Guest Editorial

Economics and Cochrane and Campbell methods: the role of unit costs

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Introduction

Systematic reviews and economic evaluations of interventions[3] have become two important, sometimes integrated, components of the research evidence-base to inform health and social care policy and practice in the UK (National Institute for Health and Clinical Excellence (NICE), 2008, 2009; Coren & Fisher, 2006; Francis, 2009). This development has paralleled the emergence of the Cochrane Collaboration (C1)[4] and (later) the Campbell Collaboration (C2)[5] as two counterpart global organisations that aim to help people make well-informed policy, practice and consumer decisions by preparing and maintaining 'world libraries' of systematic reviews of reliable and up-to-date evidence on the effects and other aspects of interventions. C1 and C2 reviews cover a wide range of health care (C1), social care (C1 and C2), education (C2) and criminal justice (C2) topics, and are intended for an international audience of end-users.

Since their inception, both collaborations have recognised that, faced with limited resources and constrained budgets, decision-makers and those who support them often need to consider not only the balance between the beneficial and adverse effects of interventions on health and well-being, but also their impact on resource use and costs, and ultimately whether their implementation is likely to lead to a more efficient use of resources. This recognition led to the establishment of the Campbell & Cochrane Economics Methods Group (CCEMG),[6] which aims to develop and support the application of internationally relevant but locally useful economic methodologies in C1 and C2 reviews. Some of the methods concern how to incorporate critical summaries of economic evidence collected from published and unpublished intervention studies into the reviews themselves, in order

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3 The term 'intervention' is used here to refer to any health, social care/welfare, education or criminal justice technology, programme, service or policy. The term 'intervention' is used interchangeably with the term 'technology' throughout this editorial.

4 For further information visit the C1 website at http://www.cochrane.org.

5 For further information visit the C2 website at http://www.campbellcollaboration.org.

6 For further information visit the CCEMG website at http://www.c-cemg.org.

to provide additional, useful policy insights. Other methods focus on making the reviews as useful as possible to inform evidence-based decision-making in specific settings. This may be achieved through development of modules incorporating context-specific economic analysis and commentary as 'front-ends' to published C1 and C2 reviews. It could also be achieved through the development of economic and effectiveness components of reviews to facilitate their use in subsequent technology assessment, appraisal and practice guideline development processes and/or economic evaluations, conducted in the UK and other jurisdictions. These two 'sets' of methodologies are not mutually exclusive.

The objective of this editorial is to explore how unit cost data fit into this overall picture.

Critical summaries of economic evidence

C1 and C2 intervention reviews provide comparative assessments of the effects of alternative interventions in terms of pre-specified sets of clinically, socially and/or consumer (e.g. patient) important outcome measures. This is achieved through systematic identification, appraisal, synthesis and summary of evidence collected from reliable primary studies, focusing on well-designed studies comparing pre-specified experimental intervention(s) with pre-specified counterfactual(s) (Higgins & Green, 2008). If appropriate, synthesis may include use of meta-analysis to combine outcome data collected from two or more primary studies in order to produce weighted average estimates of incremental effect-sizes that are potentially more precise[7] than estimates produced by a single study alone, and with increased power to detect a 'real' effect[8] (Deeks et al., 2008).

Although not yet a core methodological requirement of C1 and C2 reviews, many reviews already extend their focus to include coverage of economic issues (Shemilt & Mugford, 2009; Shemilt et al., 2006). At one end of a continuum of the degree of economic input to these reviews, their economic components are limited to brief background descriptions of the economic burden that the health condition, social or behavioural problem addressed by the compared interventions places on (for example) health and social care systems, individuals or society. The background may also describe potential impacts the experimental intervention(s) may have, compared to the counterfactual(s), on resource utilisation and/or costs incurred by health and social care systems, individuals or society. At the other end of the continuum, some C1 and C2 reviews aim to develop critical summaries of economic evidence collected from included studies. CCEMG has published methods guidance for authors of C1 and C2 reviews to inform the conduct of optional stages of research that would place the economic components of the review at different levels on this continuum (Shemilt et al., 2008a, 2008b).

As with the parallel review of evidence on intervention effects, a critical summary of economic evidence requires systematic identification, appraisal, synthesis and summary of evidence collected from reliable primary intervention studies. Intervention studies that may have collected useful evidence on economic aspects of alternative interventions include, *inter alia*, comparative effectiveness research studies and full or partial economic evaluations (e.g. cost-effectiveness analyses or cost-analyses). Some of these may report different aspects of the same research study, as is sometimes the case with economic evaluations conducted alongside randomised controlled trials.

