

CBAX Tool User Guidance

Guide for departments and agencies using Treasury's
CBAX tool for cost benefit analysis

September 2017

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<http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax>

The PURL for this document is <http://purl.oclc.org/nzt/g-cbaxt>

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Introduction

To help advisors complete cost benefit analysis (CBA), the Treasury has developed the CBAX tool to monetise impacts as part of a CBA (CBA steps 4 and 5). The CBAX tool is an excel-based spreadsheet model with a database of quantified impact values.

CBAX is designed to support rigorous transparent evidence-based CBA of budget initiatives. It is an important element of the Treasury move to ensure that robust value for money assessment is applied to investment and budget decisions. The tool encourages agencies:

- to take a long-term and broad view of costs and benefits
- to rigorously assess these by monetising impacts, where possible, and
- to be transparent about the assumptions and evidence base.

What's new?

This document replaces the CBAX Tool User Guidance released on October 2016. The Treasury intends to refresh both the CBAX tool and the User Guidance on a yearly basis.

This September 2017 refresh for Budget 2018 responds to user feedback and lessons from implementing CBAX. The CBAX tool is stable to support capability building. Changes are mainly to the templates, the guidance and the use of CBAX, including:

- Fit for purpose application, through more targeted budget requirements and clarification of grounds for exemptions. These are set out in the budget guidance.
- Increased use and visibility of CBAX analysis. As quality increases, the Treasury puts greater emphasis on how it uses CBAX analysis to inform value for money advice for Ministers.
- Availability of values developed through econometric wellbeing modelling from the Australian Social Value Bank. Government agencies can purchase a sub-licence through the Treasury and use the wellbeing impact values in CBAX.
- Model improvements that do not affect the way in which you use CBAX.

About this guidance

This guidance document sets out instructions for using the Treasury's CBAX tool. It includes: (a) an overview, (b) CBA steps, (c) worked example and (d) tips for common questions.

This guidance document should be read by:

- Any government staff preparing or endorsing spending proposals for Ministers (policy analysts and managers). It may also be useful for other spending proposals, such as when making decisions about allocating sector funds.
- Any government staff involved in reviewing spending proposals (such as Treasury vote staff, or other central agency staff).

Although it has been designed for a central government audience, it can be used by a much wider set of analysts and advisors, such as local government, iwi and community service providers.

The guidance outlined in this document are relevant for all Budget 2018 initiatives, particularly for those required to complete CBAX analysis. The CBA steps apply for all initiatives. The use of the CBAX tool is required for some initiatives, and encouraged for all initiatives monetising impacts. This includes any proposals from contingencies prior to the delivery of that Budget and requirements for use of CBAX outside the budget process in drawing down funding between Budgets.

Further information

This document is part of a suite of guidance that relates to preparing high quality funding proposals and CBAs. Other documents to be considered when preparing proposals include:

Name of document	Link
Treasury’s budget initiative and impact summary templates	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/cbax Note that this incorporates the previous CBA template, in response to feedback.
Treasury’s CBA guidance	http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/guide
Treasury’s Budget guidance	Released each year on CFISnet – agency staff should contact your Finance and Budget teams for more information
Applied examples of CBAX from previous Budgets	http://www.treasury.govt.nz/publications/information/releases/budget/2016/cbax http://www.treasury.govt.nz/publications/information/releases/budget/2017/cbax

Feedback and improvements

This document has been written by the Treasury CBAX team, with assistance and feedback from Treasury vote teams and CBAX users in the wider public sector. We would like to thank all of those who provided input and feedback.

The Treasury welcomes suggestions on CBAX and would like to learn from practical experiences of applying CBAX. Over time, the Treasury will improve and update the tool and the use of the CBAX tool.

The Treasury invites people to suggest data and information for inclusion in the CBAX impacts database. This may be information that is available and that can be shared, or it may be a request for values that people would find helpful to have included in CBAX. The Treasury anticipates refreshing CBAX on an annual basis, and as part of this, reviewing the impacts in the impacts database, and considering what else could be included.

