Learning about Aggregate Distributional Cost-Effectiveness Analysis

What is this document for?

This document will familiarise you with one research method used to measure value for money and to describe how different population groups benefit from healthcare interventions.

The content of this document builds on a training example we previously developed about economic evaluation and health inequality. You may be interested to learn more about the common terms, such as ***economic evaluation*** and ***health inequality***, by reading that training example. The numbers used in this example are for illustrative purposes only and may not always represent real-world data.

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What is 'Distributional Cost-Effectiveness Analysis (DCEA)'?

When measuring the effect of a healthcare intervention, researchers and policy makers are interested in how people's health will change if the intervention is provided. They are also interested in whether those changes in health are the same or different across different population groups, e.g., rich vs poor. Undertaking a distributional cost-effectiveness analysis will produce results that can help to answer these questions.

Distributional cost-effectiveness analysis (DCEA) is a method of research that investigates how health care influences the health outcomes experienced in the population as a whole, and whether the same care has different impacts in different population groups. Difference in the health outcomes experienced in different population groups is a type of health inequality.

Ideally, researchers would like to know how these different population groups differ in all aspects relating to health and health care for a particular intervention. For example, in the case of interventions to help people quit smoking, researchers would like to know the number of smokers in the rich and poor groups and the proportion of smokers that would use the nicotine replacement therapy to help quit smoking. A full DCEA analysis that takes account of all these differences is available in the training example.

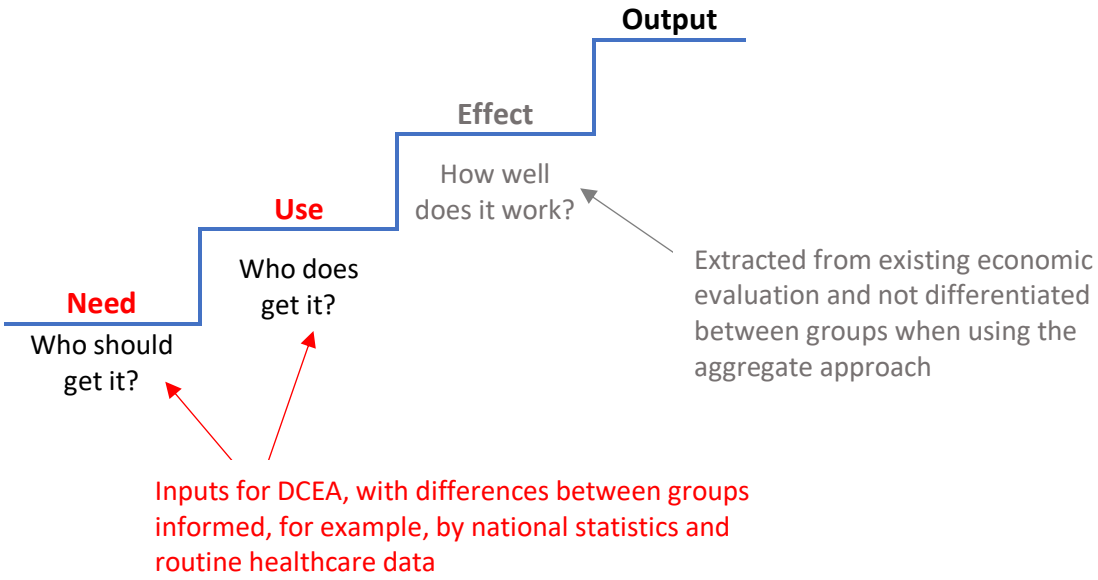
However, sometimes researchers undertake a quicker form of analysis called ***aggregate DCEA***. This method can produce results more quickly than a full analysis; it uses less information, and uses information about the costs and health outcome from the intervention that have already been calculated. This quicker approach is less accurate, but can be useful when time and resources available for analysis are limited. It can also give an idea of whether investing in a full analysis is worthwhile.

What is 'Aggregate DCEA'?