7 The estimation of an intervention effect can be improved when it is based on more information (Deeks et al., 2008).

8 Power is the chance of detecting a real effect as statistically significant if it exists. Many individual studies are too small to detect small effects, but when several are combined there is a higher chance of detecting an effect (Deeks et al., 2008).

On one level, measures of resource use, costs and cost-effectiveness can be treated as additional 'effect' outcomes in a C1 or C2 review, alongside other clinically, socially and/or consumer (e.g. patient) important outcomes (Shemilt et al., 2008a, 2008b). However, levels of resource use, costs and (by extension) estimates of the cost-effectiveness associated with interventions are highly likely to vary systematically between countries, or in different regional or service settings, and over time (Anderson, in press). Such variations are most commonly attributed to differences in unit costs and currencies between settings, and over time due to inflation (Sculpher et al., 2004). But other differences in features of the intervention and/or decision context – such as clinical or professional behaviours, attitudes and practices, practice settings, levels of consumer compliance or valuations of outcomes, economies of scale, financial incentives, current treatment or service comparators, alternative uses of resources (opportunity costs), as well as complex interactions between all of the above factors – also drive such variations (Anderson et al., in press; Lessard & Birch, in press, Shemilt et al., 2008a).

Therefore, unlike the parallel review of evidence on intervention effects, the aim of a critical summary of economic evidence is not only to explore the nature of summary estimates of (in this case) the incremental resource use, costs and/or cost-effectiveness of the compared interventions (Shemilt et al., 2008a, 2008b). Rather, the principal aim is to utilise the available evidence to summarise what is known from different studies, conducted in different settings and at different times, about economics aspects of interventions, in order to:

- Help end-users to understand key production factors, demand factors, and economic trade-offs between alternative interventions and thus the structure of resource allocation problems they may face and the main parameters that need to be considered (Drummond, 2002).
- Assess variations between settings in terms of resource use, costs and cost-effectiveness, and potential reasons for these variations, including exploration of how and why particular levels and configurations of resources appear to be related to the levels and types of outcomes observed, and what contextual factors affect these relationships (Anderson et al., in press).
- Evaluate whether an intervention appears promising,[9] from an economic point of view.

A critical summary of economic evidence therefore needs to build upon and refine theories (pre-specified at the protocol stage) and discussion (based on the available evidence) of how the compared interventions are likely to impact on the resources used in their production (input costs), potential changes in the subsequent use of resources (downstream costs/cost savings), and cost-effectiveness, and to set this in an international context (Anderson et al., in press; Gilbody & Petticrew, 1999). Such theories and discussion incorporate and embrace the fundamental *a priori* premise that the size (and possibly the direction) of estimates of incremental resource use, costs, effects and cost-effectiveness associated with interventions will be different in different settings, depending on the balance and interactions of particular mechanisms, contexts and outcomes operating at different levels within (and outwith) a given system.

9 An intervention may be judged 'promising', from an economic point of view, under four scenarios: if it appears to have the potential to result in improved outcomes and reduced (or similar) costs; if it appears to have the potential to result in improved outcomes and increased costs, to such an extent that the improvement in outcomes may justify the increase in costs; if it appears to have the potential to result in similar outcomes and reduced costs; or if it appears to have the potential to result in worse outcomes and reduced costs, to such an extent that reduction in costs may justify the worse outcomes. A further condition for an intervention to be judged 'promising' in the context of a C1 or C2 reviews may be that one of the above four scenarios appears to have potential to be applicable in a number of different settings. In practice, the available evidence on resource use, costs and effects often reveals trade-offs between different items of resource use/costs and different outcomes/effects, which may imply that further context-specific analyses are needed to build on the initial judgement.

Data on unit costs are not utilised directly in critical summaries of economic evidence conducted as part of C1 and C2 reviews, although assessments of sources and variations in unit costs (and any assumptions about resource use that underpin unit costs) between studies and settings *are* likely to be important in explaining between-study/setting variations in estimates of costs and cost-effectiveness.

'Front-end' economic modules

We are not aware of any 'systematic maps' of the evidential relationships between C1 and C2 reviews (including their economic components), technology assessment, appraisal and practice guideline development processes (including their economic components) and economic evaluations or other economic analyses[10] (which may or may not be undertaken as a component of technology assessments) conducted in the UK (or other jurisdictions). What is known is that, in many cases, published C1 and C2 reviews *are* used to inform technology assessment, appraisal and practice guideline development processes, while in other cases technology assessment reviews conducted in specific jurisdictions are subsequently converted into published Cochrane reviews.