Please contact CBAX@treasury.govt.nz with comments and suggestions.

1 Overview of using CBAX

What is cost benefit analysis and CBAX?

Any government decision to allocate funds will involve a trade-off. Understanding the trade-offs between vastly different proposals is difficult. One way of helping to evaluate different proposals is to prepare a cost benefit analysis (CBA) for the different options.

Cost benefit analysis is a framework for systematically analysing the costs and benefits (ie, the negative and positive impacts) of various options. In this way, it is an economic evaluation of the available options. It helps decision-makers to compare options by providing a common language and framework.

To help advisors complete CBAs, the Treasury has developed the CBAX tool. It is a spreadsheet model with a database of quantified impact values to monetise impacts. By using CBAX in a CBA, decision-makers can be confident that the advice has been based on:

- A common basis for assumptions when quantifying and monetising the impacts of different proposals (for example, impact values and discount rates)
- A robust framework for estimating the broader societal impacts of options.

CBAX provides a tool for advisors to do in-house CBAs. CBAX should be used with the Treasury's Budget Initiative Templates, to ensure that the full case for the proposal is made, taking into account all of the relevant information. CBAX information is integrated into the wider case, rather than being a stand-alone analysis.

The CBAX analysis provides a benefit cost ratio, return on investment (RoI) rate and a net present value (NPV) for a proposal. This informs the value for money case for the different options analysed. For budget decisions, CBAX analysis is considered together with the Budget Initiative and Impact Summary Templates. The Budget Initiative Template is a word document that outlines the case for change and the evidence base, as well as any impacts that could not be quantified or monetised.

When should CBAX be used?

All budget initiatives should be supported by a robust CBA, and agencies are encouraged to use CBAX to monetise impacts in a CBA.

CBA and CBAX should be used in a fit for purpose way, so that the information is useful for decision-making.

The budget CBA and CBAX requirements are set out in the Budget 2018 Guidance, which is issued via CFISnet. For advice on these requirements, contact your finance or budget teams within your agency, or the relevant vote team within Treasury.

Fit for purpose analysis

CBAX analysis can be varied and can be simple or comprehensive, in line with what makes sense for the proposal. Analysts should always apply a fit for purpose approach to CBAX modelling. Small, simple funding proposals might only require a simple CBAX, whereas larger proposals might justify more detailed analysis. When proposing to spend taxpayer dollars, a solid evidence base is desirable. This, along with reasonable assumptions and

sensitivity analysis, can give confidence in the results. At the very least, the transparency in assumptions and impact analysis provides a basis from which to learn for the future.

If there is very little information or evidence available, or the proposal is highly specialised, another option is to use CBAX to prepare a reverse analysis. A reverse analysis means approaching the CBA from the viewpoint of 'what would it take to make the proposal break-even', or generate a return on investment of one. It is a simple way of considering the impacts of a proposal, and assisting in judgements about whether the assumptions and values are reasonable. More information on reverse analysis can be found in Section 4.

Transparent assumptions and evidence base

Even if the evidence base is weak or inconclusive (eg, in the case of pilot programmes), being transparent about these assumptions provides a basis for developing an evaluation plan.

To be able to use CBAX, advisors will need to be able to quantify impacts and success rates, for example, the number of people expected to gain employment as a result of a job-mentoring service, based on the best available data and evidence. Sometimes there will be gaps in the evidence base, for example, when trialling a new and innovative approach. The value of the information provided by CBAX highly depends on the quality of the information input into the tool. If a CBAX is based on poor evidence quality or poor assumptions, it will be less useful for decision-making. It is important that agencies focus on improving the quality of this information feeding into the tool so that CBAX can better support decision-making. Users should focus efforts on improving the evidence base for the most significant impacts.

