characteristics that should help meet operational standards in cancer. Our results support a focus on streamlining pathways (where clinically appropriate), and show that the benefits of reducing time to first appointment go beyond meeting the 2WW target. Finally, for certain tumour sites the results support increased rollout of one-stop clinics and straight-to-test pathways, as well as initiatives to reduce cancellations by both patients and trusts.

19. The impact of body weight on employment-related outcomes: systematic review of causal observational studies

Authors: Kesaite, Mujica-Mota, Ukoumunne

Objectives: To systematically review the literature on how obesity or overweight impacts employment-related outcomes.

Methods. Three electronic bibliographic databases were searched from 01/01/2000 to 21/10/2017 for quantitative empirical studies written in English that measured the impact of

weight status on employment-related variables (i.e. absenteeism, presenteeism, wages and employment status). Only studies that took steps to correct for endogeneity using econometric techniques such as instrumental variables (IV), lagged explanatory variables, propensity score matching (PSM) or fixed-effects twin studies were included. Study quality was evaluated using published checklists for observational studies.

Results: A total of 39 causal studies were identified, of which 23 reported the effect on wages, 12 on employment and 13 on other outcomes. Twenty-two studies reported IV-estimated effects of Body Mass Index (BMI), one study reported IV estimates for BMI categories of underweight, overweight and obese vs. healthy-weight and 9 studies reported estimates for obese vs. non-obese. Twelve studies used a lagged weight exposure variable; 2 were fixed-effects twin studies; and 2 used PSM estimators. Meta-analysis pooled estimates across ten studies reporting IV estimates of the effect of continuous BMI and four studies of the IV-estimated effect of categorical BMI on log wages. The pooled estimate effect size for a one unit increase of BMI was -0.012 (95% CI: -0.017 to -0.008) in women and -0.003 (95% CI: -0.008 to 0.001) in men. The pooled estimate effect size for obese relative to non-obese individuals was -0.104 (95% CI: -0.170 to -0.038) in women and -0.045 (95% CI: -0.087 to -0.002) in men.

Conclusions:
There is substantial heterogeneity in covariates and methodology used across published studies to estimate causal effects of obesity. Overweight/obese women and men receive lower wages than normal weight individuals, but the wage penalty for men is lower, and possibly negligible, than that for women.

20. The impact of capital investment on hospital productivity in the NHS

Authors: Kraindler, Roberts, Gershlick

The hospital sector in England has faced severe funding challenges in recent years. While many hospitals have made significant efficiency improvements during this period, it has occurred as government policy transferred funding from capital to revenue budgets to fund day-to-day activities.

As hospitals look for ways to find in year savings, this may be at the expense of long term productivity improvements through capital investment.

In real terms, capital funding in the NHS has seen a mostly downward trend since 2011. Capital spending by the Department of Health is currently 22% below plan and £1billion below 2011/12 levels in real terms. This has meant gross fixed capital formation in the healthcare system is approximately 0.3% of GDP, well below most European countries. These low levels of investment have led to a significant maintenance backlog, which has increased in recent years.

There is limited empirical evidence on the impact of capital investment of productivity in hospitals. Extensive research on productivity in hospitals has focussed on labour productivity. A decline in capital expenditure is associated not only with opportunity costs of investments in new technology, but also extending the life of ageing capital. Recent studies, mainly in the United States have found positive effects of capital investment, and particularly information technology, on the performance and productivity of hospitals.

Using annual data from hospital financial statements in England, along with hospital estates data, we estimate the productivity changes from capital investment in hospitals. Multiple models of capital investment are estimated to identify where the productivity effects occur.

We use the results from the models to show the differences between hospitals with relatively high levels of investment compared to low levels of investment. The results highlight the lost productivity opportunities from reductions in real capital investment in NHS hospitals in England.

21. Do EQ-5D-3L and EQ-5D-5L capture the same changes in quality of life over time? A longitudinal study of cancer patients

Authors: Lorgelly, Cubi-Molla, Pennington, Norman

How the EQ-5D-3L and EQ-5D-5L capture changes in quality of life is a key issue for health technology assessment. This paper compares the performance of the 3L and 5L versions of the EQ-5D in capturing changes in quality of life of cancer patients over time.

Data were obtained from Cancer 2015, a large-scale longitudinal cancer cohort study in Australia. Between 2012 and 2015 EQ-5D-3L was used. From October 2015, the questionnaire switched to the EQ-5D-5L version. For every respondent, we created pairs of observations by pairing two time points where the patient reported their 3L profile ("3L pair") or 5L profile ("5L pair"). We computed the changes in utility in terms of the UK 3L or English 5L tariffs (for every 3L or 5L pairs, respectively). 5L pairs were matched with the 3L pairs using genetic matching, conditional on changes in the dimensions of the QLU-C10D, as well as age, sex and change in EQ-VAS. Matching was undertaken on the whole sample and on approximate quintiles based on the change in C10D score.

2,979 pairs were created from 2,286 patients. Changes in health (as measured by the C10D) appear to be associated with smaller changes in utility quantified by the EQ-5D-5L compared to the 3L. This is consistent with previous literature. The difference in the size of the utility change was more modest across each of the quintiles of change, and only significant for large health gains (C10D>0.1) and small health losses (-0.1<C10D<-0.02).

This paper contributes to the growing body of literature comparing the 3L and 5L, but specifically considers changes in utility. Thus it will provide much needed QALY relevant evidence to support (or not) the wider promotion of the EQ-5D-5L to researchers, industry and HTA agencies.

22. Decomposing the composite attributes of the EQ-5D reveals unstable attribute weightings

Authors: McDonald, Tsuchiya, Mullett

Policymakers attempt to respect public preferences when making difficult trade-offs between policy options.Yet most estimates of the monetary value of policy outcomes such as fatalities prevented, or QALYs, reflect only individuals' self-interested preferences. This approach may neglect/misrepresent individuals' preferences over the distribution of societal resources(e.g., see review by Guth and Kocher (2014)). We conduct an experiment in which participants rate and choose between policy options that differ in terms of their efficiency (expected number of lives a policy would save or the cases of ill health it would prevent) and their equity (balance of risk reductions for different parts of the population). Participants considered several interventions to clean up a hypothetical city's water supply. Different options would reduce the risk of death or ill health for people in different areas of the city, and the size of the risk reduction varied across options. In order to see whether personally benefitting from the risk reduction would affect this

tradeoff, we told half of our sample to imagine that they lived in a specified area of the city. Our results suggest that efficiency is the most important factor in determining which policy option is preferred, but participants were almost as influenced by equity as by efficiency. When participants were included in the scenarios, they were significantly less influenced by efficiency and by equity than their impartial counterparts, favouring policies that particularly benefitted them. However, the effect was small so it was not sufficient to overturn the general preference for efficiency and for equity. Our findings suggest that preferences for efficiency and equity are barely affected by self-interest, and contribute to the growing evidence that the number of people helped is not all that matters to decision makers evaluating health interventions.

