

# **Relationship Between the Data Collection Approaches and the Application of Health Economics Models in Practice: A Case Study Approach**

Jacque Mallender (Matrix),\* Evelina Bertranou (Matrix)

Working Paper prepared for:

**Methods for Research Synthesis:  
A Cross-Disciplinary Workshop**

Harvard Center for Risk Analysis

October 3, 2013

**[www.hcra.harvard.edu](http://www.hcra.harvard.edu)**

**\*Corresponding author: [jacque.mallender@matrixknowledge.com](mailto:jacque.mallender@matrixknowledge.com)**

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**Title:**

Relationship between the data collection approaches and the application of health economics models in practice: a case study approach

**Authors:**

Jacque Mallender, Matrix Knowledge

Evelina Bertranou, Matrix Knowledge

**Abstract:**

**Introduction:** There are a variety of data collection methods available for the purpose of populating health economic models. These can range in rigor from the most robust method such as full systematic reviews to less robust methods such as the use of expert opinion and stakeholder workshops. Often policy makers encourage the use of systematic reviews as a first line approach to generate the evidence base for decision models. However, systematic reviews are often limited by the lack of robust published data. In the face of this health economic modellers encounter three common options: (i) stay confined to the results of the systematic review, (ii) expand the systematic review (by altering search strategy or inclusion/exclusion criteria), or (iii) elicit expert opinion. Each of these methods can have significant implications for the final results of the health economics model and the applicability of the model in real world practice. It is important for those developing health economics models to understand the advantages and disadvantages of each data collection approaches along with an understanding of how these methods can be used together to ensure the final output of an economic analysis is of most use to policy makers. **Objective:** To examine the common issues encountered with data collection methods for health economics models. In addition, an understanding of how these concerns can be overcome using alternative data

collection methods. An examination of how the final combined approach to data collection is related to the applicability of the health economics models in practice.

**Methods:** To examine two case studies of health economics models developed for public sector audiences: domestic violence prevention, and provision of play interventions for children. In each of these case studies the use of systematic reviews was used as the first approach to data collection. However, the systematic reviews were limited due to lack of robust data. Each case study provides an example of how various methods can be used to overcome the limitations of systematic reviews – (i) stay confined to the results of the systematic review, (ii) expand the systematic review, or (iii) elicit expert opinion. Each case study will be assessed to determine the relationship between the approach to data collection and the applicability of the final model. **Results:** The results of the case studies show that if models are constricted to only the use of the highest quality evidence they are at risk of being robust yet limited in use for policy makers. Alternatively, the use of less robust methods produce models which are of greater value to policy makers but face issues of data rigour. Therefore, when undertaking economic evaluation it is important to be flexible in the approach to data collection. Flexible approaches ensure the final outputs from the economic model are of most use to policy makers. As mixed methods approach to data collection can introduce bias it is important the approach to data collection is transparent to ensure users of the analysis are aware of any limitations.

**Keywords:** data collection, methods, health economics

## **1. Introduction**

Increasingly, economic models referred to as decision models are being used to inform ex-ante and ex-post evaluation of welfare interventions. These models take as a starting point the theory or logic model for the intervention and build the relationships between inputs, process, outputs and outcomes to compare costs and benefits of different options. The models are populated using an array of different information, essentially to enable a synthesis of what is known about the topic within a framework that allows an informed assessment to be made about value for money.

There are a variety of data collection methods available for the purpose of populating economic models. Some take the form of robust full systematic reviews; others draw on expert opinion elicited from focus groups and stakeholder workshops. Often policy makers encourage the use of systematic reviews as a first line approach to generate the evidence base for decision models. However, systematic reviews are often limited by the lack of robust and relevant published data and face the dilemma of abandoning the model or utilising less reliable data sources. In this context, it is important for those developing economics models to understand the advantages and disadvantages of different approaches to data collection and how they can be used together to ensure the final output of an economic analysis is of most use to policy makers.

The remainder of this paper is organised as follows. Section 2 provides some background to economic evaluation of interventions. Section 3 describes the use of decision models and methods of data collection. Section 4 and 5 present two case studies – an economic model for interventions designed to reduce incidence and harm of domestic violence, and an economic model designed to measure the value of play provision for children. Section 6 summarises the data collection issues faced in the two case studies and recommends that researchers take a flexible, pragmatic, and, above all, transparent approach when populating economic decision models.

## **2. Background to economic evaluation**

Policy makers use economic evaluation to identify the resources needed to fund a policy intervention, the associated return on investment for taxpayers and the wider

society, and the affordability of a package of interventions or a programme given competing priorities for funds.

