Methods for Incorporating Equity into Economic Evaluation of Social Investments

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ABSTRACT

Standard methods of economic evaluation focus on efficiency and do not provide information about the equity impacts of social investments on social inequalities. This paper first presents a simple conceptual framework for thinking about equity in economic evaluation – the "equity-efficiency impact plane". It then describes four general approaches to incorporating equity into economic evaluation: (1) equity evidence review, (2) equity constraint analysis, (3) distributional equity impact analysis, and (4) equity-efficiency trade-off analysis. Finally, it describes two specific methods that have been applied to incorporating equity into economic evaluation of investments in the health sector, and considers their applicability to children, youth and families – Extended Cost-Effectiveness Analysis (ECEA), which breaks down the social distribution of costs and benefits, and Distributional Cost-Effectiveness Analysis (DCEA) which, in addition, provides a summary measure of equity impact and analyses the potential trade-offs between equity and efficiency impacts.

INTRODUCTION

Policymakers, stakeholder groups and the wider public are often concerned about the equity impacts of social investments on social inequalities. However, standard methods of economic evaluation such as cost-benefit analysis and cost-effectiveness analysis only provide information about the efficiency impacts of social investments on total costs and benefits. These efficiency impacts are sometimes broken down by broad stakeholder group perspectives. For example, the Washington State Institute for Public Policy cost-benefit model provides a breakdown of overall social costs and benefits by four stakeholder groups: (i) government, (ii) program participants (iii) taxpayers and (iv) others in society (Lee et al. 2012). However, this does not address equity concerns about the impact of policies on social inequalities – for example, inequalities by income, ethnicity, geographical location, disability, veteran status and other social divisions of interest to policy makers.

This paper describes economic evaluation methods for providing quantitative information about equity impacts on social inequalities, and for assessing potential trade-offs between efficiency impacts and equity impacts. The purpose of these methods is to furnish social decision makers with credible quantitative information about equity impacts, so that equity concerns can be addressed in a more systematic and evidence-informed manner within the context of a deliberative decision making process.

The paper starts by setting out a conceptual framework for thinking about equity in economic evaluation – the "equity-efficiency impact plane". It then outlines four general approaches to gathering evidence to about the equity impacts of social investments, which help to reduce uncertainty about where a program lies in the equity-efficiency impact plane. It then describes two methods recently developed and applied in the health economics literature, known as "Extended Cost-Effectiveness Analysis" (ECEA) and "Distributional Cost-Effectiveness Analysis" (DCEA). ECEA provides breakdowns of the costs and benefits of health care interventions by social group, in the same way as distributional impact analysis in other areas of social policy such as tax reform, transport policy and environmental policy. DCEA, in addition, provides a summary measure of equity impact and analyses the potential trade-offs between

equity and efficiency impacts. These methods were developed in a health care setting, but are potentially applicable in the broader context of investments in children, youth and families with a broader range of costs and benefits across multiple sectors of public policy.

Distributional equity impact analysis is routinely used to inform national tax policy, and occasionally used to inform national public expenditure decisions in areas such as transport, housing and the environment. This method is also occasionally used by international organisation such as the World Bank to inform decisions about anti poverty programmes. As far as I am aware, however, the methods described in this paper are not yet used routinely by any national or local government either to inform social investments in children, youth and families or to inform social investments in health. There is increasing potential interest in these methods in the health sector, however, as shown for example by (1) a recent Disease Control Priorities project funded by the Gates Foundation to develop "extended cost-effectiveness analysis" in the context of public health programs in low and middle income countries, and (2) a recent project funded by the UK Department of Health Public Health Research Consortium to develop "distributional cost-effectiveness analysis" in the context of public health programs in high income countries.

One reason that these methods are not yet routinely used by economists to inform social policy making has to do with intellectual fashion. For much of the latter half of the twentieth century, economics teaching and research was dominated by the "Paretian" philosophy of welfare economics, which focuses on efficiency and considers equity not to be a proper concern for economics (Atkinson, 2009, 2011; Pauly, 1995, 1996). The methods described in this paper, by contrast, are based on the "social choice" philosophy of welfare economics, which has experienced a revival in recent decades and is advocated by a number of leading figures in the economics discipline including Atkinson (Atkinson, 2009, 2011), Sen (Sen, 1999) and Fleurbaey and Schokkaert (Fleurbaey and Schokkaert, 2013) and in health economics including Williams (Williams, 1972) and Culyer (Cookson and Claxton, 2012). The "social choice" approach seeks to make explicit value judgements about social objectives, and to subject those value judgements to public scrutiny and deliberation. The idea is that economic evaluation aims to provide social decision makers and stakeholders with useful information about how far alternative decision options are likely to achieve their objectives. The appropriate set of value judgements and policy objectives is ultimately a matter for the legitimate social decision maker to specify. However, alternative sets of value judgements can be explored in sensitivity analysis to help decision makers and stakeholders think through the implications of policies in a deliberative decision making process. In this way, economic evaluation of equity impacts using a "social choice" approach can be seen as a contribution towards democracy in the broad sense of "the exercise of public reason" (Sen, 2003, 2011).