23. Parents' reporting of their children's quality of life in a hospital paediatric cardiac ward setting: a think-aloud study comparing the CHU9D and PedsQL questionnaires

Authors: McLeod, Blake, Spry, Sultan, MacDonald, Duncan

Aims and objectives

This study explored the feasibility of collecting data on children's health-related quality of life in an acute hospital setting, using CHU9D and PedsQL questionnaires, as reported by patients' parents. The study was undertaken in preparation for a future economic evaluation of RAPID, an innovative wireless early-warning system being developed to detect and allow early response to clinical deterioration.

Methods

Twenty-two parents of children aged 3-6 years admitted to the Birmingham Children's Hospital cardiac wards took part in a 'think-aloud' exercise, involving verbalising their thoughts while completing the age-specific CHU9D and PedsQL paediatric quality of life questionnaires, and participating in a semi-structured interview. The think-aloud exercise and interview data were recorded and transcribed verbatim. Three raters identified the frequency of errors in comprehension, retrieval, judgement and response in completing the questionnaires. Qualitative data were analysed using framework methods.

Results

The majority of parents were able to comprehend and respond to most of the questions in line with expectations, but a range of completion errors were identified. Two parents requested that the questionnaires be read to them, and their responses to the think aloud exercise were excluded from the error assessment. The overall error rate for CHU9D was 14% compared to 25% for PedsQL. Challenges included: (1) difficulty responding to the questionnaires' required time periods, (2) perceptions of the relevance of particular questions in the hospital setting, (3) lack of confidence in distinguishing appropriate responses, (4) perceptions of quality of life being relative to life-saving treatment, rather than any peer-group.

Conclusions

The think-aloud approach provides valuable insight into how respondents make choices when completing questionnaires. There are challenges with attempting to use either the CHU9D or PedsQL questionnaires to collect parent-reported quality of life data for young children in an acute cardiac ward setting.

24. When is a model replication successful? Exploring the role of replication within health economic modelling.

Authors: McManus, Sach, Turner, Levell

Background
The ISPOR modelling taskforce suggest decision models should be thoroughly reported and transparent. This can be tested by attempting to replicate the model using only available, published information. By duplicating the original results, it would demonstrate that the model was sufficiently reported and transparent. However, the limited number of replication attempts published suggest that replicated results frequently vary in comparison to the original (with the differences varying from -6.08 to 16.41%p). Whilst some variation may be expected, given that the number of decimal places to which a parameter is reported can easily affect the results produced, there is no formal definition of what constitutes a successful replication and how much variance is permissible before the replication is deemed a failure. With this in mind, a definition must be constructed, given the importance of replicable results and transparent research.

Objective
To explore the definition of replication used in other scientific disciplines and to consider how a successful replication should be defined within health economic modelling.

Methods
A literature review was conducted to identify how other disciplines have defined replication, with particular focus on the idea of a successful replication. The overlap of replication with other concepts more commonly used in modelling, such as validity and transparency was also considered.

Results
A substantial body of literature discussing replicability was found in the wider economic disciplines, to inform the basis of a definition being developed. Whilst these may be useful, it is also important for the definition to be formed in consensus with the wider health economics community.

Conclusion
The replication and recycling of decision models is an emerging topic within health economics. In demonstrating that a replication attempt is successful, it is possible to show that the model is well reported and transparent, only however, if a definition of what it means to be successful is formed.

25. How Averse are the General Public to Inequalities in Lifetime Health? A Systematic Review

Authors: McNamara, Tsuchiya, Holmes

In general, the poor live shorter lives than the rich, they live with lower average health related quality of life, and they can expect to experience disability at a younger age. This socioeconomic "health gap" is substantial – a person living in the poorest quintile in society can expect to experience >10 QALYs less in their lifetime, compared to an individual living in the richest. Evidence suggests that the UK public are averse to such inequality, and would be willing to trade a significant amount of average population health, in order to achieve a more even distribution of that health across socioeconomic groups. This paper details a systematic review to identify estimates of the strength of this inequality aversion. We identify 18 relevant studies. Eleven provide evidence that citizens are inequality averse, albeit with a wide variation in the strength of that preference between studies, one supports the hypothesis that citizens are not inequality

averse, three suggest citizens are averse to inequalities in terms of life expectancy (LE), but not past quality of life (QoL), and two are ambiguous. We find general, although not universal, support for the idea of sacrificing average population health in return for greater equality. The extent of that preference is heterogeneous across studies, and may differ depending upon whether an inequality is a function of LE or QoL. It is critical that health economists achieve a robust measurement of this public preference, because implementation of an erroneous preference toward inequality is associated with human cost. If we overestimate inequality aversion, we risk inflicting too much suffering, or loss of life, on those whose health is traded away in the interest of equality, and if we underestimate it, we risk failing to sufficiently alleviate the suffering, or loss of life, of disadvantaged groups.

26. What quality of life measure to use in an economic evaluation of people with kidney disease? A think-aloud study using the EQ-5D-5L, ICECAP-A and ICECAP-O

Authors: Mitchell, Caskey, Scott, Sanghera, Coast

Objectives:
Demonstrating the validity of measures used in economic evaluation is an important step in ensuring patient benefit is captured appropriately. Choice of measure is also important. When assessing capability in patients spanning typical age ranges of employment and retirement, it is unclear whether the ICECAP-A measure for adults or the ICECAP-O measure for older people is more appropriate; these measures have never been used in the same patient group. The objective of this study was to explore face validity, feasibility of completion and acceptability of the EQ-5D-5L, ICECAP-A and ICECAP-O in renal patients and to determine which ICECAP measure is more appropriate for this patient group.

Methods:
Patients who have either chronic kidney disease, a kidney transplant or have received dialysis treatment were purposively sampled from a secondary care renal unit, for variation in age and type of care received.

Participants took part in think-aloud interviews, where they were asked to verbalise their thoughts while completing the three measures; semi-structured interviews after the think-aloud component were used to probe patients' responses further.

Five raters coded each interview transcript to identify errors of comprehension, recall, judgement and response in measure completion. Thematic analysis of the interview transcripts is in progress and is focusing particularly on comparison of responses to similar attributes across ICECAP measures.

Results:
Thirty individuals interviewed between April-July 2017 were included. More errors/struggles were recorded for EQ-5D-5L (14.5%) than ICECAP-A (4.0%) or ICECAP-O (6.7%). Responses to attachment attributes for both ICECAP measures were similar, but there were more differences for other attributes. The nature of these differences appear to be influenced by age.

Discussion:
We would appreciate comment from HESG participants on the analysis that has been undertaken, the findings obtained, and the implications of those findings for use of measures at different points along the life course.

