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Methods for assessing costs of gambling related harms and cost-effectiveness of interventions

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1.1 Key points

When resources are limited, investing them in one way will likely mean that there will be less available for other activities, at least in the short term.

This necessitates careful decision making to ensure that finite resources are used to their best effect.

The discipline of economics is concerned with the allocation of scare resources and offers a range of approaches to inform such difficult decisions, including investments in actions to reduce gambling-related harms.

Four economics related questions may particularly inform decision making:

What are the costs of doing nothing?
What does it cost to deliver an intervention to address this issue?
Would such an intervention provide good value for money?
Would such an intervention be used by the intended population?

1.2 Overall rationale for using economic approaches

This guide complements our report (1) looking at the challenges in identifying and valuing the many different potential harms associated with gambling, such as impacts on mental and physical health, risks of unmanageable debt, family relationship difficulties, and poor general social functioning, as well as increased risks of crime and suicide.

These harms cut across multiple spheres of society and a range of statutory and non-statutory budget holders. Addressing the health and wellbeing impacts for those who gamble and those close to them likely requires broad public health approaches for both prevention and intervention. This then implies that the costs of intervening will fall on the public sector agencies whose concern it is to work towards such outcomes for the population.

However, such agencies have limited resources, both in physical terms (e.g. workforce) and monetary budgets. They cannot meet all needs and wants expressed by the populations they serve and using resources in one way will likely mean having less available for other activities. This necessitates very careful decision-making to ensure that the limited resources are used to their best effect.

Economics as a discipline is mainly concerned with the allocation of scare resources. It has a highly developed suite of tools that can assist with such difficult decisions e.g. criteria that define what 'value for money' might mean and approaches for developing evidence about value for money. Economic arguments and approaches are now widely used by commissioning bodies both locally and nationally, for example the National Institute for Health and Care Excellence (NICE) has developed quite specific economic-related approaches to inform their decisions about whether the National Health Service (NHS) should adopt specific interventions (2).

1.3 Key economic questions to inform decision making

Four economic questions in particular are helpful for decision making in such contexts. These are briefly described and then examined in more detail in the sections that follow.

What are the costs of doing nothing?

It is relevant for all concerned to understand the full impact of maintaining the status quo. Examining such impacts comprehensively often highlights that doing nothing incurs (potentially avoidable) costs. Understanding and evidencing the impacts and

costs of gambling harms can then help provide the impetus needed to develop and deliver interventions to help alleviate them.

What does it cost to deliver an intervention to address this issue?

If intervention is warranted, it becomes necessary to understand the full resource and cost implications of developing and delivering effective interventions to the intended population. It is important to assess resource requirements against what is already available (e.g. in terms of a suitably trained workforce, infrastructure for prevention or treatment or input from other sectors such as support from volunteers) and what new investment might be needed (e.g. additional legislation, further staff training or recruitment).

Would such an intervention provide good value for money?

Of course, when both physical resources and budgets are generally limited, the most relevant question would be whether investing in a particular intervention is a good use of resources compared with other things that could be done with the same resources/budget. This is a question about value for money or cost-effectiveness i.e. linking together information about what an intervention costs to deliver and its worth in terms of what it achieves, and comparing that with the equivalent information for alternative uses of the same resources/budget. There are specific 'economic evaluation' frameworks available to help undertake such assessments.

Would such an intervention be used by the intended population?

The final question concerns whether resources and budgets are being spent on the target population, without systematically excluding any specific sub-groups (e.g. by age or socio-economic group). Failure to achieve this might mean that an intervention doesn't deliver the anticipated benefits or value for money.

2. What are the costs of doing nothing?

2.1 Key points

There are three main types of cost: direct costs for services (e.g. to the health care or social welfare systems); indirect costs to society, (for instance due to reduced participation in paid work and volunteering); and intangible costs which are more challenging to measure (e.g. impacts of the stigma of problematic gambling).

A pragmatic approach to estimating the costs of doing nothing to address gambling harms would be to draw on estimates that have already been published; however, as highlighted in the accompanying report, this particular area is relatively under-developed and carries various methodological challenges.

This suggests that we need new estimates of the status quo to understand the implications of not taking action as well as considering potential ways of intervening to reduce the adverse impacts of gambling.

Various widely accepted economic principles can be applied when generating new cost estimates but the exact approach and level of accuracy will depend on data availability and the uses to which the estimates will be put.

Broadly, generating new estimates involves identifying relevant inputs and impacts, quantifying them and then valuing them in monetary terms.

Methodological variations and limitations impact on estimates and interpretation of costs. This means it is very important to be transparent in methods used.

2.2 Why estimate the costs of doing nothing?

The accompanying report highlights a very diverse set of gambling harms cutting across different public and private sector services, as well as impacting on families, communities and wider society. Inputs and costs will arise at various junctures. In highlighting a similar crossover of inputs and budgets in relation to mental health care, Knapp referred to the complex network of involvements from multiple agents and bodies across public, private and other sectors (e.g. families, the criminal justice system, employers) as the 'mixed economy of care' (3).

Doing nothing with regards to major social issues such as problem gambling thus carries a range of economic implications, as emphasised by the Australian Productivity Commission in their work on gambling (4). It is important to understand what these are, especially in contexts where resources are finite and needs remain unmet, because involvements naturally draw on resources and budgets that could be put to other, potentially better, uses.

Demonstrating the scale and nature of the costs of gambling harms could help identify where both the burdens and responsibilities fall. This, in turn, can help raise awareness of the full impact of gambling-related harms, help make the case for intervening to either prevent or address such harms and indicate potential routes to intervention. Such data are commonly used to make the case for various public health strategies (5).

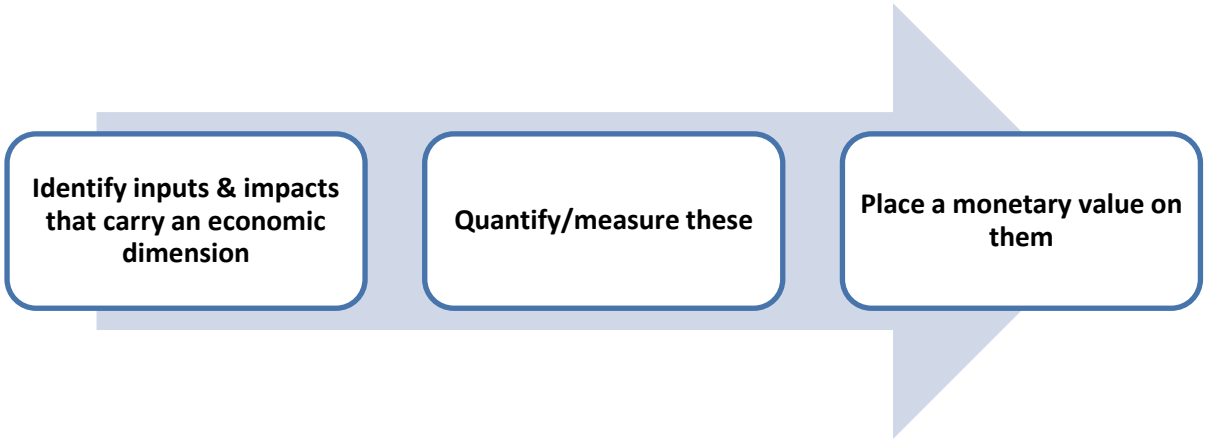
Diverse sets of economic impacts are often summarised in the form of 'cost of illness' or 'burden of illness' studies (in the case of health issues) or 'economic cases'. A pragmatic approach, especially when time and resources are limited, is to seek out relevant estimates that have already been published. Unfortunately, as indicated in the accompanying report, work on quantifying the costs of gambling harms remains limited and there is little consensus on how to do so given some specific methodological challenges. This suggests a need to derive new methodologically robust estimates.

2.3 How to estimate the costs of doing nothing?

Various widely accepted economic principles and standard concepts are helpful for estimating the costs of gambling harms. These have been applied to other issues with similarly broad-ranging impacts (e.g. alcohol addiction, mental health conditions).

Broadly, the tasks for estimating costs are as follows and each of these is explained in more detail:

Figure 1: Key steps for estimating costs



With a potentially wide range of impacts to consider (e.g. unemployment, financial debt, unpaid care), attaching a monetary value to each provides a common metric which is useful for comparing different impacts against each other (e.g. to examine which sector of society bears the greatest cost or which sub-group incurs the greatest costs) or for aggregating costs so that total costs of gambling harms can be compared, for example, against harms caused by other activities.

While such comparisons can provide invaluable insights for identifying priorities for investment, they can present challenges. The following sections will illustrate that the context in which such estimates are produced necessitates methodological variations which make it virtually impossible to completely standardise approaches used. Such variations then present challenges for direct comparisons. Some helpful questions to ask when assessing existing estimates might be: What data were used and are those

data reliable? What population do the data refer to? What impacts were included? How did they monetise those impacts? The relevance of these questions will be covered in the remainder of this section.

2.4 Some key definitions

Before examining the steps for estimating costs, it first necessary to explain some of the terminology that might be used by economists. In particular, economists' definition of a 'cost' is very specific and may differ from definitions offered by others (even an accountant).

The economic definition of cost is based on the concept of '**opportunity cost**'. This is defined as the *value of the next best alternative use of a resource*, with the opportunity cost being equal to the **value** of the alternative forgone.

Economists also distinguish between **average and marginal costs** to account for the fact that very many choices are about relative, rather than absolute, quantities. This means that it is usually more relevant to examine the *change* in total costs resulting from a marginal change in activity (e.g. the *additional* costs of harm associated with a 1% increase in the number of people gambling), rather than to examine the absolute total cost. Since many impacts do not present immediately, it is also considered more relevant to consider what costs might be in the **long run**, rather than short run.

The ideal approach to estimating costs is thus to identify what the relevant impacts are, measure/quantify these, and then to estimate their **long run marginal opportunity costs**. Having said that, such an idealist approach is not always feasible and proxy values obtained via compromise approaches may be sufficient for this purpose.