One of the advantages of CBAX is that it makes the assumptions explicit, and values different types of costs and benefits in a consistent way. So, even if the evidence is incomplete, the analysis can account for that, and still provide a basis for a more informed discussion between different options. While the CBAX database standardises impact values, this does not limit agencies as users have full flexibility to put in relevant and adjusted values.

Exemptions to CBAX

If the quantification of benefits and costs is very complex, or seems as though it would provide limited value in decision-making, then Treasury can consider whether an exemption from CBAX requirements may be warranted.

Exemptions to the CBAX requirements can be given on a case-by-case basis. These usually apply in circumstances where there is limited information for completing a CBAX, or where completing a CBAX would not provide much value to the decision-making process. Exemptions are rare and other alternatives (such as performing a reverse analysis, or approaching the CBA in a fit-for-purpose way) should be explored in the first instance. Decisions regarding CBAX exemptions are made by the relevant Treasury vote team.

For more information on exemptions please consult the Budget guidance, or contact your Treasury vote team.

CBAX requires a variety of expertise

CBA and CBAX analysis should involve a range of people with different perspectives and skillsets. Policy analysts, subject matter and sector experts, evaluation and research teams, finance and actuarial teams should all work together in completing CBAX analysis and initiative template. This might also involve working with people from different organisations.

Limitations of the CBAX tool

We recognise that there will always be limitations with a tool like CBAX. CBAX modelling is just one part of CBA and policy analysis. CBAX supplements well-researched quality policy advice including alignment with the Government's strategic priorities, realistic costings, risk analysis and implementation and evaluation plans.

The CBA information, including CBAX modelling results, is integrated into the budget initiative advice. The CBA information sets out the impacts and the transparent assumptions. This includes taking into account other considerations eg, impacts that can't be monetised, as well as impacts monetised by using the CBAX tool.

CBAX requires information and judgements on assumptions

Advisors will need to do a thorough policy analysis when conducting a CBA. This requires research, so that options are informed by evidence.

With this in mind, advisors will need to make judgements, based on the best available evidence, and what is a reasonable and fit-for-purpose analysis for the proposal. For example, advisors will make judgements about the policy and intervention options (such as what options are feasible), the counterfactual and the impact assumptions.

The purpose of CBAX is not to deliver the final judgement on what the assumptions should be. Instead, it is more about making these assumptions transparent, so that discussions and advice about impacts can be better informed, and so that we can learn from our analysis in the future. Developing policy advice is inherently uncertain, as it requires advising on changes in the future. The job of advisors is to develop practical advice, based on the best information that we have. Being clear about assumptions is key. The CBAX tool can help you do this by providing a consistent approach and standardised measurement.

How to prepare a Budget initiative

Preparing a budget initiative requires a thorough policy analysis. Working through the policy analysis and seven CBA steps (see Section 2) will help you to be confident in the advice that you provide to Ministers and decision-makers.

The budget initiative templates includes CBA information. This will draw on CBAX modelling to monetise impacts where relevant and required. CBAX is one of the pieces of analysis that advisors undertake in order to prepare a high quality budget proposal for funding.

We recommend that advisors check the yearly budget guidance issued via CFISnet to make sure that you have satisfied the requirements for preparing a budget initiative.

Introducing the Australian Social Value Bank

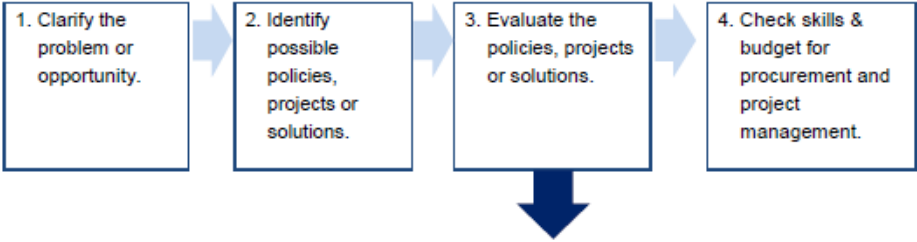
In 2017, Treasury purchased a licence to use about 60 social non-fiscal wellbeing values compiled by the Australian Social Value Bank (ASVB). The agreement gives Treasury the ability to sub-licence to the New Zealand government sector. The values include monetised impacts for wellbeing outcomes like 'housing is no longer overcrowded' and 'increased hope for the future' (see Appendix 1). See section 4 for information on the ASVB values, the methodology and how to access a New Zealand licence.