27. Valuing the EQ-5D-Y Using a Discrete Choice Experiment: Do Adult and Adolescent Preferences Differ?

Authors: Mott, Rivero-Arias, Shah, Ramos-Goñi, Devlin

The EQ-5D-Y is a patient reported outcome measure that is used to capture health states experienced by children and adolescents. Currently, no tariffs exist to assign utilities to EQ-5D-Y health states for economic evaluations. In their absence, tariffs for a different instrument (i.e. EQ-5D-3L) have been applied to generate utilities.

One of the challenges associated with valuing the EQ-5D-Y is that standard valuation methods can be cognitively demanding for adults and may therefore be even more challenging for younger individuals. However, adults may find it difficult to complete a valuation task from the perspective of a child or an adolescent. Therefore it may be desirable to seek the views of adolescents directly, using a methodology that is easier for young people to understand compared with traditional methods.

This paper has two aims. The first is to elicit and analyse latent scale discrete choice experiment (DCE) valuation data that could be used to generate an EQ-5D-Y value set for the UK. The second is to evaluate whether there are systematic differences in the preferences obtained from adolescents and those obtained from adults considering the health of a child.

An online survey was designed containing a DCE as well as additional background and feedback questions. The DCE comprised 15 pairwise choices, where the alternatives were different EQ-5D-Y health states. A representative sample of 1,000 UK adults received a DCE framed such that the respondents should consider the health of a 10-year-old child when completing the tasks. In contrast, a sample of 1,000 UK adolescents (11-to-17 years) received the same survey but was asked to consider their own health.

Data collection has recently been completed and analysis is on-going, utilising a range of flexible choice models. The paper will present the results and consider the implications of the findings for research and policy.

28. Work first, care later: the impact of labour market participation on informal caregiving

Authors: Munford, Round

Background

An increasing proportion of the population is entering older age and informal caregiving is important in meeting the needs for care. Policies aimed at increasing the role of informal care must account for the relationship between informal caregiving and labour market outcomes of caregivers. Previous research has focused on the impact of caregiving on employment, assuming the caregiving decision is primary. We switch focus and ask whether there are causal impacts of labour market outcomes, including employment status and household income, on caregiving decisions. We then extend the analysis by investigating whether the labour market outcomes and caregiving have jointly causal effects on one another.

Methods

First, we apply a longitudinal instrumental variables approach to data from the British Household Panel Survey to explore whether a causal relationship exists between labour market outcomes and caregiving decisions, using caregiver education as an instrument. We then apply a

simultaneous equations model to disaggregate the joint causal effects between labour market outcomes and caregiving.

Results
We find labour market outcomes are causally related to caregiving decisions. Average marginal effects show those in either part-time (-0.012, p<0.001) or full-time (-0.021, p<0.001) employment are less likely to provide any informal caregiving than those not in employment. Part-time employed people spend 5.126 (p<0.001) fewer hours per week caring, while full-time employed people spend 6.471 (p<0.001) fewer hours per week. This contrasts with the existing literature, showing causal effects in the other direction The simultaneous equations model are used to explore this joint causality, and are currently ongoing.

Conclusions
A key opportunity cost for those providing informal caregiving is labour market participation. Where people work fewer hours they provide more care. Policies designed to increase informal caregiving should support individuals to provide care by making it possible for them to reduce their hours of work.

29. A `Borrowing of Strength` framework for Health Technology Assessment

Authors: Nikolaidis, Soares, Woods, Palmer

Objective:
Sparse relative effectiveness evidence is a frequent problem in Health Technology Assessment (HTA). For example, evidence on a particular comparator or randomized evidence in a paediatric population may be limited. Where evidence directly pertaining the decision problem is sparse, one could expand the evidence-base to include studies that relate to the decision problem only indirectly: for instance, when there is no evidence on a comparator evidence on other treatments of the same molecular class could be used; similarly, a decision on children may borrow strength from evidence on adults. Usually, such indirect evidence is either included by ignoring any differences (`lumping`) or is not allowed to influence the decision (`splitting`). However, a range of more sophisticated methods exist in the literature which, rather than lumping or splitting, borrow strength from the indirect evidence while accounting for potential heterogeneity.

Methodology / Framework development:

We systematically searched the literature for models extending traditional network meta-analysis to allow borrowing strength. We identified 70 papers explaining such methods. The methods were categorized according to type of relationship used for borrowing (exchangeability, functional relationships, multivariate methods and prior-based relationships). A `borrowing of strength' framework was then developed by making explicit the assumptions and data requirements underlying each category. The framework was then applied to motivating issues in HTA concerning populations, outcomes, treatments and study designs. The framework was also narratively illustrated using a recent HTA undertaken for NICE.

Conclusions:
There are often several methods that can be applied to 'borrow strength'. These impose different assumptions and varying degrees of strength borrowing. The developed framework uses the type of the available data, the desired degree of strength borrowing and a critical assessment of each

method's assumptions in order to systematize the choice of methods to synthesize direct and indirectly related evidence.

30. The impact of the organ failure trajectory and associated care settings on the opportunity for a good death

Authors: Nwankwo

Research suggests that expenditure at the end of life are disproportionately large and this has led to increased professional and public scrutiny on the cost and quality of providing services. However, little is known about effectiveness of end of life care interventions and current frameworks for evaluating cost-effectiveness are often deemed inadequate or inappropriate in evaluating quality of life in people near the end of life. The ICECAP-SCM is a self-complete tool for evaluating quality of life at the end of life. Previous work has been done in exploring the feasibility of completing the ICECAP-SCM among hospice care patients. This research explores the feasibility of completing the ICECAP-SCM in patients on a different illness trajectory. The research aims to explore difficulties in completing the measure, views of individuals about end of life care and the impact of functional decline and care setting on health and wellbeing.

Think-aloud interviewing techniques were applied to 60 patients with end stage heart failure, end stage renal failure and end stage COPD, recruited from Queen Elizabeth Hospital Birmingham. Generic and specific prognostic criteria were developed with the aid of clinical consultants to ensure individuals recruited were in the end-of-life phase. Patients were asked to complete the ICECAP-SCM, ICECAP-A and the EQ5D while thinking-aloud and their responses transcribed verbatim. Transcripts were examined for errors in completion by five independent raters. Errors were classified into comprehension, recall judgment and response; based on a cognitive psychology model. Constant comparative methods were used to analyse the transcripts. Analysis focused on exploring perceptions of the measures and the impact of functional decline on wellbeing.

This research informs the global debate on the role of economic measures in resource allocation around end of life care. It further highlights the role of qualitative methods in exploring contemporary issues in health economics.