It is a method to assess how an intervention affects health inequality that uses aggregate data. Aggregate data are summaries of information, such as average cost. With aggregate data you do not see each of the individual measurements that underlie the summary.

Aggregate DCEA can be explained as a series of steps:

- Step one starts from an existing economic evaluation which provides information on the aggregate or overall **effect** of an intervention. This is typically the average change in healthcare costs and the average change in health outcomes among those receiving the intervention.
  - E.g., providing nicotine replacement therapy could increase the number of years in good health lived by smokers by on average 2, at a cost of £1000 per smoker. (*Please note, these numbers are hypothetical and do not reflect the real-world costs and health effect*)
- Step two gathers information on how the health benefits from the intervention are spread among population. This is based on levels of '**need'** and '**use**' in each population group.
  - **Need**: who should get it? E.g., how many people smoke in each socioeconomic group?
  - **Use**: who does get it? E.g., how many smokers in each socioeconomic group use the nicotine replacement therapy?
- Step three combines the information about **need**, **use** and **effect** to estimate the **output** including impacts on population overall health and on health inequality



Example:

We will go through an example of providing nicotine replacement therapy for adult smokers to learn more about how to conduct aggregate DCEA.

Step 1: Effect

Obtain the effect of the intervention from a published economic evaluation

The effect includes the change in costs and the change in health outcomes attributed to the intervention. The effect of nicotine replacement therapy was reported in a previous study as costing on average an additional £1,000 per smoker over and above current services, and providing on average 2 quality-adjusted life years (QALYS) per smoker.

Step 2: Need and use

Estimate the size of the target population for the intervention in each socioeconomic group

The target population is adult smokers who benefit from the nicotine replacement therapy.

The Office for National Statistics in the UK records that there are 8 million smokers in England. A regular survey of the general population (Health Survey for England) collects information about smoking status and socioeconomic status. Socioeconomic status in this case is represented by a measure, the index of multiple deprivation (IMD), which ranks each geographical area with about 1500 residents according to a range of things that contribute to socioeconomic advantage. Grouping areas by IMD allows us to describe impacts across five equally sized populations, from the fifth of the population that live in the most disadvantaged areas (IMD1) to the fifth that live in the most advantaged areas (IMD5). In this way we can summarise the proportion of smokers in each area defined by IMD (Table 1).

Not all adult smokers will use nicotine replacement therapy even if it is provided freely by the NHS. The information recorded by the NHS Stop Smoking Services allows us to describe the proportion of smokers in each IMD group that make use of NHS nicotine replacement therapy (Table 1).

Now we can calculate the number of people in each group defined by IMD who benefit from the intervention, e.g., IMD1 is 8 million x 23% x 4%=73,600. We can obtain the distribution of the target population by calculating the percentage of target population in each IMD., e.g., IMD1 is 73,600/601,600 = 12.2%. The distribution is also shown in Table 1.

Table 1. Distribution of smokers, uptake rate of nicotine replacement therapy and size of target population in each IMD group

	IMD1	IMD2	IMD3	IMD4	IMD5	Total
Adult smokers, %	23%	21%	20%	19%	17%	100%
Intervention uptake rate, %	4%	6%	7%	10%	12%	-
Target population, n	73,600	100,800	112,000	152,000	163,200	601,600
Target population, %	12.2%	16.8%	18.6%	25.3%	27.1%	100%

Step 3. Output

Estimate the distribution of population health benefits by socioeconomic status

We assume that each smoker using the therapy has the same effect in terms of health outcomes (QALYs). Therefore, the distribution of target population across the population groups is also the distribution of the health benefits.

First, we calculate the total health benefits for the target population, i.e., total number of target population (601,600) x average health benefits (2 QALYs) = 1,203,200 QALYs. Second, we estimate the distribution of health benefits using the distribution of target population (Table 2), e.g., IMD1, 1,203,200 x 12.2% = 146,790 QALYs.