2 The Cost Benefit Analysis (CBA) Steps

The Treasury’s *Guide to Social Cost Benefit Analysis* provides a detailed explanation of the seven CBA steps, including how CBA fits into the generic policy development process.

2.1 Summary of the CBA steps

CBA fits under the evaluation stage of the policy development process. It is a tool for completing an economic evaluation of options that have been developed in response to a policy problem.



Policy evaluation using CBA	
Undertake CBA on each of the feasible policy options	
Inputs to CBAX	<p>Step 1: Define policy and counterfactual</p> <p>Step 2: Identify the people who gain and those who lose</p> <p>Step 3: Identify the benefits and costs; allocate to time periods</p>
Analysis in CBAX	<p>Step 4: Quantify the benefits and costs within ranges</p> <p>Step 5: Discount to a common period, compare benefits and costs</p>
Outputs from CBAX	<p>Step 6: Is the result clear enough? If not, consider whether it is worth investing in more research, and repeat above steps</p> <p>Step 7: Write report</p>

We recommend checking these steps frequently while completing the policy work and the CBA. In situations where you may be struggling with compiling the information to complete a CBA or input into CBAX, consider whether it is worth (even briefly) revisiting some of the earlier steps in the policy process. For example, if you are struggling to capture pre and post intervention levels of change as a result of an intervention, it may be worth going back to step 1 and considering the counterfactual.

Example: Reconsidering earlier parts of the policy process

Suppose you are working on a policy proposal to fund a programme of nurses in schools, to prevent skin infections and subsequent hospital admissions. In researching the intervention, you come across an alternative solution, which involves funding nurses to do home visits. This has a higher success rate than school-based nurses, but is more costly. In this situation, it might be worthwhile going back to steps 1 and 2 of the policy process, to reconsider the policy problem, and the specific cohort that the problem relates to, to see if this sheds any light on which option might be worth pursuing. It could also be worthwhile completing CBAXs for both options.

2.2 Inputs for CBAX – CBA steps 1-3

To make it easy to undertake analysis, before filling in the CBAX spreadsheet model, you should establish the evidence base, and work through the assumptions (if any) and set these out in the Budget Initiative Template. It can be useful to check out the CBAX database before research to help understand the types of metrics and impacts to look out for when researching. If your agency has a dedicated research team, it is highly recommended that you engage with them early on to assist with gathering evidence, as this can be the most time consuming but also most fundamental activity in completing a CBAX. Also consider whether there are external organisations that could help, such as Superu or the Social Investment Agency, where applicable.

The Budget Initiative Template is a word document where analysts set the wider considerations for a funding proposal, such as the problem definition and the details of the intervention. Filling in this template also requires using information generated by using the CBAX tool. It is available from the Treasury website.

Step 1: Define policy alternatives and counterfactual

From stages one and two of the policy development process, you have first defined the problem, and identified several potential solutions. It is useful to set this out on one page in an intervention logic map. You should undertake CBA on each of these potential solutions. Doing a draft quick CBAX can help clarify main impacts, initial evaluation of the potential options and focusing of the policy and evidence efforts on the key policy options.

Before filling in CBAX, do CBA steps 1 - 3 to generate the information that you need to put into the CBAX spreadsheet. This information is called the **inputs**. In practice, it is an iterative process, where CBAX inputs and results informs further options and evidence development. The first step is to define the **counterfactual** of the initiative. CBAX, and CBA in general, requires a clear counterfactual in order to calculate the marginal impact of the intervention over time.