Cost benefit analysis has become a useful analytical framework for answering these questions (Cohen, 2000). There are different models for economic analysis to assess both technical and allocative efficiency issues. Table 1 summarises the main differences between cost-effectiveness analysis, which is useful for technical efficiency questions, and cost-benefit analysis, which is additionally useful for allocative efficiency questions.

**Table 1. Cost-effectiveness and cost-benefit analyses**

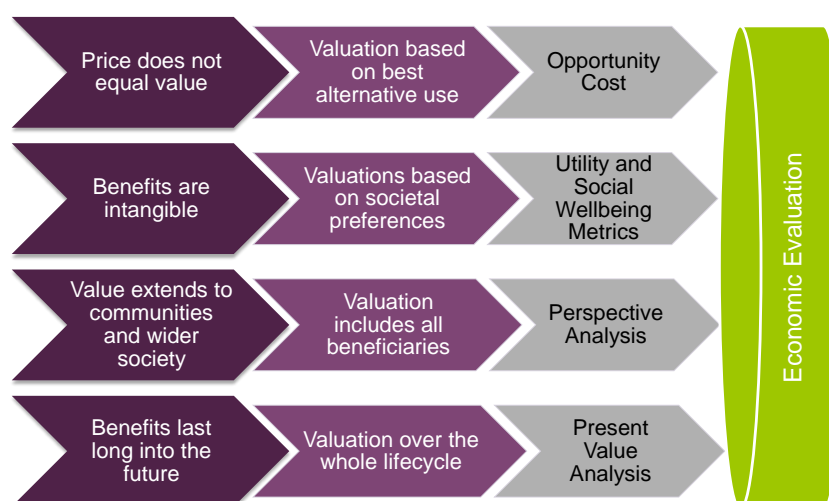
Methods	Description	Positives	Negatives
Cost Effectiveness Analysis	Measures the cost per unit of output or outcome to compare different interventions	A useful tool for deciding between alternatives to achieve the same result.	When multiple outputs or outcomes involved it requires use of techniques like Multi-Criteria Decision Analysis for additional rigour.
Cost Benefit Analysis	Values costs and benefits to enable calculation of net economic value taking into account multiple outcomes	It is easy to understand as there is a single metric to measure and compare net economic value across multiple interventions and outcomes.	It can be controversial as stakeholders find it hard to place monetary values on issues such as health, well-being, reduced fear of crime etc.

Variations on cost-benefit analysis include cost-utility analysis and cost-consequence analysis. A cost-utility analysis assesses the cost of achieving a given value of outcome as measured on a utility scale. This is commonly seen in public health and healthcare, where the utility metric of choice is the Disability Adjusted Life Year (DALY) or the Quality Adjusted Life Year (QALY). Cost consequence analysis has developed as a technique to look at costs and outcomes in discrete categories, without weighting or combining them. Cost-utility analysis and cost-consequence analysis are commonly used in healthcare, such as analyses for the National Institute for Health and Care Excellence (NICE) in England, which uses QALYs as a composite measure of quality and quantity of life and allows comparison between health interventions (Marsh, 2010).

All of these models involve analysing a variety of economic data using concepts such as opportunity cost, marginal and average costs, fixed and variable costs, current and future costs, tangible and intangible costs, and current and inflation adjusted costs (Cohen, 2000). These concepts have developed to inform public policy decisions, specifically because reliance on price as a metric of value does not allow consideration of issues such as the societal value of public goods and externalities, usually associated with these types of public health and welfare interventions.

Figure 1 provides a simple mapping of the problems which can occur when developing economic models for public interventions and the techniques which have evolved to address these.

**Figure 1. Economic models for public interventions: problems and techniques**



### 3. The use of decision models

As defined by Philips et al (2004), decision analysis is a structured way of thinking about how an action taken in a current decision would lead to a result. It usually involves the construction of a logical model, which is a mathematical representation of the relationships between inputs and results. Thus, decision models represent an explicit way to synthesise evidence available on the outcomes and costs of alternative (mutually exclusive) interventions.

