Productivity Losses and How they are Calculated

What is CREST?

The Centre for Health Economics Research and Evaluation (CHERE) at UTS has been contracted by Cancer Australia to establish a dedicated

Cancer Research Economics Support Team (CREST) to provide high quality, expert advice and support to Multi-site Collaborative Cancer Clinical Trials Groups.

FactSheets

CREST will produce a series of factsheets as resources for cancer collaborative group researchers wishing to include economic evaluation in their clinical trials.

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SUMMARY

- When people take time out of the workforce due to cancer this has a cost not only for the individual and their family, but also for society. This societal cost is lost productivity.
- Estimates of lost productivity can be used as a measure of cancer burden to inform policy making, service planning, economic evaluations and research funding.
- Many instruments are available to measure time away from work, and selection of the most appropriate instrument will be based on the research question under consideration.
- There are a number of ways to value lost productivity, and there is ongoing debate as to the best method. In this FactSheet we describe the four most common methods - the human capital, friction cost, Washington Panel and willingness to pay approaches.
- Only the human capital and friction cost approaches are recommended in pharmacoeconomic guidelines around the world.

Ultimately, the method for calculating, measuring and valuing productivity losses will depend on the clinical question, healthcare setting and policy context of the analysis being conducted.

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Productivity Losses and How they are Calculated

Everyone's work contributes to the economy in some way. Therefore, when an individual takes time out of the workforce due to illness or injury this potentially represents a loss not only to themselves in the form of lost income, but also a loss to the economy. This economic loss impacts society, and is called lost productivity. This FactSheet describes why and how we can measure lost productivity due to illness.

What is lost productivity?

Productivity loss may be temporary, such as taking time off to undergo treatment *(temporary absenteeism)*, or it may be permanent due to early retirement *(permanent absenteeism)*. When someone returns to work after illness or injury, but is less productive than before their diagnosis the associated loss is referred to as *presenteeism.* If someone dies before their retirement age, this is known as loss due to *premature mortality.*

Traditionally, lost productivity has focused on paid work. However, there is increasing recognition that people's *unpaid productivity*, through roles such as caring for children or relatives, household tasks, and volunteering, also makes important contributions to society. Some estimates of lost productivity therefore also include unpaid productivity.

Why is lost productivity important?

Estimates of lost productivity provide a societal perspective on the burden of a disease. They can be used together with epidemiological measures of burden such as incidence, prevalence and mortality, to inform population based cancer prevention and control decisions.

Lost productivity can also be incorporated into economic evaluations. Economic evaluations compare the costs and benefits of new treatments and services, and are increasingly used to inform decisions for how healthcare resources should be allocated. Typically, those decisions consider the incremental cost-effectiveness of a new intervention compared with the current practice. This is expressed as the incremental cost-effectiveness ratio: the ratio of the difference in costs to the difference in benefits between the new intervention and existing practice.

Including the workforce implications of health and illness in economic evaluations provides a broader view of the costs and benefits of healthcare to decision makers. Depending on the method adopted to value those productivity effects, it might impact on the costs or benefits when calculating the incremental cost-effectiveness ratio.

How to measure & value lost productivity

The methods for estimating lost productivity remain an area of considerable debate. Traditionally, the human capital approach has dominated the literature, but the friction cost approach is emerging as an alternative. Less often used are the Washington Panel approach and the willingness to pay approach. The inclusion of these and other methods for estimating lost productivity in national pharmacoeconomic guidelines around the world is summarised in Table 1.

In Australia, both the Medical Services Advisory Committee (MSAC) and the Pharmaceutical Benefits Advisory Committee (PBAC) recommend that the inclusion of productivity is reserved as a supplementary analysis to cost utility analyses, rather than form part of the base case.[1,2] The PBAC guidelines discuss a method that is consistent with the friction cost approach.[1] A recent review of the international literature suggests that a pragmatic approach is to use both the human capital and friction cost approaches as sensitivity analyses.[3]

Table 1: Guidelines on including productivity losses in economic evaluations[4]

Country	HCA	FCA	WPA	Other methods	Not clear
Austria	X	X			
Brazil	X				
Cuba					X
Denmark	X	X			
Finland					X
France		X			
Germany	X				
Hungary	X				
Ireland					X
Italy	X				
The Netherlands		X			
Norway	X	X			
Poland	X				
Portugal					X
Russia				X	
Slovak Republic	X				
South Korea				X	
Spain					X
Sweden	X				
Switzerland					X
Thailand	X				
United States		X			

Abbreviations: HCA: human capital approach; FCA: friction cost approach; WPA: Willingness to Pay approach.

