Measuring environmental outcomes is far more complex than we think

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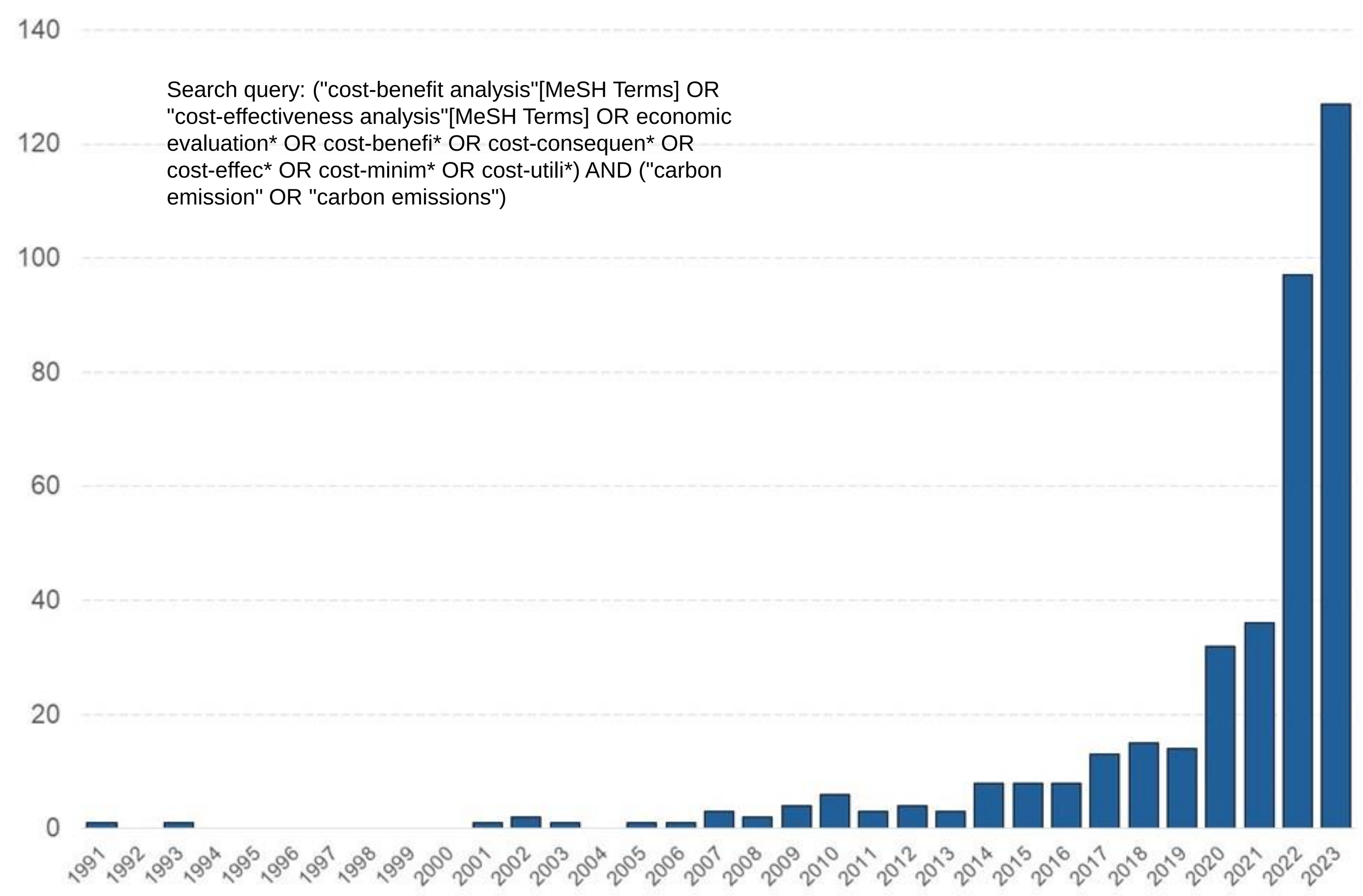
INTRODUCTION

In economic evaluation, it is typical to see assessments that measure the total costs and health outcomes (often quality-adjusted life years, QALYs) to help inform a decision. In some cases, other factors such as wider societal costs and benefits are included. In recent years, there has been a substantial increase in the number of studies that include carbon emissions as well as standard economic outcomes (see Figure 1).