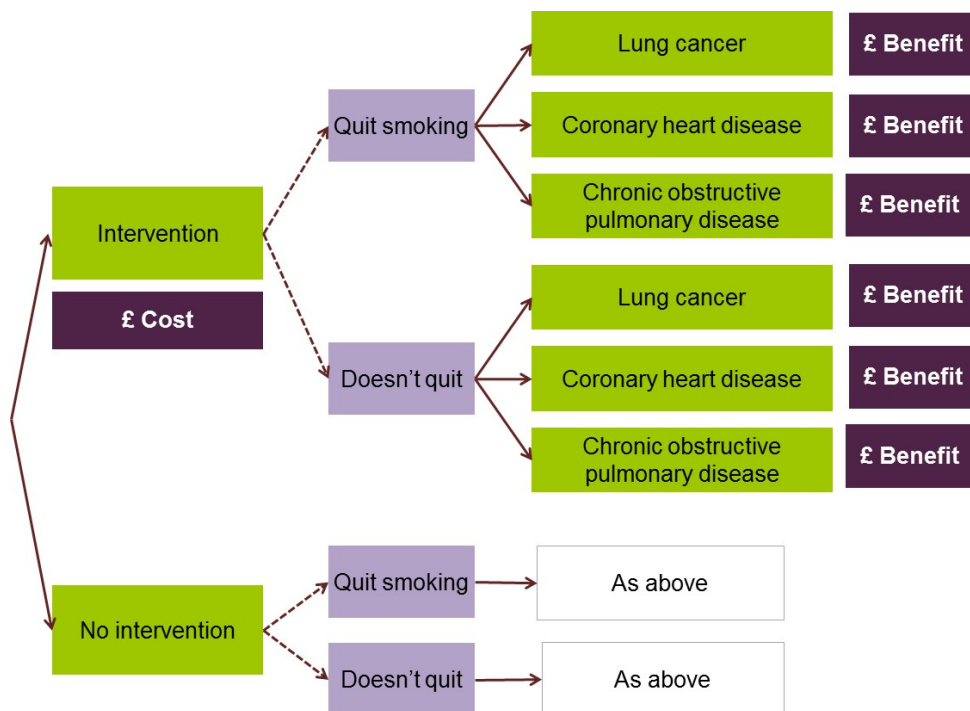
Increasingly, economists involved in health research are using these models to inform decisions to invest in healthcare interventions and public health programmes. Rather than focus on systematic reviews of primary economic studies to determine economic value, researchers are recommending decision models, which are developed in the context of the spending decision being made and are populated using data from a variety of different sources.

Whilst there is an increasingly rich source of good quality primary studies in healthcare, there are strong arguments as to why systematic reviews of economic evaluations are of limited value (Anderson, 2010). These arguments centre on the importance of context which itself impacts on the choice of model, the scope of the evaluation, and the methods used to calculate costs and benefits. There is a role however for systematic reviews of economic studies to help to map theories, and to help provide data and information to populate new economic models and to source relevant studies for a specific topic or intervention.

Most commonly, the objective of decision models is to understand the relationship between incremental cost and effect in order to assess relative cost-effectiveness, and to determine which interventions should be adopted given existing information. A graphical representation of a decision model is shown in Figure 2. Typically, a decision model relies on:

- The cost of the resources required to deliver the intervention (£ Cost).
- The effect of the intervention on the health outcome of interest (represented by the dashed set of arrows).
- The economic value associated with the health outcome generated by the intervention – usually expressed in terms of quality of life gains and health care cost savings (£ Benefit).

**Figure 2. Example of a decision model**



Several guidelines have been published for those developing and evaluating decision-analytic models. One of the most comprehensive has been developed by NICE in England (NICE, 2012). In addition to describing how to use reviews of economic studies and the development of economic models to inform public health guidelines, the guidance prescribes a mixed method approach to gathering evidence. Essentially, the NICE public health advisory committees (PHACs) need both scientific and other types of evidence from “*multiple sources, extracted for different purposes and through different methods... within an ethical and theoretical framework*”. Evidence is classified into:

- **Scientific evidence:** which is defined as “explicit (codified and propositional), systemic (uses transparent and explicit methods for codifying), and replicable (using the same methods with the same samples will lead to the same results). It can be context-free (applicable generally) or context-sensitive (driven by geography, time and situation)”.



- **Colloquial evidence:** essentially derived from expert testimony, stakeholder opinion and necessarily value driven and subjective.

The guidance provides a framework or protocol for evidence sourcing which can be used to document search criteria, sources, screening methods, data extraction, and compilation and validation.

Whilst this guidance is targeted at sourcing evidence of effectiveness, it is also particularly useful in the context of building an evidence base for economic decision models. Guidelines on decision modelling usually refer to three aspects of the models:

- **Structure**, including for example: statement of the decision model, model type, interventions and comparators, and time horizon.
- **Data**, including: data sources and associated hierarchies (Coyle et al, 2002) data identification, data modelling, and assessment of uncertainties.
- **Consistency**, including: internal and external consistency or validity of the model.