2.5 Step 1: Identify relevant inputs and impacts

The process of identifying relevant inputs and impacts is a vital one that drives the overall estimate that is produced. For example, some might consider completed suicide to be a 'human' or 'social' impact rather than an economic one and so exclude this from cost calculations. However, loss of life also carries economic implications (e.g. potential work productivity that is lost to society) and excluding such implications, especially if interested in long term costs, could significantly influence the estimates that are produced.

This cost identification process can be aided by sorting different impacts into separate categories. One categorisation commonly used in economic studies is direct/indirect/intangible costs.

Direct costs: include costs incurred by those directly affected by gambling harms. This could be the gamblers themselves, their families, statutory services or any number of other sectors, including the private sector (such as employers). It is important to ensure that all relevant sectors/groups affected are identified, especially when intervention efforts and costs might fall across sectors. For example, the Australian Productivity Commission remarked that government measures to address harms associated with gambling machines, through technical adjustments to the actual machines, could place large implementation costs on gambling venues (4).

Indirect costs: although 'indirect' suggests that this refers to secondary level costs, this usually refers to productivity losses to society due to someone working less than

full capacity, for example because of work absence/unemployment, poor performance at work or premature death.

There are three important points to note about indirect costs. Firstly, these can also be estimated for individuals other than the gambling person, such as family members affected by gambling. Secondly, productivity losses can also be estimated for those not normally in work but who withdraw from other usual activities e.g. the retired, stay at home parents, or those unable to participate in usual volunteering or leisure activities.

There are also controversies about how both paid and unpaid work losses should be estimated. In the case of paid work, it can be argued that production losses from short-term absences are often made up on return to work or that, during long-term absences, an employee is replaced by a previously unemployed person (except in times of full employment); so only the short turnover or 'friction' period incurs societal losses. This friction cost approach therefore generates much smaller estimates of lost productivity than an approach which estimates costs for the full duration of work absence (6). It is important therefore to be aware of the general approach used in any estimate of productivity losses due to gambling-related harms.

Intangible costs: these are the costs that have an important impact on relevant individuals or sectors, but which may be challenging to measure or quantify, such as relationship breakdowns or the stigma associated with having a gambling problem. Although difficult to estimate in monetary terms, they can be captured using relevant measures to usefully provide a fuller picture of impacts. The Australian Productivity Commission (2010) noted that despite the challenge of quantifying such impacts, associated costs can be substantial when they are accumulated across all affected individuals and even conservative estimates suggested costs of $A 4.7 billion annually. In cases where it still remains difficult to meaningfully place a value on these costs, it can still be helpful to write a narrative, or use a non-monetary measure for some of these impacts and indicate that any estimate of intangible costs may remain conservative because no monetary value could be added to some impacts.

It should also be noted that although the terms direct/indirect/intangible are commonly used, they are not always helpful for identifying costs because some impacts are difficult to distinguish in this way. For example, unpaid care is a direct cost to families but time out of paid work because of caring responsibilities could be seen as an indirect cost to the government if it is considered outside of their immediate policy or budgetary responsibilities.

The choice of impacts to assess is therefore best determined by the **perspective** or viewpoint taken for the assessment e.g. a public health perspective or a societal perspective. This in turn can be determined by who will use the estimates and for what purpose. For example, in their decision making about whether to adopt new health care treatments, NICE focuses on cost-effectiveness evidence from the health and social care perspective, excluding considerations of lost productivity to society (NICE, 2013). It is also worth noting that although social welfare payments, e.g. job seeker's allowance or the employment and support allowance in the UK, represent a substantial burden to governments, some economists argue that they should be excluded from cost estimates because they are simply a redistribution of purchasing power from one part of the economy to another, without any goods or services exchanged in return. However, it could also be argued that such payments represent a public expenditure that could be used in other ways and should therefore be included in a public sector perspective (Raftery, 1995). In any event, governments will incur administration costs for all social welfare benefit schemes that should be considered.

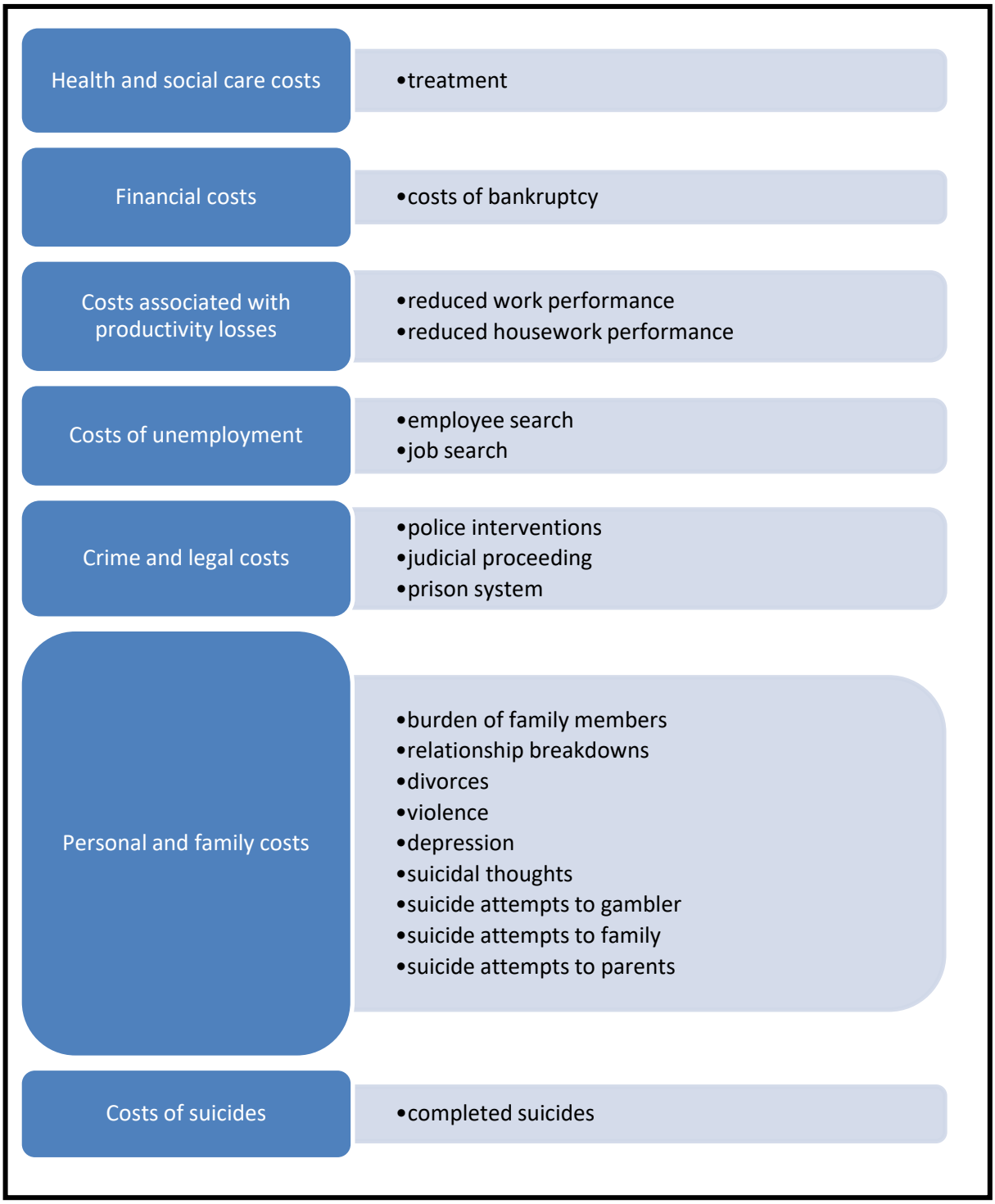
So even when costs don't fall into the budgets of the intended primary audience or traditional economic definitions of costs, it can be important to include all relevant costs to ensure they are noticed and addressed at a policy level. Given that 75% of the total costs of gambling could be borne by gamblers, their families and their social networks (7), a societal perspective is likely to be the most relevant for assessing the costs of gambling harms. This should ensure all inter-sectoral inputs, and potential burdens and gains are represented. This can also help identify opportunities for joint working across sectors and shared budgeting in order to help reduce some of these costs.

Fong and colleagues raised an interesting point about perspective and defining boundaries when discussing the limitations of their estimates for the social cost of

gambling in Macao before and after the liberalisation of gaming in the special administrative Chinese region (8). They highlighted that they only included “local” costs to the government, businesses and residents of Macao and that “*given that the predominant clientele of Macao’s gambling market are tourists from mainland China and other nearby regions, the social costs of gambling would be much higher should we include the exported costs borne by those neighbouring populations*” (p53).

They also illustrate that various costs may have multiple payers/bearers (e.g. family/friends physical and psychological costs may fall to family, friends, community and government). Given the many levels at which the harms of gambling occur and specific challenges associated with defining and measuring these, it might be sufficient to describe and define (and ideally justify) costs that have or haven’t been included, rather than impose artificial boundaries and perspectives. For example, Winkler et al in estimating the social costs of gambling in the Czech Republic (9), followed the framework of the Australian Productivity Commission(4), referring to “groups” of social costs related to gambling, without explicit mention of the burden bearer or payer (Box 1).