Another issue is that the idea of equity, fairness or justice is complex, context-dependent and value-laden, and means different things to different people (Sen, 2011). In fact, the idea can even mean different things to the same person, depending on how the question is framed, what state of mind they are in, and other apparently superficial psychological factors (Amiel and Cowell, 1999; Gaertner and Schokkaert, 2012; Greene, 2013). This makes it hard to define and measure equity impacts. However, it is not a good reason to give up on quantitative analysis and evidence. In this age of "big data", it is becoming increasingly feasible to gather credible evidence on the social distributions of policy impact and to model long-term impacts over the lifecourse. So what is needed are clear analytical frameworks and practical methods to make

sense of this wealth of data and help decision makers get a clearer understanding of the equity impacts of policies.

CONCEPTUAL FRAMEWORK

The methods described in this paper all focus on equity objectives relating to the reduction of a social inequality or disparity that decision makers consider unfair or unjust. There are many fundamentally different kinds of social inequality, and the selection of any specific equity objective is politically controversial. When specifying the social inequality reduction objective, there are three key questions to ask:

1. **Equality of what?** What is the thing being distributed – the "distribuendum". For example, is the concern to reduce inequality in the distribution of a service (such as healthcare or education) or inequality in the distribution of an outcome, such as income, health, or wellbeing? Is the concern with current period outcomes or multi-period outcomes over the lifetime? Inequality in *levels* of outcome or *changes* in outcome resulting from government action? Inequality of realised outcomes or inequality of opportunity to achieve outcomes?

2. **Equality between whom?** For example, is the appropriate unit of analysis the individual, the household, the family, or a broader group? Is the concern to reduce *all* variation in the distribuendum of interest? Or is the concern to reduce only that part of the overall variation that is considered unfair because it is related to a particular social characteristic of interest, such as inequality in age-at-death related to income, rather than inequality in age-at-death due to biological variation or luck? Is one social characteristic of particular interest – such as income or ethnicity – or is the concern with multiple different aspects of social disadvantage? Does the inequality arise from a denial of human rights, such as invidious discrimination, or from an existing distribution of income that might partially reflect choices made rather than circumstances beyond the individual's control?

3. **Equality measured how?** Measuring inequality involves summarising a many-valued distribution in terms of a single scalar inequality index, and there are different ways of doing this that can yield different answers. For example, is the concern with overall inequality (e.g. a gini index), with inequality at the top end of the distribution (e.g. the share of the top 1%), or with poverty at the bottom of the distribution (e.g. the headcount below a poverty threshold)?   Is the concern with absolute inequality (e.g. between top and bottom groups) or relative inequality (e.g. absolute inequality as a proportion of the mean)?

The answers to these questions can yield radically different measures of equity. Furthermore, important sub-questions often arise. For example, if the distribuendum is "income", the unit of analysis is "household", and the equality measure is "ratio between top and bottom income quintile" there are important further questions such as whether income is measured (1) before or after taxes and transfers, (2) with or without including the value of "in-kind" public services, and (3) with or without equivalising for household composition. The answer to this first question changes measured income inequality in the US in 2011 from a ratio of 30.5 to a ratio of 6 (http://www.urban.org/urban-wire/addressing-income-inequality-first-requires-knowing-what-were-measuring).

It is possible to articulate an inequality reduction objective without requiring consensus political agreement on the "ideal" level of equality in society. For example, not everyone would agree with Plato's proposal that no-one should be more than four times richer than the poorest member of society. Nevertheless, many people would agree that the current trend towards rising income inequality at the top of the distribution within most countries is worrying, and that a reasonable policy objective might be to curb or even reverse that trend. In other words, it may be easier to agree the desired direction of movement for a particular social inequality than the ultimate destination. We can therefore think about "equity impact" as a movement towards either increasing or reducing the particular social inequality of interest.

Efficiency Impact (EI)

+

II. Win-Lose

Beneficial Efficiency Impact
Harmful Equity Impact

I. Win-Win

Beneficial Efficiency Impact
Beneficial Equity Impact

Distributional Equity Impact (DEI)