The focus of this paper is on the issue of data identification. Best practice guidelines for identification of data developed by Philips et al (2004) are:

- Methods for identifying data should be transparent.
- It should be clear that the data identified are appropriate given the objectives of the model.
- There should be justification about any choices that have been made about which specific data inputs are included in a model.
- It should be clear that particular attention has been paid to identifying data for those parameters to which the results of the model are particularly sensitive. Identification of all available data for every parameter may not represent the best use of research resources.

- There should be a description of the quality of the data identified for use in the model.
- Where expert opinion has been used to estimate particular parameters, sources of opinion and methods of elicitation should be described.

There are a variety of data collection methods available for the purpose of identifying effect data when populating health economic models. In line with the classification used by NICE into scientific and colloquial evidence, these can range in rigor from the most robust method, such as full systematic reviews, to less robust methods, such as the use of expert opinion and stakeholder workshops.

Often policy makers encourage the use of systematic reviews as a first line approach to generate the evidence base for decision models. However, systematic reviews can yield poor results given that, particularly in some public health areas, there is often a dearth of robust published evidence. In the face of this, health economic modellers encounter three common options:

- (i) stay confined to the results of the systematic review, at the risk of finding insufficient data to undertake a health economic model;
- (ii) expand the systematic review, for example by altering the search strategy or the inclusion/exclusion criteria to select data; or
- (iii) derive data through the elicitation of expert opinion.

Each of these methods can have significant implications for the final results of the health economics model and the applicability of the model in real world practice.

The remainder of this paper examines common issues encountered with data collection methods for health economics models through two case studies. In addition, the paper aims to provide a better understanding of how these concerns can be overcome using alternative data collection models. The two case studies were selected to illustrate different approaches or methods for collecting data, and the implications for the final results of the health economic models.

#### **4. Case study 1: domestic violence**

The purpose of this research was to generate evidence on the economic value of interventions for preventing and reducing domestic violence (Matrix, 2013). The research was commissioned by the National Institute for Health and Care Excellence (NICE), whose role is to improve outcomes for people using the National Health Service and other public health and social care services by, among other means, providing evidence-based guidance and advice for health, public health and social care practitioners.

A review of the economic literature was undertaken to identify evidence of the costs and benefits of interventions to prevent and reduce domestic violence. The review was undertaken using a rigorous search protocol. Although some 1364 studies were initially identified from the search and subsequently screened for relevance, only two studies were identified as meeting all of the inclusion criteria.<sup>1</sup> The studies provided high quality estimates of the cost-effectiveness of system level intimate partner violence (IPV) programmes in primary health care, but they were limited in scope as they did not include the wider cost savings and quality of life gains associated with preventing and reducing domestic violence. Thus, due to the limited cost-effectiveness evidence, two de novo economic models were undertaken.

This case study provides a number of examples of how different data collection approaches can shape the results of health economic models.

##### **a) Use of expert opinion to define the scope of the models**

The initial scope was that the economic analysis would include the short and long-term impacts experienced by adult victims as well as children witnessing domestic violence.