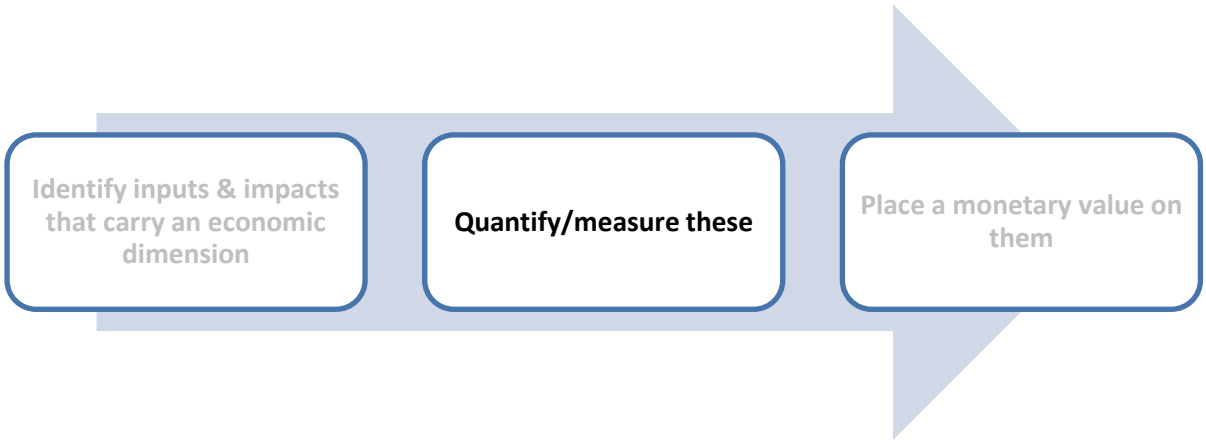
Box 1: Groups of costs estimated by Winkler et al. (9)



Such considerations highlight that it is important to have the audience in mind from the outset and ensure that all relevant perspectives/impacts are included, especially those inputs/impacts that would make up the largest component of total costs – these are

usually referred to as **cost drivers**. Cost drivers usually arise from small resources being used by many or by large resources being used by a few. Sometimes, specific impacts are intentionally excluded because, for example, they are expected to contribute little to the overall costs. Often, narrower than ideal perspectives are dictated by pragmatic considerations such as resource constraints or data unavailability. Estimates of costs in Australia have suggested that the sum of small gambling harms experienced by many low risk gamblers might be greater than the sum of large harms experienced by a few more problematic gamblers (due to the high prevalence of low risk gambling) (4) (10). It is therefore important to undertake some initial scoping of the potential contribution of specific types of resources/impacts before seemingly small impacts are excluded from data collection. In addition to the cost categories and items listed in Box 1, it is worth looking at the list of cost exclusions identified from a review of estimates derived for Australia, some of which were incorporated into new estimates of the social costs of gambling-related harms in Victoria, Australian (7).

2.6 Step 2: Measure inputs and impacts



Determine appropriate units of measurement

After identifying what the relevant inputs and impacts are, it is necessary to decide on an appropriate unit with which to measure them (e.g. for hospital stays, the appropriate measurement unit can be number of nights in hospital) and then to find existing measurements or take new measurements in these units.

Identify existing measurements

Generally, existing measurements take the form of published estimates or existing datasets.

Published estimates may take various forms e.g. academic publications based on research, audit reports from services or government reports. Drawing on such sources can be a straightforward approach but should be done with care, ensuring they are relevant to the context under current consideration and based on reliable data and methods. The reliability of the data can be assessed using relevant criteria/checklists e.g. on effectiveness using GRADE _ Grading of Recommendations, Assessment, Development and Evaluations (11) and for existing economic evidence CHEERS - Consolidated Health Economic Evaluation Reporting Standards (12). Some adjustments may be necessary before the estimates can be used. For example, a published evaluation of a service model developed in another health care system may not translate well to the health system in this country. Some of the cost components may then need re-estimation using alternative assumptions (e.g. for the type of staff who may deliver an intervention).

Identifying and accessing relevant **existing data** is often efficient and informative, particularly if such data represent large or difficult to access populations for whom it would be challenging to collect new data. However, the challenges associated with accessing and using existing datasets should not be underestimated. Many large datasets (e.g. anonymised hospital records for defined populations) involve lengthy or complicated processes to gain access permissions, and sometimes incur fees. Then data may need detailed processing to understand the content, check relevance and make them suitable for use (e.g. identifying relevant sub-samples or time periods, linking data with other relevant information). These types of data explorations and sampling assessments are vital to avoid invalid generalisations. For example, both the Australian Productivity Commission analysis and the evaluation of the costs of gambling in the Czech Republic examined the appropriateness of extrapolating data from treated gamblers to all problem gamblers – an approach that could introduce a selection bias (4, 9). Finally, analysing the data may entail complex econometric and statistical analysis. For example multiple regression modelling approaches were applied to data from a national cross-sectional survey in Germany to determine the effect of online gambling (as distinct from offline gambling) on problem gambling (13).

There is also a need to be compliant with information governance frameworks that concern how the data are stored, used and reported. If your organisation does not have relevant knowledge or permissions concerning information governance or data processing and analytical skills, then it would be worth collaborating with those that do.

Taking new measurements

There are various possible approaches to taking new measurements and choices need to be made in the context of available time and resources, suitability of existing measures and the purpose of the cost estimates, for example:

- timing of data collection – data could be collected retrospectively (e.g. by asking people to recall past events or accessing routine electronic service records) or prospectively (e.g. asking people to complete ongoing diaries);
- determining the appropriate respondent – measurements can be taken from the individuals concerned or by proxy informants such as professionals or family members;
- ascertaining whether existing measures are suitable for the purpose or whether new measures need to be developed – measures for gambling harms exist but are still in relative infancy (see summary of work in this area to date by Delfabbro & King (14)); and
- methods for data collection – data can be collected in direct interviews or by asking people to complete survey forms, and can be in-depth (which risks non-response or incomplete responses) or quick and easy but limited in scope.

Each option carries strengths and weaknesses that need to be traded off and, if new data are collected for scientific (rather than market) research purposes instead of as part of routine service delivery, this would require approval from the relevant research ethics body and informed consent by participating individuals. Compromising on methods, expense or effort could impact on the accuracy and validity of the data, or potentially contravene research governance frameworks. Some of these approaches

could be used on an ongoing basis to serve as an audit for monitoring purposes. This in turn can be helpful for justifying an ongoing commitment to funding services.

Estimating the costs of a wide range of inputs and impacts typically necessitates collecting at least some new data because it is unlikely that all relevant data for the population of interest are available and accessible, and in a desirable and combinable format. This is particularly so when we are interested in impacts that would not be routinely recorded such as support from family members or time taken off work.

Devising and issuing **survey questionnaires** can be an efficient approach in such contexts. Questionnaires are often tested to ensure they are valid and reliable for current and future uses. However, when it comes to measuring economic impacts, such testing is often tricky because the questionnaires can be very context-specific. Even commonly-used questionnaire structures, such as the Client Service Receipt Inventory – CSRI (15) which has been used in hundreds of health and social care evaluations across a number of clinical conditions, is tailored with each and every use to ensure the content fits the perspective, care context, target population and broader research methods.

As noted earlier, there are trade-offs involved when it comes to deciding the depth of detail requested. If questions cover a past period of time, then it is also necessary to limit the recall period to a relatively short period of time to ensure participants can provide reliable answers. It is rare to ask about a period longer than the past six months so, if data need to cover a longer period of time, multiple measurements at relevant intervals may be needed.

Alternatively, a diary format which asks respondents to document inputs on an ongoing basis may be more suitable. While these may address recall issues, they can also place a greater burden on respondents and risk incomplete records if they cover a long period of time. They may therefore be more helpful where a detailed snapshot is sufficient – longer term extrapolations from such data may be possible.

Examples of questionnaires that aim to assess use of resources and other economic impacts - in both retrospective and prospective formats - are freely available on-line

at the DIRUM (Database of Instruments for Resource Use Measurement) website http://www.dirum.org/. An extract from a retrospective format questionnaire is provided in Box 2.

Box 2: Example of a resource use questionnaire

BRIEFEST SACA: ANSWER THE NEXT SECTION AT EACH REPORT:

MA. In the last 3 months, has (YOUTH) stayed overnight in a hospital, treatment center, group or foster home, juvenile justice facility, or emergency shelter for problems with drugs or alcohol, behaviors, or feelings? YES. NO.....GO TO MB

Has (YOUTH) stayed overnight in a (READ EACH AND CODE): IF "YES," ANSWER COL. A AND B.

		IF YES: COL A. # NIGHTS IN LAST 3 MOS	IF YES: CHECK TYPES OF SERVICES GIVEN:
1. Hospital for problems with drugs or alcohol, behaviors, or feelings	NO YES DK	__ __ __ nts.	__assessment __individual treatment/therapy __group treatment __family/parent treatment/ed __medication __education/training
2. Drug or alcohol treatment unit	NO YES DK	__ __ __nts.	__assessment __individual treatment/therapy __group treatment __family/parent treatment/ed __medication __education/training
3. Residential treatment center	NO YES DK	__ __ __nts.	__assessment __individual treatment/therapy __group treatment __family/parent treatment/ed __medication __education/training
4. Group home	NO YES DK	__ __ __nts.	__assessment __individual treatment/therapy __group treatment __family/parent treatment/ed __medication __education/training
5. Foster home	NO YES DK	__ __ __nts.	__assessment __individual treatment/therapy __group treatment __family/parent treatment/ed __medication

Source: (16)

Top-down versus bottom-up approaches to cost estimation

There are two ways in which costs can be estimated: top-down and bottom-up costing. The top down approach brings together all total relevant expenditure over a specified time period, typically one year. These can then be divided by an appropriate unit (e.g. dividing total clinic costs by the number of users of a service to define the cost per clinic user). At its simplest it will include the annual financial resources received by an

organisation, including any income from user charges. This approach is relatively simple to use, as long as all costs associated with a service can be identified. However, the resulting estimates tend to be homogeneous across individuals and it may be difficult to identify variations e.g. across different sub-groups of individuals. An example of this approach is provided by Politzer et al., who estimated treatment costs at Johns Hopkins Center for Pathological Gambling (17). They divided the monthly cost of delivering treatment and maintaining the facility by the total units of service delivered in that month, then averaging the cost for the first twelve months of operation after static capacity was reached.

The bottom up approach, for example as used by Effertz et al. in Germany to estimate the medical costs of online gambling (13), involves identifying all specific resource inputs for a service/impact at the unit of interest (e.g. per clinic visit), attaching appropriate costs to each, then aggregating costs at the desired level (e.g. to derive the total service costs for a clinic delivering therapeutic inputs for individuals with a gambling problem). This is a useful approach for ensuring that all relevant components are included in the costs. For example, a service will consist of not only the full salary costs for any employees, but also all the administration costs for running and maintaining an office, support departments, advertising and publicity costs, as well as capital overheads such as land and premises. The bottom-up approach is more time consuming, but the richness of information that is obtained should lead to a better understanding of costs and greater flexibility in estimating future costs.