−   +

III. Lose-Lose

Harmful Efficiency Impact
Harmful Equity Impact

IV. Lose-Win

Harmful Efficiency Impact
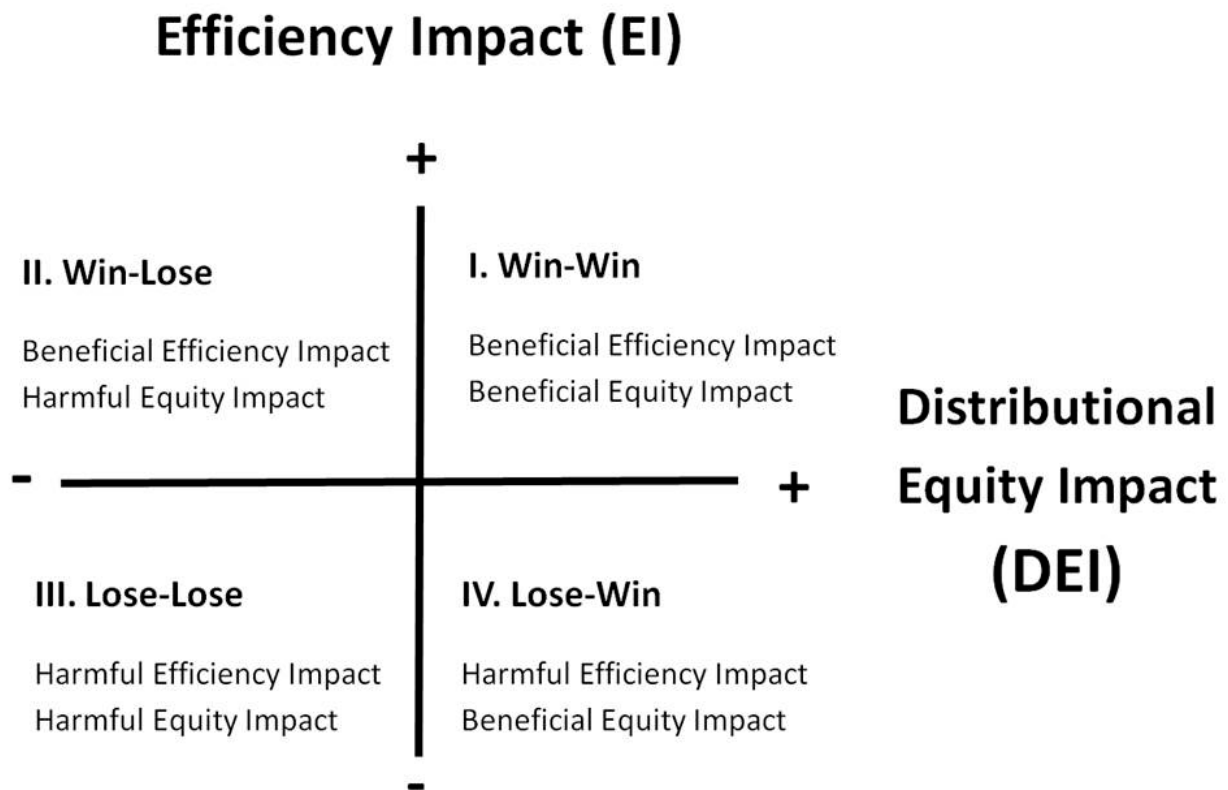Beneficial Equity Impact

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FIGURE 1: Equity-Efficiency Impact Plane

Figure 1 presents a simple framework for thinking about equity in economic evaluation. This shows the comparative efficiency and equity impacts of implementing a social investment program compared with an alternative course of action. The "efficiency impact" on the vertical axis shows the overall balance of total costs and benefits. This is the information provided by standard methods of economic evaluation, such as cost-benefit analysis and cost-effectiveness analysis. The "distributional equity impact" on the horizontal axis shows whether the intervention increases or reduces the social inequality of interest. This information is not provided by standard methods of economic evaluation.

Programs in the "win-win" quadrant are beneficial from both efficiency and equity perspectives, whereas programs in the "lose-lose" quadrant are harmful from both perspectives. Programs in the "win-lose" and "lose-win" quadrants are beneficial from one perspective but

harmful from the other, and the decision maker is faced with a difficult trade-off between equity and efficiency. This can occur if the cost of achieving a unit of beneficial outcome is higher in socially disadvantaged populations than socially advantaged populations. In the "lose-win" quadrant, the decision maker needs to decide whether the gain in equity is worth the loss in efficiency. For example, a program that focuses resources on socially disadvantaged populations may be less efficient but more progressive or otherwise equitable than one which spreads resources more evenly. In the "win-lose" quadrant, by contrast, the decision maker needs to decide whether the gain in efficiency is worth the loss in equity. For example, a universal investment may be more efficient but less equitable than a targeted investment.

An example of an intervention in the "win-win" quadrant may be the "Nurse-Family Partnership" program for low-income at-risk pregnant women, which provides intensive visitation by nurses during pregnancy and the first two years after birth (Olds, 2006). This program has been the subject of three major randomised control trials with long-term follow up in the USA in Elmira, New York in 1977, then in Memphis Tennessee in 1988 and in Denver, Colorado in 1994, and a randomised control trial is currently under way in the UK where the programme is called the "Family-Nurse Partnership". The program is motivated by evidence that *in utero* and early years circumstances have important influences on physiological and cognitive development, which in turn have important long-term impacts on school outcomes, health and earnings in later life (Almond and Currie, 2011). It has efficiency objectives relating to benefits to the child in terms of health, development and future earnings and to the mother in terms of economic self-sufficiency, along with cost savings to the taxpayer from reduced rates of youth crime and unemployment. It also has equity objectives relating to the reduction of socioeconomic and racial inequalities in life chances – i.e. to reduce current socioeconomic and racial inequalities in the chances of achieving good outcomes over a lifetime (such as good health, school grades, earnings) and avoiding bad outcomes over a lifetime (such as imprisonment, unemployment, premature death). Since children have no control over the situation into which they are born, reduction of inequality in life chances has particular relevance to that age group.