Each method has its own strengths and limitations, and requires somewhat different data for its implementation. Importantly, each method measures a specific aspect of productivity loss and may yield quite different cost estimates. These differences are discussed below.

The human capital approach

The traditional method for estimating productivity losses has been the human capital approach. This assumes that individuals have the potential to produce a stream of outputs (productivity) over their working life. The human capital approach measures lost productivity as the amount of time by which working life is reduced due to illness. This work time lost is then valued at the market wage; which economists assume, in a competitive market, reflects the value of that work to society. The resulting losses in productivity should be adjusted to account for labour force participation (the proportion of the population who wish to be employed) and unemployment (the proportion of labour force participants that are unemployed).

Thus, to calculate lost productivity using the human capital approach you simply need to know the length of time absent from work due to illness, the market wage, the labour force participation rate and unemployment rate.

For example, if an accountant takes three months off work after their cancer diagnosis, their working life has been reduced by three months. If the average accountant earns $1,000 per month, the loss of productivity to society is estimated to be $3,000. Assuming labour force participation is 90% and unemployment is 5%, the expected lost productivity is $2,565 ($3,000 x 0.9 x (1-0.05)).

Traditionally the human capital approach has only been used to capture losses due to absenteeism and premature mortality. However, economists are increasingly applying it to measure and value presenteeism and unpaid production.

Critics of the human capital approach point out that the resulting values of lost productivity are subject to biases in earning patterns. Females, young people and socioeconomically disadvantaged groups typically earn less, so their lost productivity is typically valued lower with this approach. In addition, the human capital approach measures 'potential' lost productivity, rather than the actual loss incurred by society. This leads to large estimated values of lost productivity, particularly for chronic conditions or conditions in young people.

The friction cost approach

The friction cost approach was developed in response to the criticisms of the human capital approach. The friction cost approach proposes that society only incurs losses during the period it takes to replace a worker (the so-called 'friction period') due to illness, with internal labour reserves taking up the slack of a missing employee in the short term. For longer term or permanent workplace departures, the friction cost approach

assumes that there is a pool of unemployed workers who can take over the role either directly or at the end of a chain of job movements.

Under this method, losses are again valued using the market wage. To calculate the value of lost time you need to know the length of the friction period, which is based on the level of unemployment (when more people are unemployed it is easier to find a replacement worker) and the efficiency of identifying replacement workers. Because these factors vary by industry, job type and over time, the friction period is context-specific and constantly changing.

For example, if an accountant takes 3 months off work after their cancer diagnosis, their employer will need them to be replaced. In this example, assume it takes one week to recruit a casual accountant, and the casual accountant is only 50% productive in their first week. The friction period is therefore measured as the one week it takes to recruit the casual worker, plus 50% of the first week for the replacement accountant to get up to speed. This period is valued at the average wage of $1,000 per month ($250 per week); the friction cost approach estimate of lost productivity is $375 ($250 + $250 x 0.5).

Recent developments in this method take into account the team nature of many modern workplaces by considering the capacity for co-workers to substitute for a colleague who is away sick (*compensation effects*), as well as the negative effects that one person's absence may have on team-dependent work (*multiplier effects*). However, the magnitude of these effects can be difficult to estimate.

While estimates of lost productivity based on the friction cost approach are generally considered more realistic than those of the human capital approach, many economists question the lack of theoretical underpinning to the friction cost approach. It also has the same equity flaws as the human capital approach, although these tend to be less pronounced as the resulting estimates of value for productivity loss are smaller. A more practical concern about the friction cost approach is that it requires detailed data on the friction period, which is unstable and often not known. In practice, most studies use an average friction period of around 3 months[5], although this is not how the application of the method was envisaged by its developers.

The Washington Panel approach

The Washington Panel approach assumes that individuals consider changes to their productivity and income when they complete quality of life questionnaires. This means the impact of productivity losses is captured in the quality of life measures produced by those questionnaires, typically utility scores. In this way lost productivity is incorporated into the denominator (as a benefit) in estimating the incremental cost effectiveness ratio within an economic evaluation where quality adjusted life years are measured, rather than the numerator (as a cost).

However, research suggests that most individuals do not consider income changes in their health state valuations when completing quality of life questionnaires.[6] This reduces

the extent to which there might be double counting if both monetary estimates of lost productivity and utility values are used within an economic evaluation.