31. Opening the black box of poverty alleviation programme effects on mental health – A case study from South Africa

Authors: Ohrnberger, Fichera, Sutton, Anselmi

Poor mental health is a pressing global health problem and especially dominant among the poor population living in Low-and-Middle-Income-Countries (LMICs). About 85% of the population suffering from depression live in LMICs. Evidence of the strong relationship between poor mental health and poverty makes mental health a global development problem. However, there is a gap in the literature in understanding how poverty alleviation programmes affect mental health.

We aim to fill the gap in the literature by decomposing the treatment effect of the South African Child Support Grant (CSG), a nationwide unconditional cash transfer (UCT) targeted to the poor, on adult mental health. Mental health is measured by the 10-item version of the Centre for

Epidemiological Depression Scale (CES-D). We use a sample of 4,535 individuals living below the South African poverty line in four waves (2008-2014) of the South African National Income Dynamics Study (NIDS).

We construct a mediation framework for the cash transfer mental health relationship, building on empirical findings and health economic models. Exploratory factor analysis is used to derive four factor dimensions, namely lifestyles, socio-economic status, biological factors and living conditions. We compute mediation effects using the product of the coefficient method and decompose the treatment effect in observed and unobserved components. We combine the mediation analysis with instrumental variable estimation to address self-selection into the UCT programme.

Opening the black box of treatment effects, we find that 8% of positive treatment effects in CES-D are attributed to improvements in biological and lifestyle factors, both taking an equal share of 4% in the treatment effect. This evidence shows that in the context of strong treatment gaps (95%) in mental health in LMICs, targeting programmes on improving lifestyle and biological factors can have significant positive effects on mental health outcomes and potentially individual development.

32. The relationship between public funding of social care and healthcare utilisation: an investigation of older people with dementia in England.

Authors: Pace, Liu, Goddard, Jacobs, Mason, Wittenberg

Background: Since 2010, adult social care spending has fallen significantly in real terms whilst demand has risen. Reductions in local authority (LA) budgets are expected to have had spillover effects on the demand for healthcare in the English NHS.

Motivation: If older people, including those with dementia, have unmet needs for social care, emergency hospital admissions and delayed transfers of care out of hospital (DToCs) may rise. If social care staffing levels are inadequate, the use of involuntary restraint in hospitals and care homes may also increase.

Methods: We tested the impact of changes in social care expenditure by LAs on three outcomes for people aged 65+, including those with dementia.

Rates of emergency hospital admissions / readmissions

Rates of delayed transfers of care (LA and NHS)

Rates of deprivation of liberty safeguards (DoLS)

We assembled a panel dataset of 150 LAs covering the years 2010 to 2016. We linked data on adult social care expenditure and activity, and derived relevant measures of spend and activity for older people and their carers that were consistent over time. Measures of outcome were derived from the Hospital Episode Statistics (HES), NHS England's DToCs data, and NHS Digital's data on DoLS. To account for potential endogeneity, we used lagged measures of spend and activity and investigated potential instrumental variables, such as wealth indicators (e.g. house prices). We ran count data models and controlled for a range of confounding factors.

Results: Preliminary findings suggest that reduced adult social care spending has had spillover effects on NHS performance and on the use of deprivation of liberty safeguards. Policy implications of the relationship between social care spending and healthcare utilisation are drawn out, and considered in the light of the forthcoming green paper on care and support for older people.

33. Developing a health, social care and carer-related quality of life instrument to measure QALYs

Authors: Peasgood, Brazier, Mukuria et al.

Common QALY instruments (EQ-5D, SF-6D etc.) measure and value changes in health-related quality of life. As such they have limited ability to capture the impacts on carers' quality of life, or important outcomes in social care. Sector specific QALY instruments (such as ASCOT for social care, and CarerQol for carers) offer one approach to this limitation. However, this is problematic when the impacts of an intervention include sector specific and general health outcomes.

Here we present an alternative approach: developing a generic QALY instrument that is sufficiently broad to capture important outcomes from health and social care interventions. We present a case for deriving the domains for a new instrument from the voice of the patients, carers and social care users. Qualitative research that has explored the impact of health conditions, disability, social care needs and caring on people's lives offers a rich source of data which can be sampled to gain an understanding of frequently occurring and important themes.

The data extraction and the initial selection of domains from a review of the qualitative literature can be aided by a flexible theoretical framework which supports clarity on 1) the breath of domain coverage and 2) whether a domain can reasonably be considered to be valued for its own sake, rather than as instrumental to another valued, and adequately captured outcome. Psychometric analysis, of both existing and bespoke data, along with extensive consultation with stakeholders, experts and the public can used to refine the domain structure and identify high performing items to measure each selected domain.

This paper both sets out the case for this pragmatic approach and describes how the approach has been operationalised through the Extending the QALY project - a collaboration between Universities of Sheffield and Kent, the Office of Health Economics, and NICE.

34. Considerations in conducting economic evaluations in health and social care services in elderly populations: An investigation into the validity of the EQ-5D-5L, SF-12, ASCOT and WEMWBS in older people using item response theory and differential item functioning

Authors: Penton, Young, Dayson, Hulme

Background: Old age is often characterised by declining health and increasing numbers of health conditions that may require a mix of health and social care services. These services often impact areas beyond health. Therefore, in economic evaluation, traditional measures of health related quality of life (QoL) may not appropriately describe the outcomes of interventions for older people.

Objective: This study investigates the measurement performance of the EQ-5D-5L, the SF-12, the Warwick Edinburgh Mental Wellbeing Scale (WEMWBS) and the Adult Social Care Outcomes Toolkit (ASCOT) in older people. These measures were chosen as the EQ-5D is the UK reference case for economic evaluations, while the SF-12, WEMWEBS and ASCOT cover broader aspects beyond health.

Methods: Item response theory (IRT) was used to compare the construct validity, internal consistency reliability and response distributions of these measures in older (65+) versus younger adults. Differential item functioning (DiF) analyses assessed whether older and younger adults with the same underlying QoL or wellbeing had different expected scores, signalling scoring bias due to age.

Results: IRT identified issues for all measures. Ceiling effects limited the ability of the EQ-5D-5L and ASCOT to discriminate the QoL of above average individuals, resulting in diminished internal reliability in these respondents. The WEMWBS and SF-12 showed good internal reliability and response distributions. Item redundancy was suggested in the SF-12 and WEMWBS. DiF was found for some items in all measures. DiF had the largest impact on SF-12 scores and least impact on WEMWBS.

Conclusion: All included measures report some problems. The ASCOT and EQ-5D-5L show ceiling effects for above average respondents. The SF-12 and EQ-5D-5L exhibit substantial DiF. The WEMWBS was internally consistent over the broadest range of underlying trait and exhibited minimal DiF. WEMWBS appears the most appropriate measure in older people in terms of the measurement properties tested.