Imagine the intervention under consideration is a local government investment in a nurse-family partnership program for low-income families in a large metropolitan city in the UK, and the comparator is "no investment program" – i.e. spending the money on an unspecified set of other local government services. The program has a strong evidence base from randomised control trials in the US (MacMillan et al., 2009) and according to the Dartington Social Research Institute "Investing in Children" cost-benefit model is likely to be cost-beneficial in a UK setting (Utting et al., 2012) – i.e. to lie in the top half of the diagram with a positive efficiency impact. If the relevant equity objective is to reduce socioeconomic inequality in life chances, then the program seems likely to lie in the right hand side of the diagram with a positive equity impact since it provides greater benefits to people on lower incomes. So the program seems likely to lie in the "win-win" quadrant.

However, things may not be quite so simple, for two reasons. First, there remains considerable uncertainty about the cost-benefit calculations, since existing program effectiveness data come mainly from US settings and it is not yet known how far the beneficial outcomes seen in the US will translate into UK settings. There are reasons for thinking the benefits may be smaller in a UK setting – for example, the UK has more generous pre-existing levels of welfare and health services for pregnant women and lower pre-existing rates of crime and incarceration. There are also important uncertainties relating to scalability as the program is rolled out beyond

small-scale randomised trial settings. If the program is substantially less effective in the UK than the US, then it could lie in the "lose-win" quadrant – i.e. a negative efficiency impact but a positive equity impact. If so, there is a thorny equity-efficiency trade-off to consider – is the improvement in equity worth the loss in efficiency?

The second complication is that the net equity impact depends not only on the socioeconomic distribution of benefits (pro-poor) but also on the socioeconomic distribution of the costs of the programme. This will depend, in turn, on how the program is funded. If the funds come from an increase in progressive general taxation, then the equity impact is certainly pro-poor. However, if the funds come from a local government budget that would otherwise have been used for a different pro-poor public expenditure program – such as services for disabled children – then things may be different. If the nurse-family partnership were less effective than these alternative displaced child services, there is a risk it might actually increase social inequality – since children from low-income families would be better off receiving those alternative services. Hence if the program is substantially less effective in the UK than in the US, and if it displaces more effective public services for children, then it may potentially lie in the "lose-lose" quadrant.

Another useful lens for thinking about equity impacts is the tripartite classification of different kinds of equity from the public finance literature (Steuerle, 2002):

1. Horizontal equity or Equal Treatment of Equals – the equal treatment of people who are alike in relevant respects
2. Vertical equity or Progressivity – the appropriately unequal treatment of people who differ in relevant respects, with benefits applying relatively more to those with greater needs, and costs covered relatively more by those with greater means.
3. Individual equity – the appropriate protection of individual rights and freedom from interference in the conduct of voluntary transactions

Both vertical and horizontal equity can be specified in radically different ways depending on what is meant by "treatment", "relevant respects", and "appropriately unequal". In the public finance literature, equity goals relating to the reduction of social inequality are conventionally thought of in terms of vertical equity or progressivity. For example, if "treatment" refers to the receipt of public benefits and the "relevant respect" is income, then vertical equity implies that low-income families should receive greater public benefits. And if "treatment" refers to the burden of taxation, then vertical equity implies that low-income families should pay lower taxes – either in absolute terms or, more usually, as a proportion of income. The family-nurse partnership program in the UK satisfies both of these requirements for vertical equity – i.e. it delivers larger benefits to low-income families, and it is funded through a progressive taxation system.

Social inequality reduction objectives can also be recast in terms of horizontal equity. In the health sector, for example, equity is often framed in terms of equality of access to, or delivery of, health care for people with equal healthcare needs. Similarly, in the education sector an equity objective might be to reduce inequalities of access to, or delivery of, education for children with equal educational needs. Insofar as children from low-income families have more limited access to privately funded and informal educational opportunities, a horizontal equity objective in the space of "overall" education (public, private and informal) implies a progressive, vertical equity objective in the space of publicly funded education. Greater publicly funded

education for children from low-income families (a progressive, vertical equity objective) is needed to "top up" the more limited private and informal educational opportunities of children from low-income families, thus reducing horizontal inequity of access to education.

Objectives relating to the reduction of social inequality are often in conflict with individual equity objectives, but not necessarily. An obvious conflict occurs when a reduction in social inequality requires an increase in taxation, which thereby harms individual freedom from interference in voluntary transactions. However, reducing social inequality may sometimes be a matter of changing the social norms, institutions and choice architecture within which voluntary transactions occur. For example, one way to reduce income inequality may be to shift social norms about fair pay that influence which of multiple equilibrium pay bargaining outcomes actually occurs. Also, reducing social inequality may sometimes be a matter of reducing invidious discrimination by protecting individual rights more vigorously.

Even once both the "efficiency" objective and the "equity" objective are clearly specified, there will often be substantial uncertainty about which quadrant a program lies in. Economic evaluation can provide decision makers with information to reduce this uncertainty. The key first stage in economic evaluation is to undertake two preliminary definitional tasks: (1) to define the program and the comparator, and (2) to define the main outcomes of interest – in this case, efficiency impact and equity impact.