2.7 Step 3: estimate the monetary value of inputs and impacts

Once inputs and impacts have been measured/quantified, the next task is to identify appropriate costs for each measurement unit. These costs are referred to as **unit costs**. Multiplying the number of units of an input received by each individual by the unit cost of that input gives a total cost of that input.

Unit costs can be identified from various different sources. For health and social care costs in England, many can easily and freely be obtained from the PSSRU's Unit Costs of Health and Social Care (18) and also the NHS Reference Costs (19) which are publicly reported prices that NHS service providers should charge NHS commissioners for treating their population. Each of these account for the full costs of a service, such as the administration and overhead costs mentioned above.

Other types of impacts may lack an explicit valuation in the form of expenditure data or prices so require a different approach to valuation. For example, costs associated with time off work as a consequence of gambling might be valued based on the value of wages foregone, as a proxy for the value of lost production. The same approach can be used to estimate the costs of voluntary work lost or years of work forgone due to premature death. As mentioned earlier, some economists argue that in an economy with a pool of unemployed people, these costs would be time limited (to no more than one year at the most) because others are available to fill the gap. However, full employment tends to be considered as having an unemployment rate of less than 6%, as is currently the case in the UK, so this justifies including long term productivity losses for now.

Alternative options for valuing inputs might represent different conceptual approaches. For example, when valuing unpaid support from carers, a commonly used approach is to examine the opportunity costs of their time, i.e. the value of the next best use of their time. This could be the wages they have foregone by not being able to work, or the value of the benefit they might have derived from a leisure activity. Values to use for each of these can be derived from national statistics on average or minimum wages and valuations of leisure time (20) respectively. Alternatively, one could take a replacement cost approach, i.e. the cost of substituting the unpaid carer with a paid professional (which would be available in the PSSRU unit cost compendium mentioned above). This would likely generate higher estimates for carer time because the unit costs of paid professionals are usually greater than valuations of leisure time. Another approach to estimating unpaid care costs which is conceptually very different is to place a value on the emotional wellbeing loss to carers (21). This too can generate much higher estimates that the opportunity cost approach.

Whatever valuation approach is taken, attaching monetary values to impacts such as lost productivity and unpaid care often generates large values that can demonstrate the scale and reach of economic impacts and can serve as powerful arguments for further investment to prevent or mitigate gambling-related harms.

Where unit costs cannot be readily obtained from external sources, it might be necessary to request information from specific providers or agencies and/or generate new unit costs. If so, comprehensive data would be required covering all relevant inputs and costs e.g. running overheads such as administration costs and capital overheads such as land value. As described for the measurement of inputs and impacts, a top down methodology might be useful, i.e. taking a published estimate of the entire budget for a specific service and dividing it by the total volume of activity to get a unit cost.

2.8 Step 4: aggregate the costs of all inputs and impacts

Once the costs for individual inputs have been estimated, they need to be aggregated to estimate total costs. The level at which costs are aggregated relates back to the perspective that was selected at the outset. Alternative perspectives and ways of

aggregating costs can suggest very different estimates and messages. For example, budget holders in a specific service sector might be interested in costs falling to their services either among those that use the service already or also among those that might also potentially use it. They might also be interested in average costs at the individual level and the extent to which these can vary so that they can plan their service provision accordingly. Governments on the other hand might be interested in total societal costs, which account for incidence or prevalence at the national level.

2.9 Common challenges in estimating and interpreting costs

While estimating the cost of doing nothing is a valuable exercise, estimates usually provide general indications of the size of the economic burden, rather than a conclusive picture. This is because they can be characterised by (often unavoidable) methodological variations and limitations. It is useful to be aware of potential sources for such variations, and potential limitations, when estimating costs and also when interpreting estimates produced by others - transparency is key for helping to develop such understanding. For example, when estimating the social costs of gambling in the Czech Republic, Winkler et al (9) took the Australian Productivity Commission approaches as their starting point. They recognised the methodological criticisms that had been levelled at those estimates but also valued the transparency of introducing methodological adjustments to overcome data limitations, for example: "*APC has discounted the number of people estimated to be affected by personal and family costs by 20%. This figure may be arbitrary, but in the absence of evidence it is the most transparent approach, thus we have adopted their method in our study*" (p.1,295). Some common and relevant methodological challenges are now summarised. Further description of these in the context of estimating costs associated with mental health problems has also been published (22).

Costs can be estimated or aggregated using an **incidence based approach** or a **prevalence based approach**. The former would estimate costs associated with newly affected cases over a long period of time (potentially several years or even over a lifetime) while the latter would estimate costs associated with all affected cases (regardless of when their gambling became a problem or generated harms) for a fixed

period, commonly one year or less. Therefore, a prevalence based approach indicates how widespread the problem is for a fixed period of time, whereas an incidence based approach indicates the impact of newly affected cases for a longer time period, potentially used to estimate lifetime costs, as for instance recently used to estimate lifetime costs of spinal injuries in the UK (23). The two approaches therefore represent two different, though overlapping, population samples and therefore generate very different cost estimates. Either way, obtaining reliable estimates of incidence or prevalence is crucial because this impacts heavily on estimates of total costs at a population level. This issue is fundamental to the estimation of costs of gambling harms given the acknowledged limitations associated with screening, including stigma, diagnostic assessment challenges, distinguishing between gambling behaviour and gambling harms, and the identification of harms at a community level rather than a diagnostic level. (1, 10, 14).

One of the notable challenges identified for assessing the costs of gambling harms is that of **attribution** of harms to gambling, especially so if other **comorbid** issues are present. Rodriguez-Monguio et al. found a high prevalence of psychiatric comorbidity, substance use disorders and nondependent abuse of drugs among pathological gamblers identified in a health insurance database in Massachusetts (24). Associated total health care costs were estimated to be high, despite rates of treatment-seeking for pathological gambling being low, but disentangling attribution was problematic because diagnostic codes recorded for clinical encounters were not necessarily ordered by importance.

Together, the issues of attribution and comorbidity represent challenges in establishing **causality,** that is whether the mental health problems are caused by gambling, vice versa or a mixture of both. Such complex associations can create difficulties in identifying all relevant cases and therefore risk underestimating costs or even over-estimating them through double-counting.

Estimates are influenced by the **availability of data and the context** in which such data were produced. They may therefore have limited relevance as time moves on, for example if the service context changes substantially. Longitudinal datasets that record both the onset of problematic gambling and/or risk of problematic gambling, as

well as other issues such as mental health problems, and then follow individuals over several years, represent the best way to determine causality and attribute consequences arising from gambling-related harms. Examples of gambling specific longitudinal datasets are available, e.g. in Sweden (25) and New Zealand (26, 27), but it is important to consider contextual differences if using these data to help estimate costs in a UK context.

At an individual level, the costs of gambling harms are **likely to be long term, broad and changeable in nature and size over time**. For example, there may be peaks in use of health care, repeated bouts of unemployment and repeated periods of family dependency. It can be challenging to fully identify and represent these patterns in cost estimates and the extent to which this can be done depends on both the **perspective** and **time horizon** that is taken for the analysis. Many cost of illness studies aim to estimate one year costs for ease of calculation and interpretation but longer time horizons, including lifetime horizons, are particularly useful when making a case for prevention or early intervention to tackle gambling related harms. This generally involves using modelling-based approaches which combine data and assumptions to hypothesise what costs and gambling-related outcomes might be over a period of time that is infeasible to measure directly. Such approaches will be discussed in more detail in the next section.

Finally, there is a matter of whether total cost estimates should be adjusted to account for the value of benefits, i.e. subtracting benefits from costs to present **net costs**. This obviously entails additionally identifying, measuring and valuing the benefits of gambling, as well as the harms. Such an approach was undertaken for the Australian Productivity Commission estimates of gambling costs, by accounting for factors including tax revenue and social community benefits. On the other hand, when reporting the social costs of gambling in Victoria, the authors stated such an assessment was beyond the scope of their study, especially because the value of 'consumer surplus' (benefits that exceed consumer expenditure) was uncertain (7). This analysis did however make an informed guess that net costs would either be neutral or exceed the value of benefits. It is therefore vital that the construction of total cost estimates from different studies are examined in detail before any comparisons are attempted.

3. Assessing whether an intervention provides value for money

3.1 Key points

Examining the costs of doing nothing is useful for highlighting the potential impacts of gambling-related harms but of limited use for determining how best to intervene or allocate scarce resources to achieve best value for money. Such decisions also require an understanding of outcomes associated with different interventions and alternative courses of action.

Economic evaluation frameworks are defined by their considerations of both costs and outcomes and comparative approaches that consider two or more options.

All economic evaluations measure and treat costs in the same way but differ in how they measure outcomes.

Alternative evaluation frameworks are also available. For example, return on investment analyses look at the difference between the costs of intervention and costs that can be avoided as a result of intervention. This can include social return on investment studies, which seek to estimate all cost impacts and not just changes in monetary costs.

It is important to be transparent in methods used for conducting an economic evaluation.