35. Sex, risk, and changing preferences: Integrating market forces into a dynamic transmission model to predict risk compensation among female sex workers

Authors: Quaife, Terrris-Prestholt, Vickerman

Introduction
In commercial sex work unprotected sex often sells for a higher price than protected sex, but economic factors are not considered by epidemiological models. We hypothesise that new HIV prevention products will shock the market for unprotected sex, leading to risk compensation through provision of more unprotected acts, and a reduction in the price due to risk reduction. This study uses a repeated discrete choice experiment (DCE) to estimate changes in the price of unprotected sex. We then integrate economic theory into a dynamic HIV transmission model to estimate the epidemiological impact of products.

Methods
We collected stated preference data from 122 self-reported HIV negative female sex workers in South Africa. Participants chose between hypothetical sex acts described by act price and condom use, and presented to participants twice: first with no framing, then later asking respondents to answer as if using a fully effective HIV prevention product. Using DCE-estimated changes in price, we simulated changes in quantity using the target income hypothesis; these estimates were used to parameterise a dynamic transmission model simulating changes in product impact resulting from behaviour change. Competition between product users and non-users was also modelled.

Results
DCE data predict that the price premium for condomless sex will decrease by 73% under product use, with the quantity of condomless sex doubling. Without considering economic factors, we

predict an 8.3% reduction in HIV prevalence. Accounting for risk compensation among product users, product impact is reduced by 2 percentage points. When competition is considered between users and non-users, impact is negated.

Conclusions
This study is the first to explicitly incorporate economic factors into a HIV transmission model. Predictions show that the impact of HIV prevention products on the market for commercial sex should be monitored to understand the impact of changing incentives on behaviours.

36. Cross-sectoral economic evaluation of public health interventions: a case study

Authors: Ramponi, Richardson, Kanaan, Walker

Objectives. Focusing the analysis only on health costs and consequences potentially underestimates the full impact of public health interventions. The aim of this manuscript is to illustrate and implement an analysis framework for health programmes with impacts on different sectors. In particular, an intervention to reduce alcohol misuse is used as a case study.

Methods. The Screening and Intervention Programme for Sensible drinking (SIPS) trial was selected as case study. SIPS comprises three intervention arms: Client Information Leaflet (CIL), Brief advice (BA), and Brief Lifestyle Counselling (BLC). Each intervention arm is an intensified version of the previous. Firstly, a cost-effectiveness analysis (CEA) based on health-related costs and outcomes is conducted. Secondly, another CEA from the criminal justice system (CJS) perspective is implemented, using reductions in reconviction frequency as a measure of effectiveness. Afterwards, the CEA from the health care perspective is adjusted, including also the spillover effects on victims' health. Lastly, a compensation scheme across decision makers is proposed in order to address resource allocation problems, generated when costs fall on a sector and benefits on another.

Results. From the health care prospective it is not cost-effective to invest in BA or BLC, when compared to CIL. More intense interventions are instead potentially cost-effective from the CJS perspective, even though decision making criteria are less clearly defined. From an integrated and broader perspective, BLC has a higher probability of providing positive net benefits. Depending on crucial assumptions regarding opportunity costs in CJS, conclusions and recommendations might differ according to the perspective adopted for the evaluation.

Discussion. Illustrated methods enable analysts to assess whether the choice of extending the perspective of the analysis alters the recommended decisions taken from narrower perspectives. These methods can be potentially employed in the evaluation of all public health interventions having also impacts on criminal justice.

37. Measuring and valuing time savings resulting from water and sanitation interventions in developing countries

Authors: Ross

Global cost-benefit analyses for water and sanitation programmes have diverging results. Much of the difference in results between two influential studies is explained by how authors estimated and valued time savings. In two modelled analyses of similar sanitation interventions in South Asian contexts, one analyst estimated time savings to be 68% of benefits and other 17%. These

differences are explained by differing methodologies for: (i) estimation of pre-intervention round-trip time for open defecation and number of trips per day, (ii) valuation of time saved. For the amount of time saved, both studies use assumptions rather than survey data from the region. For valuation, one analyst favours 30% of the market wage, while the other favours 30% of hourly GDP per capita.

This paper uses Monte Carlo modelling to estimate likely time savings in real-world settings in India. This is based on open access data from 'the SQUAT survey', which interviewed 3,235 households across five Indian states. It is the only large-sample dataset globally to contain both trip time and number of trips. Using these data, and different valuation options, this paper estimates distributions of the likely value of time savings from sanitation interventions in India. Some 60% of the world's open defecators live in India, so it represents the context where the majority of time savings can be reaped.

A similar analysis is developed for water supply, based on nationally representative rural household surveys in Ethiopia and Mozambique which included round-trip time to rural water points. This is of relevance as governments increasingly invest in on-plot water supplies, with avoided water collection time advocated as a key economic benefit without robust evidence. Based on the results, the paper proposes best practice options for measurement and valuation of time savings in future economic evaluations of water and sanitation interventions.

38. Measuring QALYs when health states fluctuate

Authors: Sanghera, Coast

Recurrent fluctuations in health states can occur due to long-term conditions with episodic symptoms or through side effects of cycles of treatment. Fluctuations and associated duration of symptoms can be predictable (e.g. side effects of chemotherapy treatment) or unpredictable (e.g. relapse in multiple sclerosis). Such recurrent fluctuations in health states can have an important impact on a person's quality of life. When symptoms vary by time of day, day of the week, or time of the month, it is challenging to obtain meaningful quality of life estimates for use in assessing cost-effectiveness of interventions.

The adequacy of the quality of life estimate will be impacted by: (1) the standard recall period associated with the chosen measure (e.g. 'health today' for EQ-5D, 'past month' for SF-6D) and the way that respondents understand and make judgements about these recall periods, (2) the chosen timepoints for assessing quality of life in relation to the fluctuations in health, and (3) the assumptions used to interpolate between measurement time points and thus calculate the QALYs.

These issues have not received sufficient sustained methodological attention and instead remain poorly accounted for in economic analyses. There is potential for these issues to considerably distort treatment decisions away from the optimal allocation. This paper brings together evidence from health economics, psychology and behavioural economics to explore these challenges in depth; presents the solutions that have been applied to date; and generates a methodological research agenda for measuring QALYs in recurrent fluctuating health states.

39. They Mess You Up Your Mum and Dad: Modelling the Lifecourse Consequences of Parent Training

Authors: Skarda, Asaria, Cookson

Public investments often have potentially important but unquantified long-run consequences for health, income, public cost and inequality over the lifecourse. We aim to develop distributional economic evaluation methods for quantifying these consequences by (i) building a novel lifecourse microsimulation model of an English birth cohort, and (ii) using this model to quantify the lifecourse consequences of a training programme ("Incredible Years") for parents of children aged 5-6 exhibiting antisocial behaviour.