The first task is important, and worth highlighting. It is easy to think about both the program and comparator in overly general terms that do not match the real decision options facing policy makers. For example, previous cost-benefit analyses have made the case for investment in early education by showing that high quality intensive programmes may be cost saving in the long run (Heckman et al., 2010). However, what decision makers now need is evidence to help them design pre-school programs and set investment priorities – for example, the start age, targeting strategy, number of contact hours, delivery setting and regulation of provider qualification may all imply different efficiency and equity impacts. Another example is a recent report on the costs and benefits of investment in publicly funded health care in low income countries (Jamison et al., 2013). This report defined the program as "substantial long-term investment in publicly funded health care" and the comparator as "zero investment in publicly funded health care". It found that this investment is both "efficient" and "equitable" – i.e. that it lies in the "win-win" quadrant. This kind of information may be helpful for "agenda-setting" – i.e. making the case for social investment in a broad policy area such as health care, or children, youth and families, and bringing this case to the attention of senior policy makers. However, it does not help with "priority-setting" – i.e. choosing between specific alternative social investment programs within the broad policy area.

Comparisons, moreover, are almost impossible to make at every margin. That a program may be better than none at all does not mean that the next dollar of spending, or the next dollar spent in each region, or the next dollar spend on the lower-middle class versus the poor, could not be better used elsewhere.

There are many different ways of making investments, with quite different efficiency and equity impacts – the devil is in the detail. So we need to distinguish the general "agenda-setting" question – "is social investment in this broad policy sector generally worthwhile?" – from the specific "priority-setting" question – "which specific investment program should we implement within this broad policy sector?" Once the general "agenda-setting" decision has been made to make a social investment in a general policy area, the nitty-gritty "priority-setting" task remains. To provide useful information to guide policy makers in this priority-setting task, the analyst

needs to identify and specify a set of realistic alternative investment options and to compare the efficiency and equity impacts of each option against one another.

A clear definition of both "efficiency impact" and "equity impact" is also crucial. Both concepts can be measured in different ways, depending on the objectives of the decision maker. For example, the main question of interest to a public budget holder facing severe resource constraints might be: will this investment pay for itself within five years? If so, the relevant measure of "efficiency impact" might be public budget impact over a five year time horizon. Alternatively, if the decision maker can afford to take a broader and longer-term perspective, the relevant "efficiency impact" might be the overall balance of social benefits minus social costs over the whole lifetime of program participants, with future costs and benefits appropriately discounted. In the case of health care, it is generally assumed that the relevant "efficiency impact" is the impact on population health. In standard cost-effectiveness analysis, this is calculated as the total health gains of the program minus the health opportunity costs of the resources invested in the program that could have been used in other ways to deliver other health benefits. The "equity impact" refers to whether social inequality is increased or reduced by the program. Equity impact can be defined in different ways depending on the decision problem in hand and what kind of social inequality is of most concern to the decision maker.

Equity impact can also be defined on a continuum from specific to general. For example, imagine policy makers in a low income country are considering an investment in maternity services (Gwatkin, Bhuiya, and Victora, 2004). The two main policy options are illustrated in Figure 2, which shows the resulting impact on the proportion of birth deliveries attended by a skilled midwife in the first two years of the program.

A highly specific definition of equity impact might be equality in gains from the policy over the next two years by wealth asset group, in terms of changes in the proportion of attended deliveries. This is specific in the following ways:

1. The focus on equality of gains from the policy, rather than equality of levels
2. The focus on equality in a specific health service, rather than equality in general health services, or equality in health, or equality in wellbeing (including dimensions of wellbeing other than health, such as consumption, education and so on)
3. The focus on the next two years, rather than the whole lifetime of program recipients
4. The focus on wealth asset groups, rather than other social divisions such as ethnicity and urban-rural location

A disadvantage of the specific definition is that, in all four of these ways, it may give decision makers an overly narrow perspective on equity impact that distracts attention from the social inequalities they are ultimately most concerned about. For example, policy makers may be more concerned to reduce inequality in coverage levels than coverage gains. If so, a policy that delivers larger coverage gains to the poorest wealth quintile group than the richest might be considered more equitable than one that delivers equal gains to both groups. Furthermore, the ultimate concern may be to reduce inequality in lifetime health between socioeconomic groups. In that context, a degree of pro-poor inequality in coverage gains from the policy may be seen as fair compensation for broader inequality in lifetime health.

A highly general definition of equity impact, by contrast, might be equality in quality-adjusted life expectancy at birth between population sub-groups defined by all three social variables: wealth asset quintile, urban-rural location, and ethnicity. A drawback of this

definition, however, is that producing a formal quantitative estimate requires data-intensive modelling of long-term impacts for different social groups. So, depending on the analytical capacity available, the appropriate definition for formal economic evaluation purposes may lie somewhere in between the ends of the specific-to-general spectrum. Furthermore, when conducting an economic evaluation it is always good practice to conduct sensitivity analysis using alternative definitions of key parameters – in this case, alternative definitions of equity impact at different points on the specific-to-general spectrum.