Willingness to pay approach

The Willingness to Pay approach is not a pure measure of lost productivity associated with illness. By using economic methods to ask people the amount they would be willing to pay to reduce the risk of experiencing a negative health event, willingness to pay studies capture lost wages as well as medical expenses and intangible costs such as pain and suffering.

The single example of the Willingness to Pay approach being used in a study of cancer related premature mortality productivity losses resulted in much higher estimates of lost productivity than studies using the friction cost or human capital approaches.[7] The Willingness to Pay approach is currently not recommended in any national pharmacoeconomic guidelines (see Table 1).

Measuring the time absent from work

Underpinning the four approaches to estimating the loss in productivity is the ability to measure the loss in work time associated with illness. Time absent from work can be measured in a number of ways. Some studies use administrative data, such as leave records or insurance claims to estimate time absent from the workplace. Other studies use workplace reports of worker productivity, either through objective measures such as number of phone calls taken by call centre staff, or through subjective reports from managers.

Most commonly, lost productivity is captured through self-report. There are many instruments available for the self-reporting of work time lost due to illness, some of which are specific to a research question, job type, or disease, although none are cancer-specific.

A recent review of generic self-reported instruments for measuring productivity loss recommended the Work Limitations Questionnaire and Stanford Presenteeism Scale as the English language instruments with the best, although still limited, evidence of reliability, validity and responsiveness.[8] However, both of these instruments only measure presenteeism, and it is complex to analyse the responses in a way that allows monetary valuations from the Work Limitations Questionnaire, and not possible with the Stanford Presenteeism Scale.

Given these limitations, other generic instruments which collect both absenteeism and presenteeism, and allow valuation in monetary terms are the Health and Labor Questionnaire (which also collects information on unpaid production) and the Work Productivity and Activity Impairment Questionnaire (which is available for general health and specific conditions).[9] Given the low levels of evidence supporting any one instrument for measuring productivity loss, caution should be taken to select a measure which reflects the research question and objectives of the study.

Cancer and lost productivity

Over 40% of people diagnosed with cancer in Australia are of working age[10] and many cancer patients take time off work for treatment and recovery.[11] Approximately one third of people do not return to employment after a cancer diagnosis.[11]

There are no national estimates for the paid and unpaid productivity losses associated with cancer in Australia. Previous Australian research has only estimated productivity losses for all cancers at a state level[12] or for specific cancers.[13]

There are few studies examining lost productivity for less common cancers worldwide, and presenteeism and unpaid work are rarely included in base case analyses. A recent paper examining the economic burden of cancer in the European Union took a societal perspective and identified that 60% of the economic burden of cancer is in non-healthcare areas, and in particular, lost productivity.[14] Specific estimates for Ireland show a substantial productivity loss incurred by society due to cancer-related premature mortality - €73 billion, or 1.4% of the Irish gross domestic product (GDP), in cumulative net present value terms over the next 20 years.[15] Similar estimates for the US place the cost of lost productivity due to cancer premature mortality at approximately 1% of US GDP.[16]

Applications of lost productivity estimates

Estimates of lost productivity provide an additional measure of the burden of cancer on society. While traditional measures such as incidence and mortality take a public health perspective, productivity loss takes an alternative, economic, perspective. This may form a useful supplement for policy and decision makers, particularly because the resulting estimates can be expressed in terms of other economic metrics, such as GDP.

There continues to be considerable debate about which costs should be included in economic evaluations. Including productivity losses in economic evaluations may lead to more optimal resource allocation at the societal level, as a broader range of costs to society and the economy are considered in decision-making.

Lost productivity estimates are also of value outside of the policy context. Research in the US, UK, Canada and Australia has revealed considerable mismatches between funding levels for individual cancer sites and the societal burden of cancer.[3] Estimates of lost productivity could be used to inform research funding allocation in order to better reflect the societal impact of cancer.

Regardless of how they are used, the way in which productivity losses are measured is important. When studies of productivity losses included two approaches, the friction cost estimates were usually 1.4% to 2% of the human capital approach estimates.[3]

Conclusions

Lost productivity is an important part of considering the societal burden of cancer. Given the ongoing debate over the most appropriate methods and instruments for estimating lost productivity, researchers should take a pragmatic and transparent approach to its measurement, such as including results of both human capital and friction cost based analyses in their results. This will allow other researchers and decision makers to choose which estimate to use based on their philosophical viewpoint.

For more information

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