Family circumstances at birth are based on data from the Millennium Cohort Study (MCS) in 2000-1. We then simulate how outcomes evolve year-by-year over the lifecourse using difference equations to represent life-stage specific causal pathways. The equations are parameterised using quasi-experimental evidence and then calibrated to MCS and other longitudinal survey data. Family circumstances influence the development of cognitive and socio-behavioural skills and health behaviour, which then influence future educational attainment, income, health behaviour, mental and physical illness and mortality. We also account for public cost savings in benefit payments, health and community care costs of illness, and public costs of conduct disorder in childhood, imprisonment in adulthood, and residential care in retirement.

We assume training is delivered to parents of all children age 5-6 at high risk of conduct disorder. Using a recent participant-level meta-analysis, we allow for differential effects on conduct disorder by gender, baseline behaviour problems and parental mental health. As well as quantifying impacts on specific outcomes, we use a general summary measure of individual benefit – the "good life-year" – which extends the conventional quality-adjusted life year by adjusting for income as well as illness. We estimate cost per good life-year, break-even period to recoup up-front investment costs, and lifetime public cost savings. We also investigate how benefits are distributed within the general population between children with different levels of parental income, education and mental health.

40. Does Choice and Competition in Public Services Improve the Performance of Non-Altruistic Providers, but Worsen the Performance of Altruistic Providers?

Authors: Skellern, O'Keeffe

In an influential application of David Hume's famous proposition that "in contriving any system of government, every man ought to be supposed a knave", Julian Le Grand argues that providing public services using markets, choice and competition can help to align the behaviour of 'knavish' (e.g. self-interested, lazy, avaricious, time-serving) providers with that of 'knightly' (e.g. altruistic, public-service-motivated) ones. Studying the English National Health Service (NHS) during the 2000s, we provide evidence that, while competition in public services can indeed improve the behaviour of 'knaves', it may worsen the behaviour of 'knights'. We obtain this evidence by estimating the effect of a major competition-promoting reform in which patients were allowed to choose which hospital they attended for elective surgery, on clinical quality as captured by mortality from acute myocardial infarction, using measures of hospital-level altruism drawn from the NHS Staff Survey. Our estimates indicate that non-altruistic hospitals responded to competition by improving care quality, but that the response of altruistic hospitals was attenuated and - more tentatively - perhaps even negative. These findings are consistent with predictions from economic theory that, when prices are fixed, hospital competition will lead to

care quality improvements when hospitals are not altruistic, but will have more ambiguous effects - including possibly negative effects - on altruistic hospitals. We conclude by discussing implications for future public service reform efforts.

41. A new framework for model-based economic evaluation using moment-generating functions for random variables

Authors: Snowshill

Background: Health economic evaluations frequently include projections for lifetime costs and health effects using modelling frameworks such as Markov modelling or Discrete Event Simulation. Markov models typically cannot represent events whose risk is determined by the length of time spent in the current state (sojourn time) and Discrete Event Simulations may require many thousands of samples to produce stable estimates.

Methods: Moment-generating functions for random variables can be used very efficiently to calculate discounted costs and health effects when these are constant, one-off, exponential or polynomial with regard to time. Extended moment-generating functions are required when polynomial functions are used and these are derived for the exponential distribution and the Kaplan–Meier estimator. Competing risks are also incorporated into the framework. Recommendations are provided for numerical methods which can be applied in spreadsheet and statistical software. Finally, an example is presented comparing the new framework to Markov modelling and Discrete Event Simulation, including a spreadsheet implementation of the moment-generating function framework.

Conclusions: The moment-generating function framework can be readily applied to health economic evaluations in the place of Markov modelling or Discrete Event Simulation and does not suffer from the limitations of these methods. Calculations are simple, unbiased and efficient and can be implemented in spreadsheet and statistical software.

42. Ineffective or uncomparable? Assessing models designed to improve care for people with complex needs

Authors: Street, Kasteridis, Mason

Introduction
As part of NHS England's Vanguard programme, two new care models were introduced in South Somerset to improve care for people with complex care needs. Patients are managed by a Complex Care Team (CCT) or receive Enhanced Primary Care (health coach) (EPC). We assess the impact of these models on a range of utilisation measures.

Methods
In the absence of randomisation, we employ propensity score matching methods to match cases enrolled to the interventions to out-of-area control patients. Matching variables include age, gender, socio-economic status, multimorbidity and a hospital admission risk score. Because patients continuously enrol to the interventions we perform matching in 6-monthly cohorts. Additionally, we perform difference-in-differences analysis to adjust for other factors that could also influence outcomes.

Data
We use individual level linked primary and secondary care annual and monthly data to track the patient's activity before and after the interventions. From February 2015 to August 2017 602 patients were enrolled into the CCT, and between September 2016 and August 2017 908 patients were enrolled in EPC. Our analysis sample is restricted to cases and potential controls present throughout the sample period producing 487 (706) pairs of CCT (EPC) matched cases and controls.

Results
There is no evidence that either intervention significantly reduced utilisation. This finding holds for all cohorts and is not sensitive to the choice of matching algorithm.

Discussion
This work forms part of a larger evaluation of two interventions for people with complex conditions and care needs. As is typical of many such initiatives, the analysis here is complicated by the two interventions offering personalised care rather than a 'one-size-fits-all' package and by 'fuzzy' enrolment criteria which have evolved over time. Consequently the counterfactual may not be well-defined, biasing results toward non-significance.

43. Design and preliminary findings of a Delphi consensus survey to identify the essential contents of Health Economics Analysis Plans (HEAPs)

Authors: Thorn, Hollingworth, Noble et al

Objectives: Health Economics Analysis Plans (HEAPs), designed to set out the proposed analysis in a randomised controlled trial (RCT), currently lack consistency, with uncertainty surrounding the appropriate content. We aimed to develop a list of essential items that should be included in HEAPs for RCTs using the Delphi technique.

Methods: An electronic Delphi survey was developed using REDCap software. Expert participants were recruited through the UK Health Economists' Study Group (HESG) mailing list and direct contacts both in the UK and internationally. Respondents were asked to rate 72 potential HEAP items (derived from existing HEAPs supplied by health economists) on a numeric rating scale according to how strongly they felt the item should be included in a HEAP. Respondents were also asked to suggest additional items and to comment on the items. A second round is in progress, in which participants have been reminded of their ratings from round 1 and provided with group summary scores (median, mean, standard deviation, range) for each item. Participants have been asked to consider their ratings in the context of the group feedback.

Results: 62 participants completed round 1 of the survey. 97% identified themselves as health economists, with 93% of respondents from Europe and 7% elsewhere. The participants mainly worked in academia (85%) or industry (6.5%). No item ratings met the pre-agreed consensus criteria for dropping from the study; therefore, all items were included in round 2.