It is not always necessary to conduct a formal quantitative economic evaluation of equity impact: sometimes common-sense will be sufficient to ascertain the direction of equity impact. There are at least three issues to consider when thinking about the likely direction of equity impact. First, does the program explicitly target particular social groups? Second, does the program implicitly favour particular social groups due to the geographical location of service delivery or other factors? Third, does the program require behaviour change on the part of potential recipients in order to deliver benefits? If so, it may favour socially advantaged groups with greater resources (wealth, human and social capital) to invest in the requisite behaviour change. In the health literature, this is sometimes referred to as the distinction between "agentic" programs (e.g. advising pregnant women to consume folic acid) and "structural" programs (e.g. regulations requiring the fortification of flour with folic acid) (McLaren, McIntyre, and Kirkpatrick, 2010).
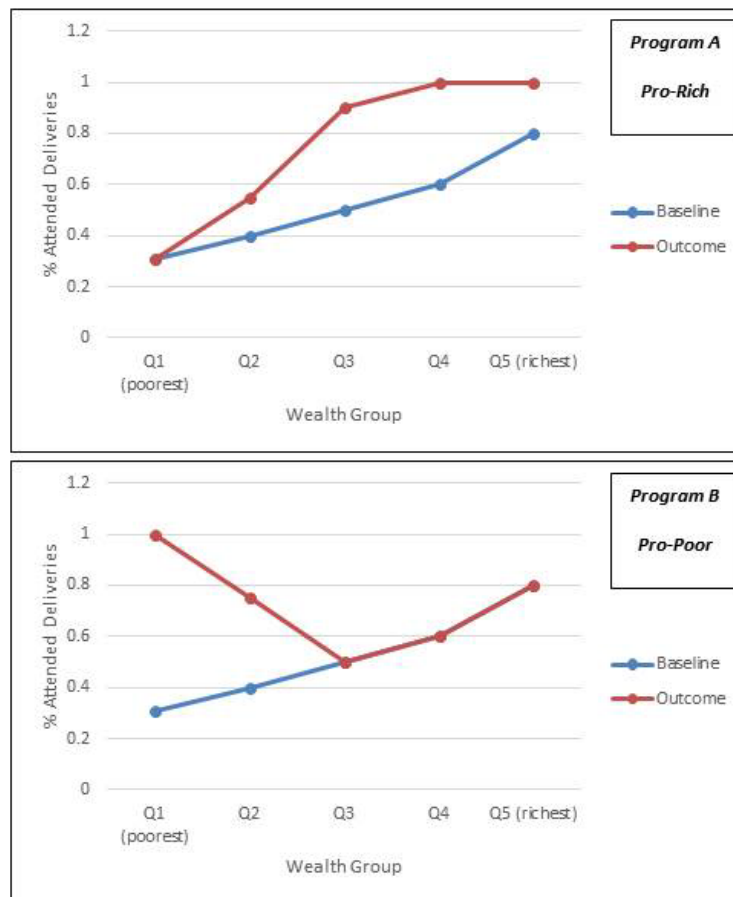

FIGURE 2: Two options for investing in maternity services in a low income country
SOURCE: Adapted from Gwatkin et al. (2004)

GENERAL APPROACHES

We can distinguish four general approaches to providing decision makers with evidence about the equity impacts of policies on social inequalities (Cookson, Drummond, and Weatherly, 2009):

1. Equity Evidence Review
2. Equity Constraint Analysis
3. Distributional Equity Analysis
4. Equity-Efficiency Trade-Off Analysis

The first approach is to review existing evidence about social inequalities relevant to the social investment under consideration. For example, the review might review evidence about the magnitude of the relevant social inequalities, stakeholder views on these inequalities, and how far the main social investment options under consideration have potential to reduce or increase particular social inequalities. Useful guidance on methods for incorporating information about distributional equity in systematic reviews of intervention effects is provided by the Equity Checklist for Systematic Review Authors, produced by the Campbell and Cochrane Equity Methods Group (O'Neill et al., 2014). This checklist uses the acronym PROGRESS-Plus as an aid-memoir to ensure all relevant equity characteristics have been considered – including Place of residence, Race/ethnicity, Occupation, Gender, Religion, Education, Socioeconomic status, and Social Capital, and Plus represents additional categories such as age, disability, and sexual orientation. Equity evidence review might also review the relevant philosophical and applied ethics literature to clarify the equity issues at stake – see, for example, this review by Miljeteig and colleagues about life support restrictions in an Indian neonatal unit (Miljeteig et al., 2010).

The second approach treats equity as a constraint, rather than an objective. It asks: how much benefit is foregone if a more cost-beneficial option is ruled out on equity grounds? The idea is to use standard economic evaluation models estimate the efficiency loss associated with being constrained to choose an "equity-oriented" investment rather than a more cost-effective or cost-beneficial investment. This efficiency loss may be measured in terms of money, life years or other metrics. Like all the methods described below, equity constraint analysis can be performed within a mathematical programming framework if detailed information is available on multiple investment options (Cleary, Mooney, and McIntyre, 2010; Epstein et al., 2007). However, a simple version can still be performed even if information is only available on two programs – one "equity-oriented" investment and one "efficiency-oriented" investment: the efficiency loss simply being the difference between the two.