3.2 Estimating the cost of an intervention

Section 2 described how the costs of doing nothing to address gambling-related harms can be estimated. Exactly the same approach can be used to estimate the costs of a

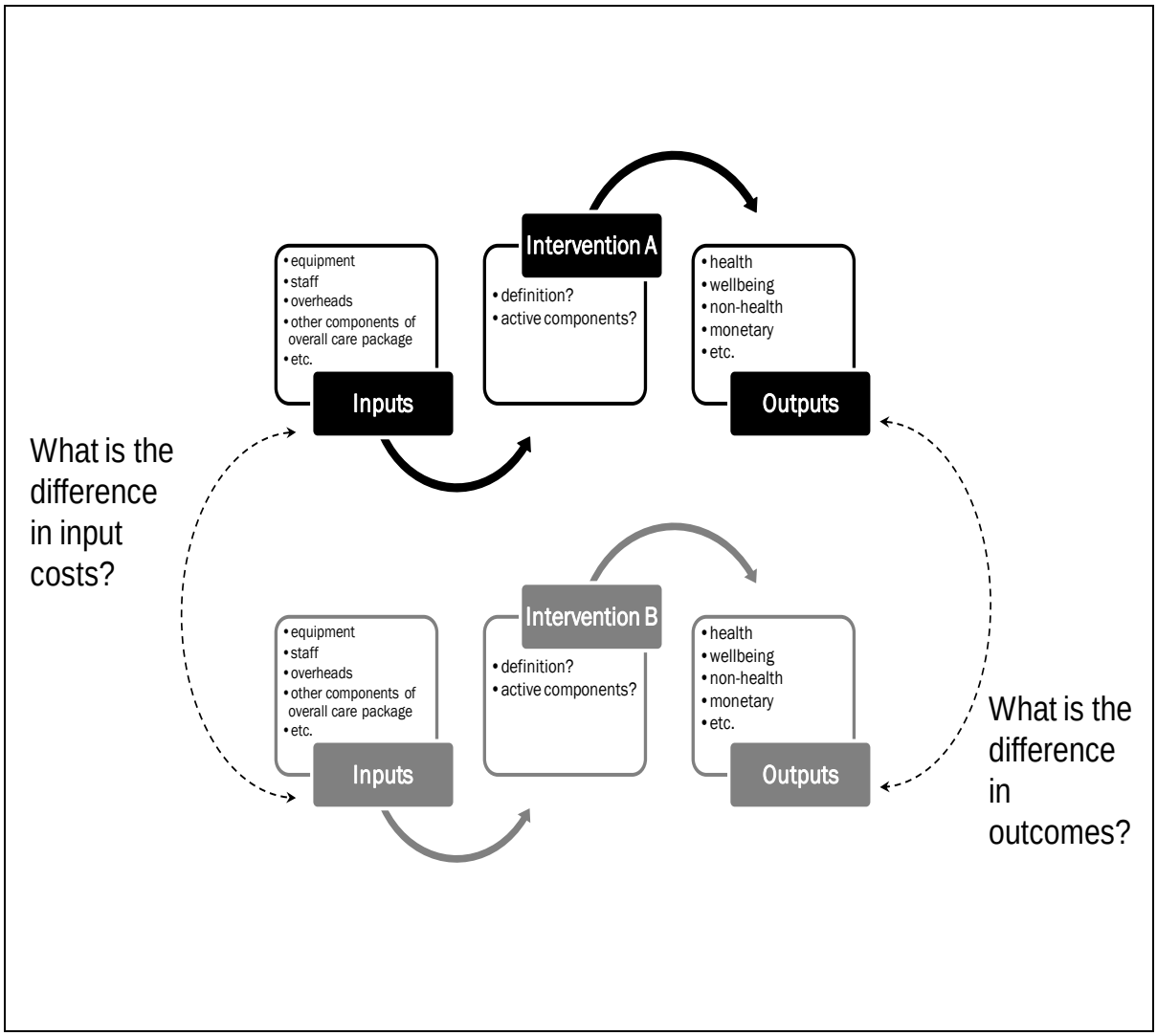
specific intervention to tackle this issue. This involves identifying relevant inputs, quantifying these inputs in appropriate units, and then attaching unit costs to these input quantities. Again, matters such as perspective, time horizon and data availability will determine the scale of the costing and the approaches taken.

Following such an approach can provide useful information about what investments are needed and which sectors potentially may need to lead in implementing actions. However, **'cost analyses'** that only focus on costs will not tell us much about the success of interventions in relation to their intended effects or whether they are a good use of resources compared with other potential interventions that could be invested in. They therefore have limited use for decisions about allocating scarce resources.

3.3 Linking costs with outcomes to estimate value for money

A more useful approach for assessing value is to conduct an **economic evaluation** which additionally considers the outcomes associated with an intervention and (a) examines the link between resources expended and the outcomes that are achieved and (b) compares those costs and outcomes with those that might be achieved with alternative options. These alternative options could be the status quo or (existing or potential) alternative interventions. The standard conceptual framework for economic evaluation is represented in Figure 2.

Figure 2: Standard conceptual framework for economic evaluation



Source: Adapted from Patel (22)

While economic concerns are paramount when resources are constrained, investment decisions are complex. Value for money is likely to be just one of several criteria that would inform decisions. Other relevant criteria might include overall level of need, impacts on the level of inequality in outcomes across society or acceptability to users. So contrary to some beliefs about the role of economic evaluation, the purpose is not simply to decide how to save money but to help determine how to use limited resources most effectively. This could involve decisions about removing existing investments, but more often it is about using existing investments in alternative ways or increasing investments where there is potential for enhanced outcomes.

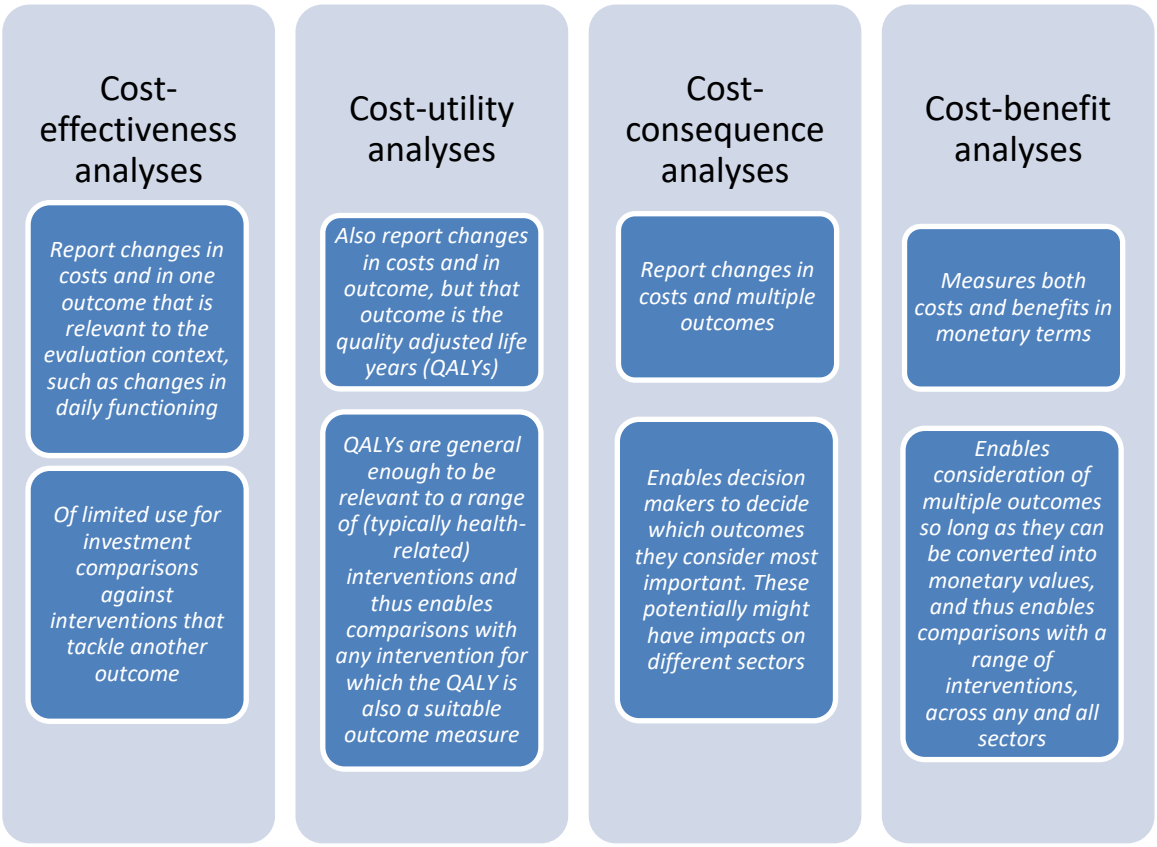
Four standard economic evaluation approaches are available to assess the impact of actual or potential interventions aimed at addressing gambling-related harms:

- Cost-effectiveness analyses
- Cost-utility analyses
- Cost-consequences analyses
- Cost-benefit analyses

Although some of these terms are used informally and interchangeably in everyday language, they each carry specific meaning in economics. Each is defined in Box 3 and explained in more detail.

The key point to note is that while the approaches are similar in their approach to estimating costs, they differ in how they consider outcomes. Deciding which approach to use depends on what outcomes are of interest, which in turn will depend on the perspective or policy or practice question that is posed.

Box 3: Types of economic evaluation



3.4 Cost-effectiveness analysis

Cost-effectiveness analysis can be used if there is one main outcome, relevant to the context, that is worthy of particular focus. The outcome would generally be measured and expressed in the most appropriate natural/physical units, for instance years of life gained or gambling-free days. This is quite an intuitive approach if a relevant and feasible outcome measure naturally presents itself.

Policy question example: *If we implement a walk-in community-based gambling counselling service, what would be the additional cost associated with any reduction in prevalence of co-morbid depression over one year, compared with referral-based counselling provision?*

Once both costs and outcomes have been estimated for all interventions of interest, results of cost-effectiveness analyses can indicate one of five possible messages:

- All interventions have similar costs and outcomes.
- If costs are lower and outcomes are higher for one intervention, it is clearly more cost-effective and is considered to 'dominate' the other(s). However, as discussed below, there can be considerable uncertainty around cost-effectiveness results, which should be explored using available methods.
- If outcomes are similar between interventions, then the one with lower costs can be regarded as more cost-effective.
- If costs are similar between interventions, then the one with better outcomes is regarded as more cost-effective.
- If both costs and outcomes are higher for one intervention, then it falls on relevant decision-makers to make difficult choices about whether the additional benefits are worth paying for.

In the last scenario, results of cost-effectiveness analyses are generally expressed as **incremental cost-effectiveness ratios (ICERs).** These combine cost and outcome information to represent the additional cost per additional unit of outcome. For example, the additional cost per additional problematic gambling free day.

This metric is relatively simple to produce if it is based on, for example, average costs and outcomes observed in each comparison group. However, summary data such as averages provide no information about the amount of variation that might exist in values among the populations that were examined e.g. whether different results are indicated for specific sub-groups. Graphical representation of the variation can be helpful and **cost-effectiveness planes** (Figure 2) are typically used for this purpose.