Discussion: The Delphi survey showed good engagement from health economics experts in round 1. The final results (available in time for the meeting) will be used to provide a 'template' HEAP to facilitate trial-based economic evaluations. The Delphi results will be set within a broader discussion of the implementation of HEAPs, such as how prescriptive they should be and how and when they should be published.

44. Fair integration or double jeopardy? A view on integrating family spill-over effects in health economic evaluations and the role of the interdependent utilities model

Authors: Tomini, Dirksena, Joorea

Family spill-over effects (FSEs) in cost-utility analysis are identified with the effects of ill-health on persons that are close to the patients - called significant others (SOs). Such effects can also reflect back on the patient. Despite their importance, FSEs are often neglected. This is mainly because including FSEs increases the risk of double counting due to the existence of utility interdependence between persons. Utility interdependence creates a risk of 'horizontal' double counting when utility is measured both in the patient and the SOs and we try to integrate spill-over effects in the effect side of the incremental cost-effectiveness ratio (ICER). Utility interdependence creates a risk for 'vertical' double counting when (parts of) spill-over effects are included both on the effect side and cost side of the ICER.

The main aim of the paper is to give new insights on double-counting when integrating FSEs in cost-utility analysis. The paper provides first an appraisal of the methodology for measuring and valuing FSEs taking into account the risks of both horizontal as vertical double counting. Secondly, special attention is paid on the integration of FSEs measured in terms of health or well-being. Finally, a framework to decide upon the incorporation of FSEs is presented, and directions for future research are identified.

45. Wheelchair outcomes Assessment Tool for Children (WATCh) – Development of a patient-centred outcome measure for young wheelchair users

Authors: Tuersley, Bray, Tudor Edwards

Introduction: As part of an NHS England funded research programme to develop patient-centred outcome measures (PCOMs) for use with children and young people, this study aimed to develop a PCOM for NHS paediatric wheelchair and posture services. Over 60,000 children are registered with NHS wheelchair services in England so identifying and addressing the outcomes of most importance to these users could help services to maximise the benefits achievable within available resources.

Methods: A survey was sent to young wheelchair users (<18years) and their parents to explore the importance of a range of pre-defined outcomes and to identify novel outcomes. Subsequent face-to-face interviews further explored survey responses. Participants were also asked to score and record their satisfaction levels for the outcomes they identified as most important.

Results: Questionnaires were completed by 21 young wheelchair users or their parents, followed by 11 interviews. All outcomes proposed in the survey were rated as 'extremely important' by at least one respondent, as were additional outcomes uncovered in the qualitative data. Key outcomes related to: getting around, socialising, activities and independence. In consultation with the service providers and service users, a questionnaire tool (WATCh: Wheelchair outcomes Assessment Tool for Children) was developed to allow clinicians and therapists to identify, score and monitor individual users' most important outcomes. The WATCh tool was further refined through piloting with service users and clinical staff; it comprises 16 outcome options, from which service users select their five most important to be monitored.

Conclusions: The novel patient-centred WATCh tool, developed with input from young users of wheelchair services and service providers, will be used to measure key outcomes identified by users before and after provision of wheelchair equipment. Future research will examine

correlation between results of the WATCh tool and generic utility measures, and its potential in economic evaluation.

46. Cognitive ability and 'noise' in the measurement of time and risk preferences

Authors: van der Pol, Fawns-Ritchie, Deary

Introduction
The interest in the relationship between time and risk preferences and health behaviours has increased rapidly. Whilst most studies show a statistically significant correlation, the size of the correlation is generally small. This is surprising as time and risk preferences are key parameters in economic models determining health investments. The low correlation may in part be the result of decision errors which bias the measures. Decision errors may occur due to lack of engagement but given the complexity of the experimental measures of time and risk preferences it is likely that lack of understanding may also lead to response errors. However, little is known about the robustness of the experimental measures. In this paper we explore whether complexity of the measures may play a role by examining the relationship between cognitive ability and response consistency.

Methods
We use data from the new HAGIS survey (Healthy AGeing In Scotland). The estimation sample consists of 600 individuals aged 50 and over. Time and risk preferences were measured using standard experiments as well as survey measures (such as general willingness to take risks). Cognitive functioning was measured using a range of different measures. The relationship between cognitive ability and response consistency within the time and risk preference experiments as well consistency across the different measures was assessed using regression analysis controlling for several covariates.

Results
Preliminary results show that cognitive ability is associated response consistency within the time preference task. The results also show that the consistency between the experiment risk measure and the survey measures is a function of cognitive ability.

Conclusions
Further refinements of the experimental measures are required in order to better inform the relationship between time and risk preferences and health behaviours especially in populations with lower cognitive ability.

47. The effect of education on the nutritional composition of the diet

Authors: von Hinke

Good nutrition is central to a healthy life, with unhealthy diets causing many diseases, including heart disease, type 2 diabetes and hypertension. Governments across the world are trying to encourage individuals to make healthier dietary choices, through channels such as information provision (e.g. the five-a-day campaign, food labelling, fiscal measures, and targeted benefits.

One hypothesis, based on the model for the demand for health, is that education affects health directly via the accumulation of knowledge and improved cognitive functioning. For example,

education can change individuals' allocative efficiency, affecting the allocation of health inputs. Education may also indirectly affect health inputs by increasing earnings, which can in turn affect health outcomes. For example, higher wages may increase the affordability of health-improving foods. However, higher wages also increase the opportunity cost of time, potentially leading to individuals increasing their consumption of (time-saving) ready meals, which tend to be less healthy.

Despite an extensive literature on the importance of diet in the development of disease, there is remarkably little evidence on the role of socio-economic indicators in determining dietary choices, in particular on their causal effects. The contribution of this paper is to fill this gap. By investigating the causal effect of education on the nutritional composition of the diet, I directly explore whether education affects individuals' allocative efficiency. I investigate the causal effect of education, using national changes to the UK minimum school leaving age introduced in 1972 as exogenous variation in years of schooling in an IV setup.

48. The cost-effectiveness of interventions to improve case-finding and engagement with HV treatment for people who inject drugs in the UK

Authors: Ward, Reynolds, Harrison, Irving, Hickman, Vickerman

Background and Aims: People who inject drugs (PWID) are at high risk of Hepatitis C virus (HCV) infection, however approximately 50% are undiagnosed and rates of linkage to care are very low. This study investigated the cost-effectiveness of introducing a nurse facilitator in drug treatment centres to increase case finding and engagement with the HCV treatment pathway compared to the status quo in the UK

Method: A dynamic HCV transmission and disease progression model of 1000 PWID was parameterized with UK specific data (40% chronic HCV prevalence) from the Hepatitis C Awareness Through to Treatment (HepCATT) drug treatment centers pilot study. The model estimated the decrease in disease related death if odds of case finding was increased 2.4-fold and the odds of engagement onto the HCV treatment pathway was increased 10-fold (data from HepCATT). Costs for the intervention were collected from participating centers and HCV treatment delivery costs were updated to reflect current treatment guidelines. A cost-effectiveness analysis with a 50-year time horizon and £20000 per quality adjusted life year (QALY) willingness to pay threshold for the incremental cost-effectiveness ratio (ICER) was performed. A cost-effectiveness acceptability curve was calculated from the probabilistic sensitivity analysis.