The third approach estimates the social distribution of costs and benefits by social characteristics that are considered to be of interest from an equity perspective. Distributional analysis is relatively straightforward when evaluating changes in the taxation system, and the financial impacts of tax changes are often broken down by socially relevant groups such as income groups, age groups, married couples versus single people, and so on (Browne and Levell, 2010; Cronin, 1999; Davis, 2015). Distributional analysis is also sometimes performed in relation to social expenditure decisions, including policy on transport (Geurs, Boon, and Van Wee, 2009) and the environment (Serret and Johnstone, 2006). However, distributional analysis of social expenditure programs is challenging, since it is often hard to find credible effectiveness

evidence on how program effects vary by different social groups. A further challenge is allowing for the social distribution of opportunity costs. This will depend crucially on how the programme is financed – for example, financing a programme through a progressive taxation system will have a very different distributional impact than financing it from a budget for poverty alleviation.

Finally, equity-efficiency trade-off analysis aims to quantify trade-offs between efficiency and equity (Asaria et al., 2014; Fleurbaey et al., 2013; Morton, 2014). This is typically carried out using a social welfare function, which explicitly articulates a set of value judgements by the social decision maker about the appropriate balance between equity and efficiency objectives. This requires a summary measure of equity impact that combines information about the social distribution of costs and benefits to estimate the overall direction and magnitude of impact on social inequality. One method of conducting equity-efficiency trade-off analysis in the health sector is described in some detail below – distributional cost-effectiveness analysis (DCEA). Another noteworthy approach to equity-efficiency trade-off analysis is the "equivalent income" approach, which adjusts monetary costs and benefits using a system of "distributional weights" (Fleurbaey et al., 2013). Many of these efforts, however, measure equity on a vertical scale but often give limited or no attention to whether those in equal situations are treated equally (e.g., housing for the poor that is distributed only to a minority of those eligible).

METHODS FROM THE HEALTH FIELD

Extended Cost-Effectiveness Analysis (ECEA)

Extended cost-effectiveness analysis (ECEA) is a form of equity distribution analysis that was developed to assist health care priority setting in low income countries (Verguet et al., 2015; Verguet, Laxminarayan, and Jamison, 2014; Verguet et al., 2013). It extends standard cost-effectiveness analysis in two ways: (1) by including risk protection benefits as well as health benefits, and (2) by providing a breakdown of costs, risk protection benefits and health benefits by social group – typically wealth asset quintile, but alternative social group variables could be used instead. Similar equity distribution analysis approaches have been used in other health contexts, for example to analyse the distribution of costs and health benefits from community case management of childhood pneumonia (Waters et al., 2012) and minimum alcohol pricing (Holmes et al., 2014).

As typically practised, a limitation of ECEA and other equity distribution analysis approaches is that they often do not explicitly model the social distribution of health opportunity costs. For example, Waters and colleagues find a "pro-poor" distribution by wealth asset quintile of lives saved due to investing in community case management of childhood pneumonia. However, they do not consider the impact on lives saved of alternative uses of this investment within the health sector. Alternative public investments in health would also save lives, and this saving of lives would presumably also have a "pro-poor" distribution. So the net equity impact of this program, after allowing for the distribution of health opportunity costs as well as the distribution of health benefits, might be less "pro-poor" than they estimate. However, the distribution of health opportunity cost can in principle be incorporated into the ECEA approach, by estimating the distribution of "net" health benefits (health benefits from the program minus health opportunity costs from not being able to fund displaced programs) rather than merely the

distribution of the "gross" health benefits of the program. In fairness, as noted before, it is virtually impossible to make comparisons at every margin.

Another limitation in the analysis performed by Waters and colleagues is that they assume it is possible to target programs precisely towards individuals within particular wealth quintiles groups, and hence that it makes sense to compare separate programs for each wealth quintile group. Separate programs for each wealth quintile group are not possible in practice, of course, and so it would be more useful to compare realistic program options with different mixes of participants across the wealth quintiles.

Distributional Cost-Effectiveness Analysis

Distributional cost-effectiveness analysis (DCEA) includes an ECEA style distributional analysis, but goes further by constructing on overall measure of equity impact and modelling the potential trade-offs between equity impacts and efficiency impacts (Asaria, Griffin, and Cookson, 2015; Asaria et al., 2014).

To do this, DCEA uses the summary measure of health benefit known as the "Quality Adjusted Life Year" (QALY). The QALY is often used in cost-effectiveness analyses in high income countries, and is routinely used to inform investments in new health technologies by the National Institute for Health and Care Excellence in England and Wales. The advantage of the QALY is that it enables value for money comparisons between different kinds of health care program with different health outcomes. Importantly, it also facilitates the modelling of long-term impacts on people's health that occur well after the intervention study has finished. This is an important advantage over natural units of health benefit such as lives saved, which cannot be used to compare the health benefits of health care programs that improve people's health-related quality of life.