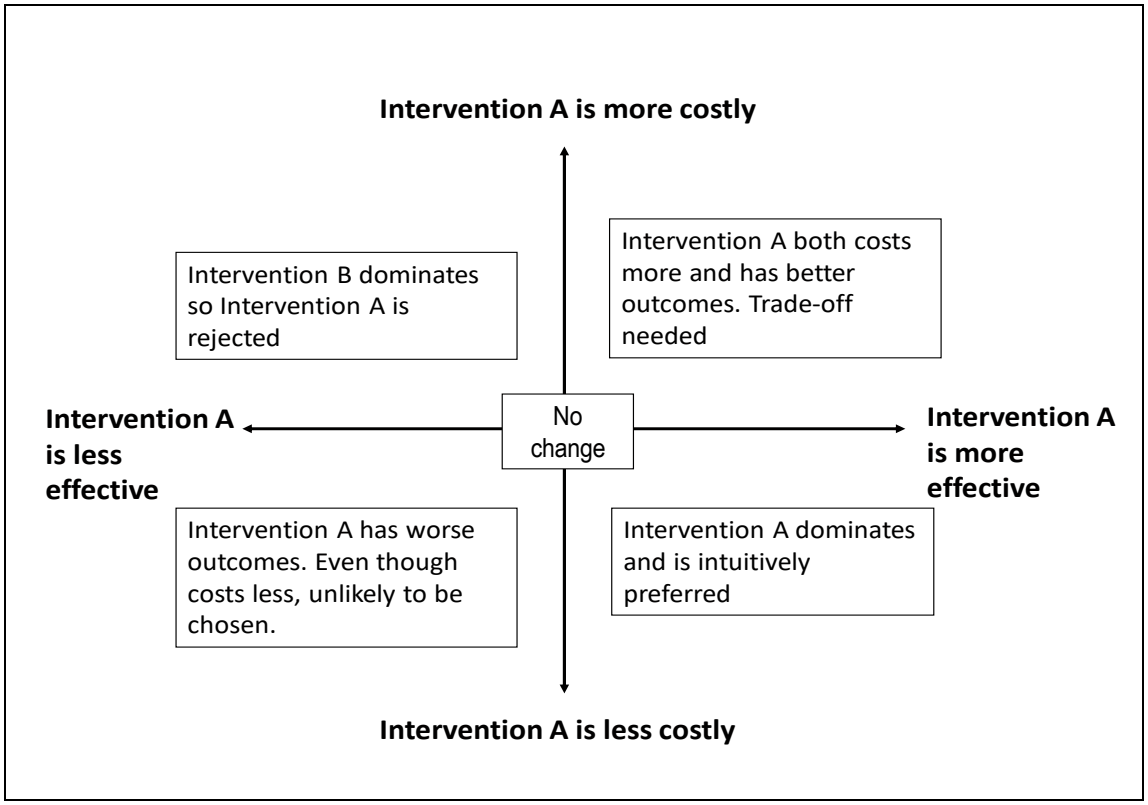
Cost-effectiveness planes effectively represent the five potential messages described above but with additional information about the variability in data. Differences in costs can be represented on the vertical axis; moving upwards past the origin suggests that the intervention of interest costs more than the comparator, and vice versa. Differences in outcomes can be represented on the horizontal axis; moving towards the right past the origin suggests that the intervention of interest has better outcomes

than the comparator, and vice versa. It is possible to simulate multiple datasets from the original data, each based on different randomly selected subsets of the original data. Coordinates for cost and outcome differences from each simulation can then be plotted on the chart. If, for example, the majority of coordinates fall into the top-right quadrant, this indicates that a new intervention offers better outcomes at greater cost. Producing such simulations requires more specialist expertise and software.

When a new intervention does improve outcomes at a greater cost, there is remaining decision uncertainty if it is unclear if and how much further investment may be considered acceptable. For example, if the additional cost per additional depression-free day is £68, is this an acceptable price to pay for extra depression-free days among those who experience problem gambling? While this entails a value judgement – with no right or wrong answer – such decisions can be formalised or standardised by setting out what values may or may not be acceptable. Bars that are set for this purpose are termed **cost-effectiveness thresholds**.

Sometimes, cost and effectiveness coordinates might be spread across all four quadrants of the cost-effectiveness plane (but perhaps with some clustering in one area). This would suggest that the results are highly variable and it may be more relevant to examine whether there are different cost-effectiveness messages for different sub-groups. The graphical representation is therefore a useful indicator of how certain we can be that the average results are reliable for decision making.

Figure 2: Cost-effectiveness plane: possible messages from cost-effectiveness analyses



The two limitations noted above in relation to simple cost-effectiveness analyses - lack of representation of variability in findings and uncertainty about what value is placed on outcome improvements - can both be addressed using **cost-effectiveness acceptability curves (CEACs)** based on what is known as the **net benefit approach**. This is a more advanced approach to cost-effectiveness analyses and, as with the simulation approach described earlier, may require more specialist expertise.

In brief, net benefits provide a single summary monetary measure of costs and outcomes for each assessed individual, accounting for the value that a decision maker may be willing to pay for an outcome improvement i.e. the **cost-effectiveness threshold**. Typically, the calculation is expressed as follows:

Net benefit = (value that a decision maker would be willing to pay X outcome) - cost

The values that a decision maker might be willing to pay can be varied to create a series of calculations and, for each one, the proportion of individuals for which one intervention has a greater net benefit than another can be observed and plotted as a curve (**cost-effectiveness acceptability curve**). These curves then represent the probability that one intervention is cost-effective compared to another, accounting for the variation in individual level costs and outcomes and the values that a decision maker might be willing to pay for a unit improvement in outcome.

3.5 Cost-utility analysis

Policy question example: *What impact would there be on health care costs and quality-adjusted life years over ten years if people presenting in primary care with any addiction issues were referred to a suicide prevention programme?*

The requirement for a single outcome measure in a cost-effectiveness analysis can be a challenge where there are multiple relevant outcomes of interest. While it is possible to introduce further outcome measures and calculate separate results based on these separately (as will be discussed in relation to cost-consequences analyses), findings from multiple outcome measures may suggest mixed messages about value for money and be difficult to act upon. Using different outcome measures across different evaluations can also generate inconsistencies in decision making. A broad multi-dimensional outcome measure is therefore desirable.

Cost-utility analysis is similar to cost-effectiveness analysis in that it uses one single outcome measure. However, the outcome measure that is used, **quality-adjusted life years (QALYs)**, represents two dimensions of outcome, quality and length of life. These are sufficiently broad to be relevant to a number of policy decisions and represent some of actual trade-offs, usually associated with health and health care. QALYs have become widely used in health care policy making in England. They are also used elsewhere, although perhaps with variations in the underlying approaches.

Calculating QALYs is a two-stage process. Firstly, health states need to be measured. This might be done using one of several widely used instruments available for assessing health-related quality of life, such as the EQ-5D-5L (28) or

the SF-12 (29). Secondly, a utility value needs to be estimated for each health state measurement. The concept of **utility** refers to the *value* that is placed on particular levels of health status. This can be measured by the preferences of individuals or society for any set of health outcomes. This is what the quality-adjustment refers to.

Utility values are often represented on a scale capped at 1, which represents a year in full health. A value of zero represents death. Negative values are also possible because some health states may be deemed worse than death. Utility values need to be adjusted for the time spent in the relevant health state. For example, if a health state associated with receiving a particular intervention is associated with a utility value of 0.6, two years spent in that health state represents 1.2 QALYs. It is necessary to measure health states at least twice over the period of interest in order to estimate a change in health status and utility values over that time; intermediate measurements help to refine estimates of the change. Results of cost-utility analyses are usually expressed in terms of additional cost per additional QALY gained by undertaking one intervention instead of another.

There are several methods to calculate utility values for specific contexts or populations e.g. visual analogue scale, time trade off, or the standard gamble. The latter two can be particularly complex for the methodologist in terms of conceptualisation, construct, implementation and analysis, and also for respondents who are faced with multiple complex questions. Nevertheless, the time trade off method has been used to estimate the relative burden of harm (in terms of disability weights) associated with different levels of gambling (10)

In health care evaluations, it is in fact common practice only to measure health states and then apply ‘off the shelf’ utility values for those health states which have been calculated in other populations, usually the general public (30). Using off the shelf general population utility weights carries several advantages, including representing taxpayer views, being potentially more objective and standardising the basis of decision-making.

However, whether estimating new utility values or using existing ones, it is wise to be aware of some of the nuances that surround the construct of underlying methodologies

to produce such valuations. An example is provided by Delfabbro & King's cautionary assessment (14) of previous use in Australia of the time trade off method (31). Although they acknowledge the usefulness of the approach for assessing harm, one of the limitations they illustrate is that if time trade off questions were framed differently, respondents could perceive low risk harms as opportunity costs rather than true harms, and thus generate different (lower) values for the burden of harm among low risk gamblers.

Thinking back to the values that decision makers might be willing to pay for outcomes, NICE in England recommends that interventions should normally be funded without extensive debate when they cost up to £20,000 to £30,000 to gain one extra quality adjusted life year. For instance, if a new intervention to address addiction costs £26,000 per QALY gained, NICE would likely recommend its implementation.

However, there are concerns that existing health state description systems may not be sensitive enough to pick up on changes in health status for all conditions e.g. in mental health (32). This may also apply to addictive disorders such as problem gambling. QALYs also are argued to carry an equity bias since people who are less disabled or who are more likely to have a longer life expectancy (i.e. because they are younger) can expect greater QALY gains (33). While QALYs have been used to estimate the impacts of gambling-related harms, as in Switzerland (34), limited exploration of the appropriateness of quality of life measures used in health economic analysis for gambling has led some researchers to explore the potential development of a gambling specific quality of life measure (31).

Moreover, while there is a clear threshold for acceptable levels of expenditure for QALY gains, there are few for other outcome measures. So where QALYs are not relevant to a decision, there remains a risk of greater and uneven value judgements.

3.6 Cost-benefit analysis

Although cost-utility analysis usefully allows the combination of two important outcomes, a major limitation is the focus on length and quality of life, which may not be of primary interest to some policy makers. For instance, policy makers worried about gambling-related harms' impact on levels of crime or unmanageable debts would be more interested in outcomes directly linked to those impacts. Cost-benefit analysis, one of the oldest and broadest forms of economic evaluation, is useful in this case because it uses money as a common measure of value for all outcomes regardless of their nature.