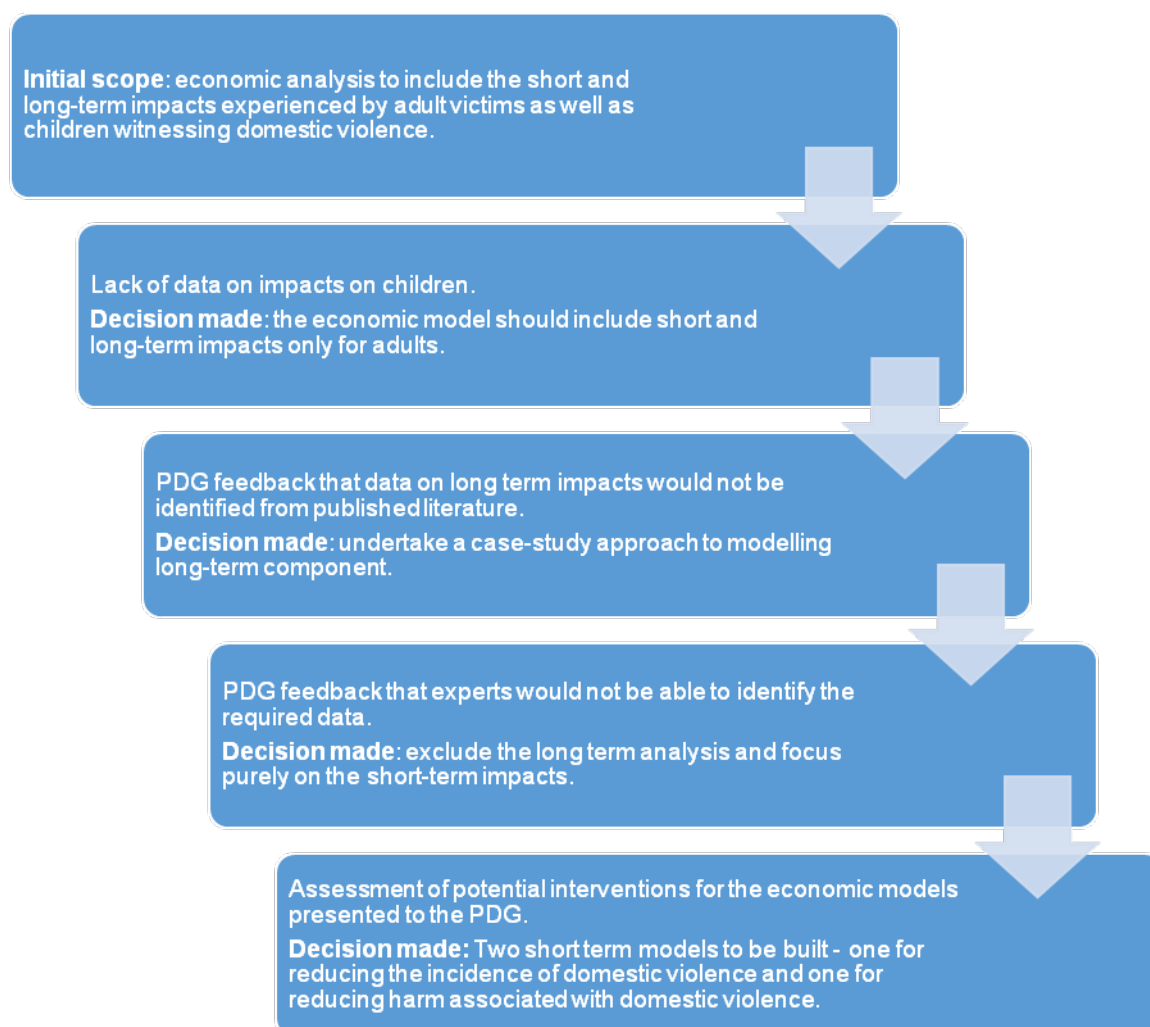
The final scope of the analysis was defined based on cooperation between the project team, NICE, and a group of stakeholders represented via the Preventing and Reducing Domestic Violence Programme Development Group (PDG). It was agreed that the final scope for the economic analysis was the development of two short-term

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<sup>1</sup> Inclusion criteria were around: study design, population, interventions, comparator, setting, outcomes, country of study, date of publication, and language of study.

economic models only including impacts experienced by adults. Figure 3 outlines the decision making process.

**Figure 3. Decision making process to agree scope of economic analysis**



The example above illustrates how the use of expert opinion can shape health economics research. Numerous discussions happened around the trade-offs between scope and rigor of the evidence. The decisions made meant that the final scope of the economic analysis was much narrower than initially planned. However, stakeholders believed this was necessary in order to produce results that would be ‘trusted’ by policy makers, ultimate users of the evidence.

To compensate for the limited scope of the models, the analysis was supplemented with a cost-consequence analysis. The purpose of the cost-consequence analysis was to provide a more complete picture of the potential benefits that due to lack of data it was not possible to measure (in natural units or monetary terms) and hence were excluded from the economic models.

**b) Use of a systematic review and interpretation of limitations when populating economic models**

The economic models were informed by a systematic review conducted to identify interventions effective at reducing and preventing domestic violence.<sup>2</sup> An assessment was undertaken to determine which studies were suitable for modelling. The assessment involved:

- **Relevance:** relevance of the identified intervention for the purpose of either incidence or harm reduction. Any studies which did not measure the impact of the intervention specifically on domestic violence incidence or domestic violence related harm were excluded.
- **Intervention type:** each intervention was assessed for the typology of intervention – e.g. advocacy, counselling, skill building, therapy, provider support, or mother and child. This was conducted to facilitate the PDG on which types of interventions the economic analysis could use to recommend.
- **Outcome measured:** each intervention was assessed for the specific outcome measured within the study. For example, if incidence reduction potentially measured through Conflict Tactics Scale, or if harm reduction measured through Becks Depression Index or CAPS PTSD index. This was conducted to estimate the likelihood the specific outcomes measured could be linked to economic value.
- **Feasibility:** each intervention was assessed for feasibility of including within the economic model. For certain interventions the outcome measured was not adequate enough to immediately link to economic value and required further

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<sup>2</sup> The review was undertaken by researchers at the University of British Columbia, Canada.

research. For example, several interventions measured “increased referrals”. However, in order to link “increased referrals” to incidence of domestic violence or harm reduction additional literature searches were required. Studies which required marginal further research were rated as high feasibility. Correspondingly, studies which required high levels of further research were rated as low feasibility.