If the technology assessment review comes first, this may already include comparative, context-specific analyses of the costs, cost-effectiveness and/or budget impact of interventions, alongside (and incorporating) evidence on intervention effects assembled using a systematic review.[11] There are many examples of (and variations on) this approach in UK health technology assessment reviews (e.g. Pilgrim et al., 2009; McDaid et al., 2009; French et al., 2009). The UK Social Care Institute for Excellence (SCIE) has recently developed a position statement on economic evaluation in social care and sought advice on methods for costing practice guide recommendations, building on established evidence review processes (Francis, 2009; The Matrix Knowledge Group, 2008).

If the C1 or C2 review comes first, there is scope to build a bespoke 'front-end' economic module onto the review that includes context-specific economic evidence, tailored for use by specific sets of stakeholders.[12] Taking health and social care as our example and the UK National Health Service (NHS) as the decision-making jurisdiction, the 'front-end' economic module of a C1 review might, at minimum, consist of an 'economic reading' of the clinical effects evidence contained in the review,[13] together with a summary of its economic components, and an assessment of implications for NHS policy and practice. However, the economic module could also include any (or all) of the following: a cost analysis (Drummond et al., 2005), a budget impact analysis (Mauskopf et al., 2007) and a decision model to assess cost-effectiveness (Briggs et al., 2006),[14] each conducted from a UK NHS perspective. The cost analysis component is described below. The budget impact

10 Other forms of economic analysis (i.e. other than full or partial economic evaluations) include, *inter alia*, budget impact analysis and econometric analysis.

11 Technology assessment reviews may also include a systematic review of existing cost-effectiveness evidence.

12 The precise configuration of each 'front-end' economic module would need to be determined on a case-by-case basis in consultation with all stakeholders.

13 For some reviews, this may be all that is needed, as it may be possible to conclude on the basis of an 'economic reading' of the clinical effects evidence that it is implausible that an intervention is not cost-effective, or possibly cost-saving (e.g. if the incremental levels of 'per patient' resources needed to provide the intervention are very likely to be small and, due to the beneficial effects of the intervention, the incremental 'per patient' reduction in the subsequent utilisation of expensive services is very likely to be high).

14 If it is not judged feasible to develop a decision model to assess cost-effectiveness, another option (applicable to evaluations of certain types of intervention, such as medications) may be to estimate the cost of preventing an event. The cost of preventing an event is an "approximate cost-effectiveness statistic" calculated by synthesising estimated costs with the epidemiological measure 'Number needed to treat' (NNT) (Maharaj, 2007).

analysis would build on the cost analysis,[15] while the cost-effectiveness analysis would build on both the cost analysis and the review of intervention effects (including the meta-analysis, if available).[16,17]

The cost analysis component of the module would build on both the review of intervention effects and economic components of the review. A cost analysis is a comparative analysis of alternative interventions in terms of their costs only (Drummond et al., 2005). It involves the *description*, *measurement* and *valuation* of changes in resource use that occur as a result of the production (implementation) and effects (outcomes) of the compared interventions. Costs may be differentiated into those associated with resources used in the production of the interventions (resource inputs) and those associated with the influences of the effects of the interventions on subsequent resource or service utilisation (resource consequences). Data on types and/or amounts of resource inputs (description and/or measurement) may be collected from primary studies (either comparative effectiveness research studies[18] or economic evaluations) included in the systematic review, subject to assessments of the applicability of these data to the NHS setting. Depending on the scope and applicability of data available from the review, these may need to be supplemented by analysis of NHS administrative datasets to establish reliable estimates of resource inputs applicable to NHS health and social care practice. Data on types and amounts of resource consequences (description and measurement) may be collected largely from the C1 review, provided the review has collected (and possibly synthesised) outcome data on the range of effects that have important associated resource consequences (e.g. complications of treatment and secondary procedures for a surgical intervention).

Unit cost data have a crucial role at the *valuation* stage of a cost analysis. Essentially, unit costs are applied to each measured amount of resource (e.g. the number of weeks patients stay in a community rehabilitation unit multiplied by the unit cost of the stay, per week). In our example economic module (and depending on the specific resource inputs and resource consequences associated with compared interventions), applicable sources of national UK health and social care unit costs data may include this volume, National Schedule of NHS Reference Costs volumes (Castelli, 2008) and British National Formulary volumes (e.g. British National Formulary, 2009). Other useful UK sources of information and data relating to the calculation of unit costs of health and social care are listed in an appendix (see page 199).