Policy question example: *Do the total monetary benefits of implementing harmful gambling screening among young adults exceed the monetary costs over their lifetimes?*

Results of cost-benefit analyses are expressed either as a ratio of money costs to money benefits, or a simple sum expressing net benefit (or loss) of one intervention against another. The decision is then based on whether the monetary benefits exceed the monetary costs for each intervention being considered.

This ability to combine multiple cost and benefit dimensions into one summary figure is particularly convenient when issues/interventions/costs/outcomes cut across sectors. So this approach could be particularly helpful approach for addressing gambling harms. An early example of the use of this approach to evaluate a treatment for gambling is provided by Politzer et al. (17). They monetised the effectiveness of the treatment in terms of dollars saved (not gambled) while in therapy, for a range of potential impacts such as loans and family stability. Balancing these benefits against the costs of the actual treatment, they estimated a benefit to cost ratio of 21.3:1.

Although there are numerous methodological challenges in estimating monetary values for all costs and benefits, several methods are available to do this:

- Market-based valuations (e.g. using wages to value the cost to society of time off work due to illness).

- Determining how much individuals might be willing to pay (or accept) to derive (or forego) a service/outcome. The two main criticisms of this method are that willingness to pay may be associated with ability to pay, and that valuations of hypothetical situations may not reflect true willingness to pay.
- Discrete choice experiments which, similar to willingness to pay techniques, are based on the notion of trade-offs. However, rather than eliciting values for the whole service/outcome, they instead focus on particular attributes and can therefore help to identify which attributes have most influence on choices (35).
- Expert opinion (either implicitly through observing actions/policy decisions or explicitly by deriving opinion statements).

QALY outcomes, as described above in relation to cost-utility analyses, can also rather straightforwardly be monetised by multiplying them with available monetary valuations of life years. An example of this is provided by Kohler who monetised quality of life losses associated with pathological gambling in Switzerland using a life year valuation of 50,400 CHF based on secondary sources (34). The resulting annual loss attributable to gambling addiction was estimated at CHF 3,830 per pathological gambler. Based on an exchange rate of 1 CHF = 0.81 GBP, the valuation of the life year is equivalent to £40,650, which is somewhat higher than the £20,000-£30,000 cost placed on a QALY by NICE in England. However, there are various alternative estimation approaches which may generate much higher valuations. The varying conceptual bases of different valuations should be accounted for when choosing between them. A summary of valuation approaches is provided by Social Value UK (36) and methods for monetising various other outcomes for public health economic evaluations are described by McIntosh et al. (37).

3.7 Cost-consequence analysis

Many economic evaluations do not fit neatly into any one of the types of economic evaluation described above, particularly if a multitude of outcomes are of interest and it is infeasible to estimate the monetary value of each of these. So there is increasingly a tendency to report a range of costs and impacts (or consequences) without attempting to calculate a cost-effectiveness ratio or to value consequences in money terms. This is referred to as cost-consequence analysis. It is largely a presentation style with information provided in a less aggregated form. Proponents of this approach argue it to be more transparent compared with other forms of economic evaluation. However, it presents challenges if different outcomes suggest different decisions and the relative merits of each outcome, as they relate to that decision, may need to be considered and traded off against each other.

Policy question example: *What are all the costs and benefits associated with increasing the minimum legal age for online gambling?*

While data obtained for a cost-consequence analysis do not preclude the transformation of these into one of the other forms of economic evaluation, doing so in an unplanned way or by selecting specific data while ignoring other data should of course be cautioned against to avoid a risk of bias.

Sensitivity or scenario analyses

It is probably now clear that all approaches to economic evaluation necessitate a series of methodological decisions, assumptions, data sources and estimation approaches. Each one of these introduces a level of uncertainty into estimates. A key final step is therefore to check what impact this uncertainty potentially has on the conclusions that can be drawn from the evaluation. Typically, this is done using sensitivity or scenario analyses – a series of approaches which entail modifying values used in the analyses to check the impact on the estimates. Varying the input values will of course very probably lead to changes in the specific estimates but the key question is whether such variations in turn alter the overall conclusions of the evaluation. Such analyses and their findings should be transparently reported.

4. Estimating value for money using modelling approaches

4.1 Key points

Modelling is a way of drawing together different information sources or hypothesising scenarios that have not been examined empirically.

Specific circumstances where it might help assess value for money include: when values are sought for a longer time frame than would be feasible in an empirical evaluation (e.g. benefits are expected to appear several years into the future); adaptation of the results seen in one setting in another adjusting for differences in local contexts, or when alternative scenarios to those used in empirical research are of interest but don't warrant further empirical research (e.g. alternative mechanisms for delivering an intervention).

Models are best created through collaboration of multiple stakeholders to ensure that they are built robustly and can deliver reliable estimates.

Economic modelling is a good way of synthesising multiple sources of data and, when underpinned by robust techniques such a systematic reviews and meta analyses, can provide more robust evidence than a single empirical study.

4.2 Why do we need modelling approaches?

It is not always possible to rely solely on empirical studies to estimate either the costs of any problem, such as gambling-related harms, nor on the cost effectiveness of interventions to tackle these issues. Policy makers may, for instance, be interested in a longer term time frame than can be covered by empirical studies or they may want to make use of existing evidence from a different country / setting and adapt it to their

own context. If the evidence from another country is particularly robust, e.g. based on longitudinal datasets in the case of costing analyses, or well conducted empirical studies in the case of effectiveness evidence, then modelling can play a key role. It can also be used to help inform decisions on whether to fund future empirical evaluations by giving an indication of the level of impact that would be needed for an intervention to be cost effective. As a result modelling is widely used in economic analysis for public policy. NICE, for example, always uses modelling, synthesising data from multiple sources alongside local costs when assessing the case for investing in public health and health care interventions. The OECD, for example, also produces models of the very long-term (lifetime) costs and consequences of unhealthy lifestyles (38).

A common starting point for assessing value for money of interventions using a modelling based approach is when there is new evidence of short term effectiveness for a specific intervention. This may then prompt a decision to check longer term impact by, for example, gathering published evidence on the relationship between those short term outcomes and longer term impacts. These may be supplemented with other relevant evidence (for example, related to other relevant outcomes) and informed assumptions that account for expert views. Such information would then be combined using economic modelling techniques.

Indeed, economic modelling is a good way of synthesising multiple sources of data and, when underpinned by robust techniques such a systematic reviews and meta analyses, can provide more robust evidence than a single empirical study.

4.3 Types of modelling

While modelling can still draw on the overall frameworks used in the four economic evaluation approaches described earlier, there are also other analytical approaches that may be relevant in a modelling context. For example, models can provide estimates and comparisons of future *monetary returns*, *pay-offs* or *cost off-sets* from current investments. A commonly used approach in public health is to estimate the

return on investment (ROI) (which typically monetises the benefits) and **social return on investment (SROI)** (which assesses benefits in natural units)**.**

Return on investment models have been used, for example, by Public Health England, to generate evidence on a range of interventions to promote many different mental and physical health related actions. For example a modelling tool to calculate potential return on investment for eight mental promoting interventions has been published (39). This synthesised evidence on effectiveness from systematic reviews and meta-analyses alongside information on English specific costs to generate information on the level of economic payoffs across different time periods, while indicating which sectors (e.g. health, social care, criminal justice) would benefit. Policy makers and other end users are also able to adjust some of the assumptions in these models and understand how this affects the economic case.

As in the example on mental health promotion where end users can change model assumptions, an important step when estimating value for money using any approach, but particularly so for a modelling based approach, is to carry out a series of 'sensitivity analyses' or 'scenario analyses'. These are ways of checking what impact alternative estimates and assumptions might have on the results. If the results are robust under even very conservative assumptions, they can give power to the findings and strengthen the case for investment. In fact, such sensitivity analyses are necessary for all forms of economic evaluation described earlier given the reliance on various assumptions and sources even when data are obtained empirically.

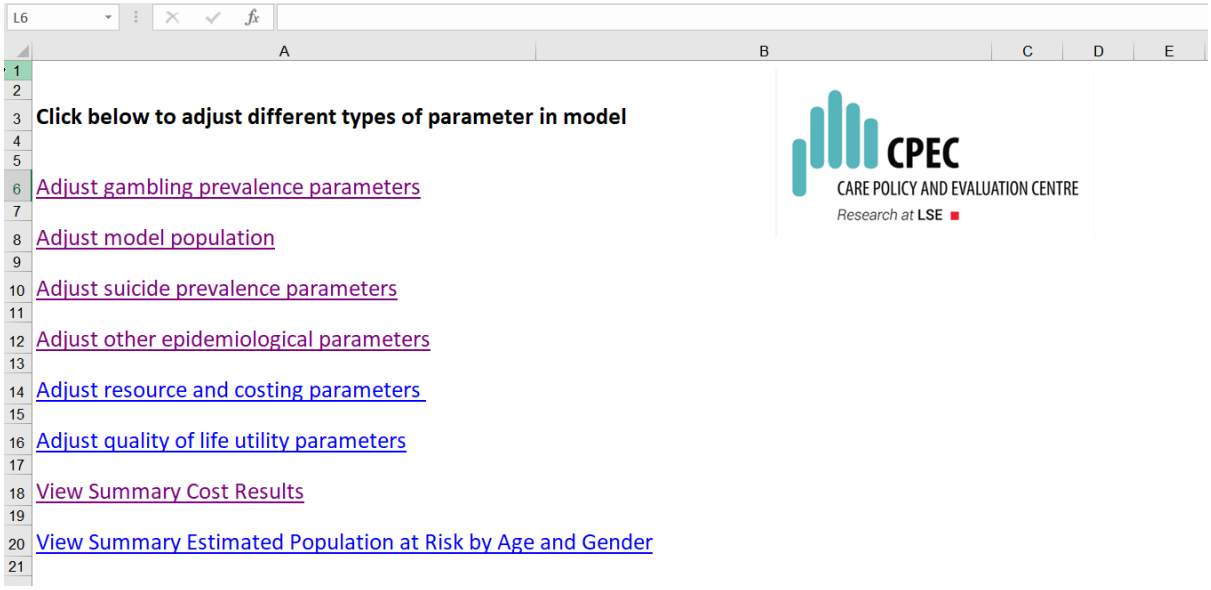
4.4 An illustrative model of costs of gambling-related harms in Great Britain

To illustrate how models can be used to calculate the costs of gambling-related harms in Great Britain an Excel based illustrative tool has been created. In brief here we set out the scope of the model, and indicate the type of data needed to populate the model.