A short-list of interventions based on the above assessment was presented to the PDG. Based on the short-list presented the PDG selected two interventions to be modelled:

- Independent domestic violence advisors (IDVA): provision of IDVA for the prevention and reduction of incidence of domestic violence (Howarth et al, 2009)
- Cognitive trauma therapy – battered women (CTT-BW): provision of CTT-BW to women after leaving an abusing relationship to reduce harm associated with domestic violence; specifically post-traumatic stress disorder (PTSD) (Kubany et al, 2004).

These two studies were the focus of the economic analysis. Below the limitations of these studies and the implications for the research are discussed.

The effectiveness of many public health or health promotion interventions depends on changes in individual behaviour, thus making outcomes difficult to attribute and generalise. It is recommended that, where possible, the relative effectiveness of interventions should be assessed by randomised controlled trials (RCTs). However the existence of RCTs in many public health or health promotion interventions is quite limited. In fact, RCT data was not available in relation to interventions to reduce the incidence of domestic violence. The study chosen for the economic model (Howarth et al, 2009) was a before-after evaluation which did not provide any control group.

A number of additional limitations hampered the reliability and relevance of the evidence reported in Howarth et al (2009). Firstly, the study was based on provider reported outcomes on behalf of domestic violence victims. This may have introduced

bias on the effectiveness estimates. Secondly, the evaluation had been conducted in 2009. Since 2009, there had been various improvements to services provided to domestic violence victims and therefore the data may not completely have reflected the situation in the UK at the time the economic analysis was undertaken. In order to deal with these limitations, the results of the economic analysis were tested in sensitivity analysis, showing that for a variety of scenarios the intervention remained cost-effective.

Kubany et al (2004) was chosen for the economic model of an intervention to reduce harm associated with domestic violence as it presented the most robust and relevant evidence available. However, the study was subject to a number of limitations. Firstly, the study was conducted in the US. CTT-BW is not offered in the UK. However, as the clinical staff required to deliver CTT-BW exist it was considered that an intervention of this nature could be provided in UK. Secondly, the study was based on a relatively small sample size (n=125). Therefore it was noted that the outcomes measured from the study may not be scalable to a larger population group. Lastly, the intervention provided CTT-BW to a very specific population group – that is women with clinically persistent PTSD who have left their partners. In this context, policy recommendations based on this evidence needed to consider how accurately this population group could be identified and provided therapy services.

## **5. Case study 2: play**

The objective of this research was to generate economic evidence of the benefits of staffed play provision (Matrix, 2009). The research was commissioned by Play England which is part of the National Children's Bureau, a leading children's charity. Two specific forms of play provision were evaluated: adventure playgrounds and after school play clubs. The economic value of these forms of play provision was assessed by undertaking cost-benefit analysis (CBA). The CBA compared the costs of providing the interventions with their benefits in terms of health and educational outcomes. The CBA answered the following two questions:

- What is the economic value (£) of an **adventure** playground, compared with **no playground**?

- What is the economic value (£) of an after school club staffed **with qualified play personnel**, compared with an after school play club **not staffed with qualified play personnel**?

The economic models were built upon the following four elements:

- The cost of the resources required to deliver the interventions.
- The effects of the interventions on short term children's outcomes, expressed in natural units.
- The relationships between short term children's outcomes and longer term outcomes, expressed in natural units.
- The benefits of the interventions – i.e. the monetary value of the long term outcomes generated by the interventions.

This case study provides a number of examples of how different data collection approaches can be used to inform health economic models.