Results: Increasing case finding and engagement with the HCV treatment pathway averts 69 (95% CI 37-112) deaths over the 50-year time horizon. The mean ICER was £4,193 per QALY, with 100% of the simulations cost-effective at the £11,000 per QALY threshold. Univariate analysis showed decreasing HCV treatment drug costs to a quarter of the list price decreased the mean ICER to £1,963 per QALY (all simulations cost-effective at £7,000 per QALY threshold).

Conclusion: Increasing case-finding and engagement with HCV treatment using a nurse facilitator is cost-effective at the £20000 willingness to pay threshold. As the cost of HCV drugs decreases these interventions will become more cost-effective.

49. A novel way of anchoring discrete choice experiments valuing EQ-5D health states

Authors: Webb, O'Dwyer, Meads, Kind, Wright

Background: The debate continues as to who should be the source of health state utility valuations (HSUVs); the general population or individuals with direct experience of the condition of interest. We conducted a valuation of unlabelled EQ-5D-3L health states across age-matched samples of the general population (GenPop), general carers (GenCar) and carers of those with dementia (DemCar).

Methods: An online valuation survey was conducted with the three groups in UK. The survey included a discrete choice experiment (DCE) task valuing EQ-5D-3L health states and a visual analogue scale (VAS) task valuing 11111, dead and 33333. DCE data were analysed with a mixed logit model and resulting latent scale HSUVs were anchored to the 0-1 scale using VAS responses. We compared the rescaled valuation coefficients using t-tests and HSUVs using plots.

Results: Valuations were available from GenPop (n=458), GenCar (n=221) and DemCar (n=241) samples. Almost all coefficients were statistically significant and in the expected direction. After Bonferroni correction there were no statistically significant differences between groups in level coefficients. However, there was a clear trend for the DemCar coefficients to be higher than those of GenPop. The DemCar EQ-5D HSUVs were noticeably higher than GenPop valuations and, in most cases, slightly higher than GenCar valuations. In general, these differences were more pronounced for more severe health states. To illustrate, values for 33333 were -0.266, 0.045, 0.080; and for 22222 were 0.593, 0.651, 0.734 for the Genpop, GenCar and DemCar groups, respectively.

Conclusion: There were noticeable differences in HSUVs with the DemCar group providing higher values than the other groups. Analyses exploring explanations for this are on-going. Implications of the results are discussed in light of the arguments for including carer QALYs in broader perspective economic evaluations. The potential impact of HSUV source on economic evaluations will be explored.

50. How should resources for an extended access service in primary care be allocated? An evaluation of practice use of extended access services in England.

Authors: Whittaker

Objectives
Rising use of emergency services across many health systems and dissatisfaction with access amongst patients have placed emphasis on the need for better access to primary care. NHS England has sought to address this with the provision of extended access to primary care into the evening and at weekends. The service is based on a hub model, with several practices hosting the service which is accessible to any practice within the local area. Current proposals for funding are based on a capitation basis which assumes the need for the service does not vary outside of population size. This paper seeks to inform whether a weighted capitation approach to funding and provision is necessary to allocate resources for extended services in a more efficient and equitable way.

Methods
Extended appointments have been piloted across NHS England Greater Manchester since 2014. Using unique appointment data from these pilots in 2016, practice use of appointments are modelled via count models. This is modelled against a range of demographic characteristics of the

practice's population, measures of access to the practice at core hours (informed by the literature), and additional supply-side measures e.g. whether the practice is the hub and distance to the hub.

Results
Preliminary results find significant variation in practice use of appointments with hub practices dominating use ($p<0.001$), and greater distance to the hub practice resulting in lower use ($p<0.001$). Demographic characteristics of the practice population did not predict practice use, and there is limited evidence that poor access in core hours resulted in greater use of the extended access service.

Discussion
This paper finds limited evidence in support of a weighted capitation approach to the provision of an extended access scheme in primary care. However, there were significant hub effects found, suggesting the potential for widening inequalities in access.

51. Under pressure: family practitioner responses to the introduction and subsequent removal of stricter pay-for-performance targets for blood pressure control

Authors: Wilding, Kontopantelis, Munford, Guthrie, Sutton

Objectives
The cost-effectiveness and equity consequences of pay-for-performance depend on whether it induces temporary or permanent increases in quality and on which types of patients are affected.

For many years, family practitioners had been paid for controlling the blood pressure of patients with hypertension of all ages to 150/90 mmHg or lower within the last nine months. In 2013, stricter targets of 140/90 mmHg were introduced for patients aged under 80 years, while the original target for patients aged over 80 years was unchanged. From 2014, the control target was returned to 150/90 mmHg for all patients, the measurement window was extended to within the last year, and the financial rewards for an average practice were reduced by two-thirds from £10,000 to £3,300.

We analyse the responses of family practitioners to this introduction and subsequent removal of stricter blood pressure control targets for patients aged under 80 years in England.

Methods
We obtained data on 71,109 patients diagnosed with hypertension registered with 131 family practices over seven years (2010-2017) from the Clinical Practice Research Datalink. We estimate how the targets affected the full distribution of systolic blood pressure readings and the timing of the most recent measurement for patients above and below 80 years old. We also analyse changes in the medications received and the number of patient consultations. We consider heterogeneous effects across patients stratified by gender, frailty, co-morbidities and area deprivation.

Results
The proportion of patients aged under 80 years meeting the stricter target increased from 59.2% in 2012 to 68.5% in 2013 and fell to 57.2% in 2014. There was an increase in patients with recorded systolic blood pressure in the 136-140 range (achieving the new target) and a reduction in 141-150 range (achieving the old but not the new target). There was substantial evidence of bunching of recorded pressures just below the required thresholds. Following removal of the stricter target, the proportion of patients without a blood pressure measurement increased from 8.2% to 11.9%.

A similar pattern of changes, but to a smaller extent, was observed for patients aged 80 years and older. Patients with no co-morbidity experienced the largest changes.

Discussion

Family practitioners responded very rapidly to the introduction and subsequent removal of stricter targets. Incentivising a tighter target for one year led to large increases in patients recorded as achieving the tighter target, but performance fell below baseline in the next year when the incentives were reduced. There was some evidence of positive spillovers for older patients. Pay-for-performance may not lead to lasting improvements in patient care.