Figure 1: Frequency of economic evaluations including carbon emissions as an output



Accounting for the environmental impact of healthcare is an important issue. However, the true impact of changes to the care pathway is more complex that is currently being reported.

The aim of this poster is to demonstrate that there are many unexpected consequences of environmental harm (and benefit) that arise from healthcare decision making.

METHODS

A hypothetical example is used (see Table 1) to demonstrate a number of unexpected consequences that are not usually captured in economic evaluations that aim to measure environmental harm

In the example below, two medical devices are compared, each reporting outcomes for costs (whole lifetime, including downstream care pathway costs), life expectancy (in months) and carbon emissions (whole lifetime, including the downstream changes to the care pathway).

Table 1: Consequences of using each device

Outcome	Device A	Device B
Cost	£3,820	£5,410
Life expectancy	121 months	120 months
Carbon emissions	25kg	30kg

On first assessment, it would appear that Device A 'dominates' Device B in that it has more favourable outcomes in all respects. A decision maker would, therefore, ordinarily approve Device A for use in the healthcare system and might reasonably expect that it will help move the system closer to a net zero emissions target.

However, the following section details three additional considerations that are not usually accounted for in such evaluations.

ADDITIONAL IMPORTANT CONSIDERATIONS

The following factors should also be in important part of a health economic evaluation that aims to estimate environmental outcomes

Principle 1: Impact of displaced healthcare

Device A is £1,590 less expensive than Device B. However, this saved money will be reinvested elsewhere in the health system. Because more healthcare resources are being used, this will lead to an increase in carbon emissions. In the UK, the NHS is responsible for approximately 25 megatons of carbon emissions and has an annual budget of £168.8 billion. Therefore, for each £1 spent, the average CO_2^e emission is 0.1481kg. This means that the £1,590 saving from Device A will be reinvested and will (on average) lead to an *increase* of 235kg (far higher than the 5kg direct reduction from using a more sustainable device).

Principle 2: Impact of increased life expectancy

On average, a human is responsible for around 12,700kg of CO_2^e emissions each year. This means that, if Device A leads to one additional month of survival, this would be expected to increase CO_2^e emissions by approximately 1,058kg. Again, this is vastly greater than the anticipated direct saving from the more sustainable device. This assumes that only life expectancy changes the level of CO_2^e emissions. In practice, this might also be driven by changes in quality of life, although it is unknown whether increases in quality of life would be likely to increase or decrease CO_2^e emissions (it would likely vary for different conditions). Although these consequences fall outside the health system, they cannot be ignored, since they would have a real impact on the level of CO_2^e emissions and would, therefore, impact on any aspirations to reach a net zero level.

Principle 3: Impact of climate change on human health

The increase in carbon emissions described above will impact on human health on a global level. It is estimated that, for every 1 million tons of CO_2^e emissions, there will be 226 excess deaths as a result of climate change. This means that the net increase in CO_2^e emissions described above (-5kg + 235kg + 1,058kg = 1,288kg will contribute to approximately 0.000291 additional deaths. Although this appears small, it would equate to around 0.01 QALYs, which may be enough to impact on the incremental cost-effectiveness ratio in the standard economic evaluation. Of course, this only includes the impact of excess deaths; in reality, climate change impacts on many other factors, including quality of life and other economic consequences.

CONCLUSIONS

Measuring the true environmental impact of medicines is complex, and ignoring key indirect consequences could results in suboptimal (or even counter-productive) decisions. Moving healthcare systems towards a net zero target will require wider thinking that simply choosing between individual therapies.

In the example above, a device that initially seemed to save 5kg CO_2^e emissions actually results in a net *increase* of 1,288kg. It is clear, therefore, that further methodological work is required before decision makers start to base important decisions on simple assessments.

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