**a) Use of a systematic review and interpretation of limitations when populating an economic model**

An adventure playground provides a good quality play space for children to take risks, explore, and experiment. In the short run an adventure playground promotes children's physical activity and social play. How were these benefits quantified in monetary terms? It was estimated that in the long term these short term effects will lead to improved health and educational outcomes. Increased physical activity in childhood was associated with higher levels of physical activity in adulthood, which in turn decreases the chances of experiencing a number of diseases such as coronary heart disease, stroke, and type II diabetes. The monetary benefit of reduced incidence of these diseases was measured in terms of healthcare cost savings and increased quality adjusted life years. Similarly, it was estimated that the effect of an adventure playground on social play has a positive relationship with educational attainment, first in primary education, and subsequently in secondary education. The



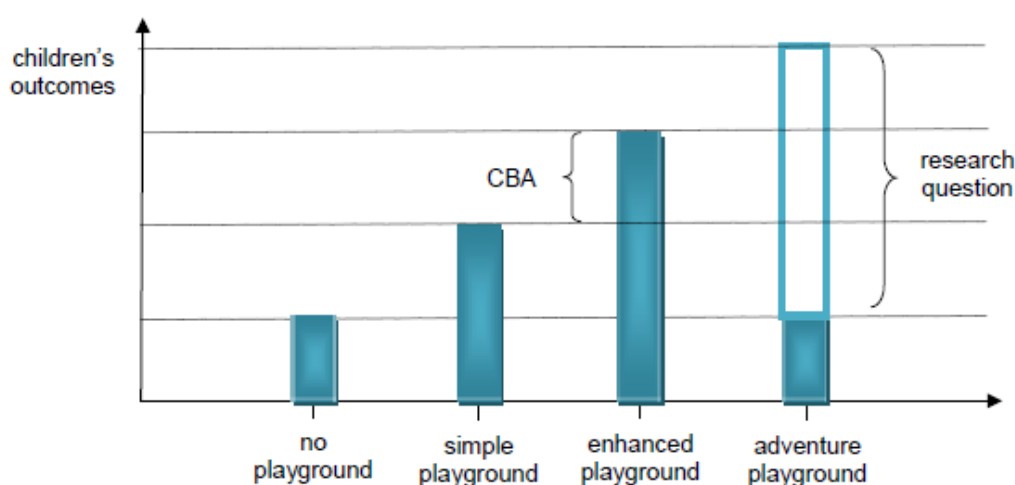
monetary benefit of improved educational performance was estimated by the associated increase in adult earnings.

A systematic literature review was undertaken to identify articles measuring the effect of an adventure playground on childhood physical activity and educational attainment. A number of websites and databases were searched including: Play England, Science Direct, Pub Med, ERIC, Google Scholar, National Children's Bureau, National Literacy Trust and NFER. The search strategy had no restriction on time period or age groups. Examples of key terms searched along with the word 'playground' were: 'physical activity', 'emotional', 'social skill', 'behaviour', 'learning', 'activity', 'skill', 'children's outcomes', and 'school readiness'. Additional studies were identified by pearl growing – i.e. following up studies referenced in studies identified through the search.

The literature review did not identify studies that addressed the research question directly – i.e. measuring the effects of an **adventure playground** compared with **no playground**. However, evidence was found on the effects of different types of playgrounds). Therefore, estimates of the effect of the closest type of playground to an adventure playground compared to a simple (no adventure) playground were used to populate the economic model (Colabianchi et al, 2009; Hart et al, 1986; Pellegrini, 1992).

Figure 4 illustrates this mismatch between the evidence available to populate the CBA and the research question in graphical terms. The evidence available meant that the estimate of effect used in the model was based on both an intervention (enhanced playground) and a comparator (simple playground) that did not strictly match the intervention (adventure playground) and the comparator (no playground) in the research question.

**Figure 4. Mismatch between evidence available and research question**



The results of the CBA suggested that investing in an adventure playground has a positive rate of return and is therefore a good use of public resources. Even though the benefit cost ratio was relatively small, it is likely that, given the limitations in the data available to populate the model, the benefits were underestimated. Opinion elicited by playground managers when asked to compare an adventure playground with a simple playground suggested that the effects could be up to three times higher than those obtained from the literature review and used in the model.

#### **b) Use of expert opinion to populate an economic model**

An after school club with qualified play personnel provides opportunities for children to engage in better quality play. Staff who have had play work training are more experienced at helping children develop positive relationships, promote self-directed play, and improve play practices. In the short run the benefits of attending an after school club with qualified play personnel, compared with an after school club with non-qualified play personnel, can be estimated in terms of improved educational outcomes. As with adventure playgrounds, the long term benefits were estimated by predicting the effect on educational attainment in primary and, subsequently, secondary education. The monetary benefit of improved educational performance was estimated by the associated increase in adult earnings.

A systematic literature review was undertaken to identify articles measuring the impact of afterschool play clubs with qualified personnel on educational attainment.