Use of the QALY allows the distribution of health gains from a social investment in health to be compared directly with the distribution of health opportunity costs from displaced alternative social investments in health. It also allows equity impacts to be defined in terms of inequality in lifetime health – quality-adjusted life expectancy at birth – rather than merely in terms of inequality in health gains from a particular program. As discussed earlier, seeking to achieve social equality in health gains from a particular program is a rather narrow and specific principle of equity. Policy makers may ultimately be more concerned with reducing inequality in lifetime health between social groups, and DCEA allows them to measure equity impacts in terms of this more general equity objective.

To compute an overall measure of equity impact, DCEA starts by modelling the baseline social distribution of lifetime QALYs (Love-Koh et al., 2015). Baseline inequality in this distribution is then measured using an inequality index, such as the Atkinson index. The equity impact of the program is then measured in terms of the change in this index due to the program – allowing for the social distribution of health opportunity costs as well as the social distribution of health gains. If the program is in the "win-win" or "lose-lose" quadrant, then no further analysis is required.

However, if the program is in one of the two "trade-off" quadrants – i.e. "win-lose" or "lose-win" – then an analysis of the trade-off between equity impact and efficiency impact is performed. DCEA does this using a social welfare function such as the Atkinson welfare function. This function has an inequality aversion parameter, e, which reflects the decision

maker's degree of concern for reducing social inequality in health (equity) compared with improving total health (efficiency). This allows the analyst to determine what level of inequality aversion, *e,* is required in order to make the program worthwhile. The decision maker can then make up their own mind, based on their own strength of concern for inequality. Empirical benchmarks for *e* can be set based on the precedents set by prior decisions, and also based on surveys of the views of the general public (Robson et al., 2015).

A limitation of DCEA is that to date it has only been applied to distributions of health outcomes, rather than distributions of income, education and other dimensions of wellbeing. It would therefore require further methodological development to make it suitable for application to social investments in children, youth and families. Unfortunately, a QALY type metric is not currently available for social investments in children, youth and families. This is because such investments have many different kinds of health and non-health benefit. For example, intervention studies have evaluated twelve different potential benefits of the Nurse-Family Partnership (Lee et al., 2012): (1) crime committed by child, (2) high school graduation of child, (3) test scores of child, (4) child abuse and neglect, (5) K-12 grade repetition by child, (6) K-12 special education by child, (7) disruptive behavior disorder symptoms of child, (8) crime committed by mother, (9) high school graduation of mother, (10) public assistance required by mother, (11) substance abuse by mother, and (12) employment of mother. Of these, five showed statistically significant benefits in US settings (1, 3, 4, 6 and 7).

In principle, however, it is possible to create a "wellbeing QALY" that would allow DCEA to be applied to social investments in children, youth and families (Cookson forthcoming; O'Donnell et al., 2014). The idea is to measures years of good life, rather than merely years of healthy life. This could be done by adjusting for consumption-related as well as health-related dimensions of quality of life. Quality of life during a period of time would then be a function of both consumption and health during that period, on a scale such that 0 represents a fully unsatisfactory quality of life and 1 represents a fully satisfactory quality of life. Alternatively, it could be done by measuring this directly using subjective life satisfaction data (O'Donnell et al., 2014). Either way, the basic idea would be to value all the outcomes of investments in children, youth and families in terms of their impacts on wellbeing. If quality of life is measured using consumption and health, then this could be done by value outcomes in monetary terms of consumption, as is currently done in cost-benefit analysis. DCEA could then be applied by computing social distributions of both consumption and health over the lifetime, and using these to compute equity and efficiency impacts in terms of wellbeing QALYs rather than health QALYs. Alternatively, outcomes could be valued in terms of their impact on subjective life satisfaction, and wellbeing QALYs computed directly without needing to estimate separate distributions of consumption and health.

CONCLUSION

Social investments in children, youth and families typically have equity objectives to do with reducing social inequalities, as well as efficiency objectives. This paper has described methods of economic evaluation that are capable of addressing both equity and efficiency objectives. These methods can help to provide decision makers with quantitative information about equity impacts on social inequalities as well as efficiency impacts on total costs and benefits. Since equity objectives are often highly controversial, the aim of these methods is not

to prescribe a grand, all-purpose algorithm that tells decision makers what they ought to do. Rather, the aim is to provide a flexible set of tools that can be used to furnish decision makers with useful quantitative information that helps them achieve their own preferred equity objectives.

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http://www.wsipp.wa.gov/Reports/12-04-1201

Dartington Social Research Unit Investing in Children Cost-Benefit Model
http://dartington.org.uk/projects/investing-in-children/

National Institute for Health and Care Excellence in England and Wales
https://www.nice.org.uk/

Statistics Canada LifePaths model of individual long-term outcomes
http://www.statcan.gc.ca/eng/microsimulation/lifepaths/lifepaths

Campbell and Cochrane Equity Methods Group
http://equity.cochrane.org/welcome

Disease Control Priorities 3 Project work on extended cost-effectiveness analysis
www.dcp-3.org

University of York work on distributional cost-effectiveness analysis
https://www.york.ac.uk/che/research/equity/d-c-e-a/phrc/

Family-Nurse Partnership UK
http://fnp.nhs.uk/

Nurse-Family Partnership US
http://www.nursefamilypartnership.org/

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