The model brings together data on the prevalence of individuals at low or moderate risk, as well as those already meeting the criteria for problematic gambling in Great

Britain with information on the likelihoods of gambling-related harms costs and consequences of gambling-related harms. It also allows the end user to adjust a range of parameters and see how this impacts on the overall estimate of costs. Figure 3 provides an overview of the potential parameters that can be adjusted, these include a range of assumptions around gambling, suicide, other epidemiological parameters, such as the risk of depression, quality of life utility values and resource and unit cost data. We have noted that there is limited information available on causality. The model makes use of published data on attribution where available (even if non UK sources) but also allows the end user to adjust all attribution rates, e.g. for depression, so that policy makers can see how sensitive overall costs are to different attribution rates.

Figure 3: Menu options in illustrative modelling tool



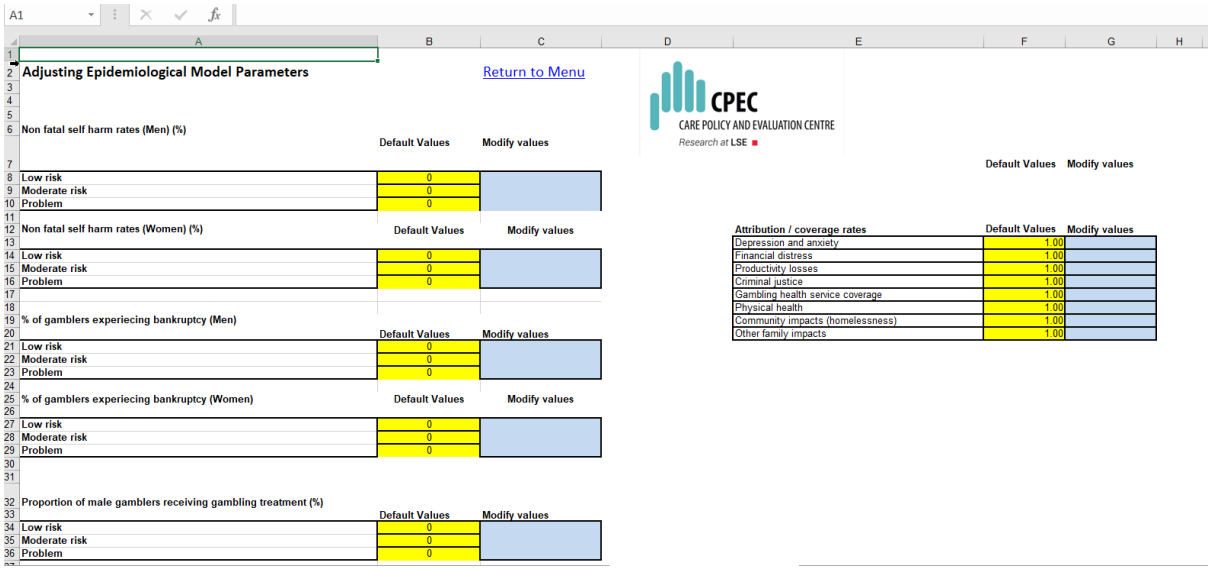
The illustrative model takes a prevalence-based approach to costing and estimates potential costs of gambling-related harms for a one year period. Prevalence data are taken from the Gambling Commission's quarterly telephone survey broken down by age and gender. This would suggest that across GB there are more than 420,000 people at risk of or living with problematic gambling. The model includes worksheet with a breakdown of these data, and gambling prevalence and many other estimates in the model can be adjusted. Figure 4 provides an excerpt of some of the parameters where default assumptions can be made and then varied. If figures are entered into the 'Modify values' column these will be used rather than the default assumptions

(which in this illustrative model remain blank) on prevalence shown in the yellow cells of Figure 4.

The model focuses on ten different types of cost that may be incurred. These include contacts with mental and physical health services, costs of suicide and self-harm, bankruptcy / financial problems, lost employment, increased risk of imprisonment due to gambling, community impacts (here homelessness) impacts, family impacts (risk of divorce and relationship breakdown) and lost quality of life to both gamblers and their families. These represent some of the major potential impacts of gambling related harms where we could identify plausible data on impacts, but by no means all potential costs. Further versions of a model can would refine the structure and costs further as data become available. It should also be noted that not all of these costs fall on the public purse; some of the family impacts are borne by family members whilst quality of life losses are felt by the whole of society.

All resource use assumptions and unit costs are taken from a UK context and are already preloaded in the model. Ideally data on adverse events due to gambling should all be drawn from a UK context. We have identified UK sources for increased risk of homelessness, prison related criminal justice costs, contacts with most health care services and risk of financial bankruptcy. In many cases however available estimates are not readily available in a UK context. For this reason we have all of the assumptions on the risks associated with gambling-related harm blank. Values can be entered by the end use to see what impact they have on overall costs. Default values on the quality of life for both gamblers and families can also be entered into the model.

Figure 4: Examples of option to adjust model parameters



Adjusting Epidemiological Model Parameters

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CARE POLICY AND EVALUATION CENTRE
Research at LSE

Non fatal self harm rates (Men) (%)

	Default Values	Modify values
Low risk	0	
Moderate risk	0	
Problem	0	

Non fatal self harm rates (Women) (%)

	Default Values	Modify values
Low risk	0	
Moderate risk	0	
Problem	0	

% of gamblers experiecing bankruptcy (Men)

	Default Values	Modify values
Low risk	0	
Moderate risk	0	
Problem	0	

% of gamblers experiecing bankruptcy (Women)

	Default Values	Modify values
Low risk	0	
Moderate risk	0	
Problem	0	

Proportion of male gamblers receiving gambling treatment (%)

	Default Values	Modify values
Low risk	0	
Moderate risk	0	
Problem	0	

Attribution / coverage rates	Default Values	Modify values
Depression and anxiety	1.00	
Financial distress	1.00	
Productivity losses	1.00	
Criminal justice	1.00	
Gambling health service coverage	1.00	
Physical health	1.00	
Community impacts (homelessness)	1.00	
Other family impacts	1.00	

The model also allows the size of the target population to be adjusted from the preset defaults covering the entire GB population. This allows the end use to potentially adjust population estimates so as to calculate the average cost per gambler by gender, risk and age group. For illustrative purposes, Table 1 provides (*for illustrative purposes only using a range of data and assumptions, often from beyond the UK*), on how costs can be presented when the model is populated. Here we set up the model solely to look at the impacts on a hypothetical total population of 500 men and 500 women aged 25-34. The model suggests that just under 6 of these 1000 individuals would fall into our three risk categories. The breakdown of costs illustrates that quality of life losses to gamblers and their families potentially represent the largest component of cost, although most of this cost would not fall on public agencies. This is likely to remain the case when using quality of data when available from a UK context. Again these numbers are purely illustrative, but this type of model as Figure 5 shows allows mean costs per annum for associated with different levels of gambling-harm risk to be shown by age, gender and risk group.

If models can reasonably estimate at least some of the potential level of costs that might be averted then it will also be possible to look at the level of effectiveness needed in reducing gambling-related harms given different level of policy maker willingness to pay for such interventions. It would also be possible to calculate return

on investment over different time periods and note which sectors of the economy may benefit most from a reduction in gambling-related harms.

Figure 5: Illustrative one year gambling related costs for a hypothetical general population cohort of 500 men and 500 women aged 25-34.

Annual costs of gambling related harms Return to Menu

Men	Low risk	Moderate risk	Problem	Total
Mental Health Related Costs	183	125	36	343
Suicide and Self-Harm	56	5	47	107
Bankruptcy / Financial Problems	0	1	1	2
Employment Productivity Losses	0	0	522	522
Quality of Life	11,755	5,286	1,682	18,723
Criminal Justice	873	582	512	1,966
Community	511	50	59	620
Other family impacts	62	24	40	125
Family quality of life impacts	15,674	4,429	1,388	21,490
Physical Health	0	0	116	116
Total	29,114	10,500	4,401	44,015
Cost per case	8,916	14,699	21,566	10,521

Women	Low risk	Moderate risk	Problem	Total
Mental Health Related Costs	162	26	0	189
Suicide and Self-Harm	60	2	0	62
Bankruptcy / Financial Problems	0	0	0	0
Employment Productivity Losses	0	0	0	0
Quality of Life	5,620	1,444	0	7,064
Criminal Justice	20	8	0	27
Community	244	14	0	258
Other family impacts	30	6	0	36
Family quality of life impacts	7,493	1,210	0	8,703
Physical Health	0	0	0	0
Total	13,629	2,710	0	16,338
Cost per case	8,731	13,886	19,311	9,304

Note: Estimates of cost shown here are purely for illustrative purposes to indicate information that can be provided by the model. They should be considered to be representative estimates of cost in GB.

5. Summary

This document provides a brief overview of approaches that might be taken from a public health perspective to identify and quantify the costs of gambling-related harms, as well as looking at economic tools that can be used to determine whether interventions to address problematic gambling are likely to be considered as value for money.

It sets out a rationale for taking action and describes different types of costs typically included in economic analyses. It looks at different approaches to collecting data, even where it is not possible to make use of registry and/or other electronic data sources. It also emphasises the importance of being transparent in how any costing analysis or economic evaluation is undertaken.

It also highlights the role that modelling can and should play both in estimating the costs of gambling-related harms and in assessing the cost effectiveness of actions to address this issue. An illustrative model, where many basic assumptions can be varied, has been created. This allows the end user to see how even small changes in the prevalence of at risk and problematic gambling can impact on overall costs. Models can also illustrate how changes in rates of gambling in different population groups in future might impact on future economic impacts of gambling related harms. In future the model could also be adapted to compare the economic case for investing in actions to tackle gambling-related harms compared with this status quo.

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