Table 2. Distribution of health benefits

	IMD1	IMD2	IMD3	IMD4	IMD5	Total
Population receiving health benefits, %	12.2%	16.8%	18.6%	25.3%	27.1%	100%
Health benefits, QALYs	146,790	202,138	223,795	304,410	326,067	1,203,200

Estimate the distribution of health opportunity costs

In a publicly funded healthcare system such as the NHS, the people who use services do not pay for them individually. Instead, services are funded from the NHS budget. When money is used to fund a particular intervention for a particular group, such as smokers, this does not come from a pot of money that would have only funded services for smokers. The money comes from a pot that could have funded services for any NHS user.

In economic evaluation, we convert costs into the health benefits that could have been achieved through funding alternative services. This is known as the health opportunity costs. Because different population groups use the NHS to different degrees, the health benefits of these other services would not be shared equally across the population. Sicker groups tend to have more health benefits from alternative services, and we would call this "bearing more of the health opportunity costs".

To calculate the health opportunity costs in each group, we calculate the total additional costs of providing smoking cessation services, i.e., multiply the total number of target population (601,600) by the average incremental cost per person (£1000) = £601,600,000. Previous research has shown that spending an additional £13,000 in the NHS funds would fund sufficient services to provide 1 QALY health benefit [1]. From this we can calculate the total health opportunity costs of 46,277 QALYs (£601,600,000 / £13,000 per QALY = 46,277 QALYs) for the nicotine replace therapy.

Another study calculated how much different population groups benefit from additional NHS expenditure [2] (Table 3) using the Hospital Episode Statistics database containing details of all admission, A&E attendances and outpatient appointments at NHS hospitals in England. Based on these estimates, we can calculate the amount of health opportunity costs for each group, e.g., IMD1, 46,277 x 26% = 12,032 QALYs.

Table 3. Distribution of health opportunity costs

	IMD1	IMD2	IMD3	IMD4	IMD5	Total
Health opportunity costs, %	26%	22%	22%	16%	14%	100%
Health opportunity costs, QALYs	12,032	10,181	10,181	7,404	6,479	46,277

Calculate the net health benefits for socioeconomic groups

We obtained the health benefits (Table 2) and health opportunity costs (Table 3) for each population group, and now we can calculate the net health benefits by subtracting the health opportunity costs from the health benefits (Table 4), e.g., IMD1, 146,790 – 12,032 = 134,758 QALYs. As we assume non-smokers do not benefit from nicotine replacement therapy, the net health benefits estimated here are for all people in the population group. For all people (smokers and non-smokers) in IMD1, providing nicotine replacement therapy will lead to additional health benefits at 134,758 QALYs. Using the total population size obtained from Office for National Statistics (Table 4), we can calculate the average benefit per individual.

Table 4. Distribution of net health benefits

	IMD1	IMD2	IMD3	IMD4	IMD5	Total
Health benefits	146,790	202,138	223,795	304,410	326,067	1,203,200
Opportunity costs	12,032	10,181	10,181	7,404	6,479	46,277
Net health benefits	134,758	191,957	213,614	297,006	319,588	1156,923
Adult, n	8,307,456	8,863,275	8,790,681	8,657,257	8,376,275	42,994,944
Net health benefits (per capita)	0.016	0.022	0.024	0.034	0.038	-

Summarise the impact on health inequality

We now know the net health benefits of providing nicotine replacement therapy for a typical individual in the five groups. The final step is to assess how these benefits affect health inequality.

In England, people living in the most advantaged areas (IMD5) expect to live 11 years in full health longer than those in the most disadvantaged areas (IMD1) [3]. As Table 4 shows, the net health benefits per capita are higher for people living in the more advantaged areas. Based on these results, we conclude that providing nicotine replacement therapy for smokers increases overall health, but tends to increase health inequality, i.e., the gap in net health benefits between less advantaged (IMD1) and more advantages (IMD5) in health outcome is larger.

Researchers are also interested in to what extent this increase health inequality. The analysis requires the use of a summary measure to describe the distribution of health by giving different weights to the health benefits gained by different population groups. Detailed information about summarising, presenting and interpreting the impact on health inequality is available in the training example we previously developed.

References:

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