A number of websites and databases were searched including: Science Direct, Pub Med, ERIC, Google Scholar, National Children's Bureau, National Literacy Trust and NFER. The search strategy had no restriction on time period or age groups. An example of key terms searched along with words effect and evaluation were: 'after school programs', 'play benefits', 'play rangers', 'extended schools', 'playgroups', 'play schemes', 'play club', and 'after school care'. Additional studies were identified by pearl growing – i.e. following up studies referenced in studies identified through the search.

In discussions with Play England it was decided that none of the articles was useful for the purpose of answering the research question. The three main reasons these articles could not be used included:

- Impact of training not valued: none of the articles were able to identify the impact of trained personnel on children's outcomes. The articles examined the provision of after school care versus no care, which was not the scope of the economic model.
- Intervention was not play specific: articles provided analysis of after school clubs that were not play specific – e.g. academic, sports, music.
- Age group: articles focused on early years setting (ages 0-4) which was considered below the average age of after school club children.

Due to the inability to use the articles identified in the literature review, the economic model relied fully on expert opinion for the estimated educational effect on children in after school play clubs. Play England identified after school club managers which had a close relationship with nearby schools. Within the time frame allowed six after school club managers were contacted. Managers were asked about current staff and the estimated effect of trained staff on primary school exams. Managers were told the focus of the project was to compare the benefits of training specifically; therefore the comparator was an after school club with non-qualified personnel. Managers were asked if they believed after school programs with qualified play personnel provided a positive effect on exams score in comparison to after school programs with non-qualified play personnel. If they answered yes, they were asked to measure

this effect by stating how many children out of 10 see a benefit from qualified play personnel. Then managers were asked out of the children who see a benefit what the magnitude of the effect is in terms of percentage increase in exams' performance. The effect size was the number of children thought to see a benefit multiplied by the magnitude.

The results of the CBA suggested that investing in afterschool play clubs with qualified personnel has a positive rate of return and is therefore a good use of public resources. However, given the large net benefits estimated, it was recommended that the results were treated with caution. Due to the lack of evidence on the impact of play work training, the CBA relied on expert opinion. In the absence of a control group with which to compare the effect on children's outcomes of qualified personnel, it is likely that the effect measures estimated by after school play club managers represent an overestimate. However, the sensitivity analysis indicated that even if the effect of the intervention was dramatically reduced to less than 10 per cent of the effect size used in the model, the net benefits would be positive.

## **6. Discussion and conclusion**

Decision models can provide a useful framework for analysing the potential net economic value of policy interventions. They can help to inform resource planning and investment decisions by putting a structure to a plethora of evidence concerning the logic model of the intervention, the target population, the relationship between inputs, process, outputs and outcomes, the resource requirements and essentially the cost and benefits.

However, the method of building decision models and obtaining data from diverse sources means these models can be subject to uncertainty and potentially bias. As the case studies have shown:

- It is possible that systematic review methods will not provide the data required to answer the research question. This was the case in the two models of play presented. In one case, this lack of data was supplemented by the use of expert opinion. In the other case, despite the mismatch between the research question and the evidence found, a model was built using the data that most

closely matched the analysis. Both models were subject to limitations and sensitivity analysis was undertaken to account for the potential overestimation and underestimation of the benefits associated with the intervention.

- Both the quality of the evidence and its relevance in terms of population, intervention, comparator, and outcome, are important when selecting data to populate models. The two models of play provide examples of limitations in the evidence base and how to deal with them when interpreting results. The two models of domestic violence also provide examples of limitations in the quality of the data (before-after study) and relevance in terms of population (specific targeted group) and intervention (clinical staff required not available in the UK).
- Regardless of the use of more or less scientific data available to populate the models, there is great value in engaging experts and stakeholders in the design and development of models and identification of data. The domestic violence example showed that stakeholders had a key role in shaping the scope of analysis so that the results would be 'trusted' by those using them to make decisions.

There is a delicate balance to be struck between presenting rigorous evidence of proven net economic benefit, and using these types of models constructed from a variety of different sources to help decision makers to make choices about intervention investment and programme funding.

As mixed methods approach to data collection can introduce bias it is important the approach to data collection is transparent to ensure users of the analysis are aware of any limitations. The experience of these case studies shows that by following the basic rules set out by Philips et al (2004), it is possible to use data from a variety of sources, and deploy sensitivity testing to build credible models.

Overall therefore, it is important to be flexible in the approach to data collection. Flexible approaches ensure the final outputs from the economic model are of most use to policy makers.

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