Finally, it should be noted that all the components of data we have suggested could potentially be drawn from effectiveness and economics components of C1 and C2 reviews to inform elements of 'front-end' economic modules may also, in principle, be used to inform development of corresponding elements of technology assessment reviews (e.g. assessments of cost-effectiveness and budget impact) or other economic evaluations (e.g. model structure, selection of key parameters, ranges of input data values for key parameters) conducted in specific jurisdictions.

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15 Supplemented by applicable demographic and epidemiological data.

16 Supplemented by applicable demographic, epidemiological and (possibly) health state utilities data.

17 If an applicable decision model or other economic evaluation of essentially the same decision problem faced by end-users of the economic module had already been conducted using the same analytic perspective, this may obviate the need to produce some elements of the economic module (or existing analyses could be updated for the module).

18 It may be possible to collect data on resource inputs from comparative effectiveness research studies whether or not the study incorporates any formal economic analysis. CCEMG is developing a 'resource use data coding tool' designed to collect data on 'resource inputs' from such studies, to inform analyses of the implementation costs of interventions (i.e. by applying unit costs to the measured amounts of each resource).

Conclusions: future challenges and the role of unit cost data

One of the key challenges in the ongoing development of economics methods for use in the preparation and maintenance of C1 and C2 reviews and front-end economic modules is the need to establish empirical evidence, through the conduct of methodological research, regarding methodological choices that may be made at each stage of the research process, including the degree to which implementation of specific approaches adds value to reviews, and at what extra cost.

It is also essential to continue to build capacity among both systematic reviewers and applied economists to support the production of economics components of reviews, through network development and training activities (training of both systematic reviewers in economics methods and applied economists in systematic review methods). To this end, CCEMG would like to invite applied economists and others working within or across the fields of health and social care, education and criminal justice to contribute to our network and its work. Please e-mail research@c-cemg.org or visit the website at http://www.c-cemg.org for further information.

Another challenge is to ensure that economics components of C1 and C2 reviews and bespoke front-end products complement (and do not duplicate) parallel outputs produced within (and outwith) established and emerging technology assessment, appraisal and practice guideline development processes in the UK and elsewhere. In the UK, this requires ongoing collaboration between C1 and C2 (and affiliated researchers and methodologists) and a wide range of UK agencies and stakeholders, such as (at a national-level) the Department of Health, the National Institute for Health and Clinical Excellence, the Health Technology Assessment Programme, SCIE, the Home Office and the Department of Children, Schools and Families.

This editorial has described the pivotal function of unit costs data in the production of economic analyses that aim to help decision-makers consider how they should act on evidence from C1 and C2 reviews. In the UK, some key challenges for developers of unit costs data lie in the development of national sources of education and crime and justice unit costs data to sit alongside existing sources of health and social care data, and also in ensuring that the range of available unit costs data within and across these sectors is sufficiently broad to inform economic analyses of the ever-increasing range of new and existing technologies requiring evaluation and re-evaluation. In the context of these challenges, current expansions in UK unit costs research are encouraging.

The Personal Social Services Research Unit (PSSRU) is currently developing national unit costs of crime and justice (Netten et al., 2008), and the Centre for Child and Family Research (CCFR) in Loughborough is working on education unit costs as part of a project to develop a 'children's services' cost calculator for UK local authorities.[19] Also, efforts to improve the range and quality of the information contained in current PSSRU Unit Costs volumes are undertaken every year and the publication is kept as current as possible by using the latest data taken from routinely-collected reports, literature and ongoing research. To ensure the accuracy and comprehensiveness of the information, advice is sought from a working group consisting of the Department of Health, PSSRU, the Centre for Health Economics (CHE) at the University of York and the Centre for the Economics of Mental Health (CEMH) in the Institute of Psychiatry, Kings College London. This working group

19 See CCFR's website at http://www.lboro.ac.uk/research/ccfr/ for further information, especially the 'Exploring costs and outcomes' research theme.

meets annually to discuss gaps in the data and to plan future research. It also discusses research in progress so that the unit costs reported always reflect, to a greater or lesser degree, work in progress. Furthermore, every year users of the Unit Costs report are invited to comment on the information and estimates which need improving. In our view, as the range of parallel national public sector unit costs sources and their developers continues to grow, it would be useful to assess whether establishment of a centralised, and possibly international, directory is warranted, to allow researchers and other users of unit cost data to continue to identify gaps in the coverage of public sector unit costs data needed for current and forthcoming analyses in different settings.

Note

Ian Shemilt and Miranda Mugford are two editors of a forthcoming book, *Evidence-based Decisions and Economics: Health care, social welfare, education and criminal justice*, to be published by Wiley-Blackwell in Spring 2010.

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