The '**counterfactual**' is the situation that would exist if the intervention does not go ahead. The counterfactual needs to be realistic. In many situations, as status quo of 'Doing nothing' is not a realistic counterfactual. You should consider questions like:

- What is the status quo? What are the current impacts of 'business as usual'?
- Would an intervention for the same problem be provided by someone else?

- Would other factors already affect the impacts?
- What would you actually do, if you did not undertake the proposed intervention? What is the next best alternative?
- Are there other things that might influence the situation? If we weren't to fund the proposal, would the problem remain the same, or decline over time, or get better?

Example: Counterfactuals

Counterfactuals depend on the specifics of a situation. You will need to have a good sense of the problem, and the target group for the intervention. Here is a table with some examples:

Fund a vaccine to prevent the outbreak of an infectious disease	Vs	Do nothing
Fund New Zealand's participation at the Dubai 2020 World Expo	Vs	Benefits at risk (such as the early implementation of the Gold Coast Free Trade Agreement, and improved business connections)

If you think that there is more than one probable counterfactual you have the option of doing a CBA under both, this is often called 'sensitivity' or 'scenario' analysis.

For more guidance on this step see page 9 of the Treasury's *Guide to Social Cost Benefit Analysis*.

Step 2: Identify who gains and who loses

The next step in the CBA process is identifying who is going to be impacted, both positively and negatively, by the initiative.

An intervention can have numerous positive and negative impacts (benefits or costs) occurring at different years into the future, and each of these might apply to a different group of people. There will be primary, or direct immediate impacts, as well as flow-on secondary impacts.

Although CBAX analysis distinguishes government and non-government impacts, all impacts should be considered as part of the analysis.

Think broadly about the impacts. We strongly encourage you to think broadly about the impacts of a proposal. Who might gain? Who might lose? Who might be affected, and in what way? A good way to do this is to gather together some stakeholders, or subject matter experts, and brainstorm the potential impacts. As your analysis progresses, and your understanding of the problem deepens, you may find that other impacts come to mind.

Include people who gain and lose outside the immediate organisation and sector, and try to capture all people affected by the intervention. Note that some impacts might be easier to monetise than others.

In later steps, you might exclude some impacts from the CBAX which have marginal value, in order to prioritise impacts with greater value. However, ‘casting the net’ wide early on can help to identify impacts that aren’t immediately obvious, but which may change the pitch of the funding proposal and those you need to engage with.

Example: Identifying who gains and who loses

Consider a proposal to fund a vaccine for all the six year olds in New Zealand. Here is a list of those who might be impacted:

- The children themselves (in that their wellbeing is positively impacted)
- Parents
- Employers of parents
- Schools and teachers
- Wider community (benefits from herd immunity)
- Fewer hospital admissions and GP visits

Some of these might be easier to quantify than others. Take for example the wellbeing impacts on children. To the extent that this is about their own subjective wellbeing, this might be hard to precisely quantify. However, it is still an important impact, and should be included in the analysis.

To figure out who will be impacted and how, a good place to start is to consider the intervention target group, or the **CBAX cohort**. Bear in mind that people or organisations outside the target group might be affected by an intervention, and these people will also need to be included in the analysis.

Identifying cohorts of the policy target group is important. For example if the target group is 25 year olds, the number of 25 year olds each year forms a cohort. The cohorts identified are entered into CBAX. If an initiative’s target group is 100, the spread across years determines the number of cohorts.

	Individuals experience the intervention in year				
	Year 1	Year 2	Year 3	Year 4	Year 5
1 cohort	100	0	0	0	0
5 cohorts	20	20	20	20	20

For more guidance on this step see page 10 of the Treasury’s Guide to Social Cost Benefit Analysis.

Step 3: Identify the costs and benefits; allocate to time periods

After completing step three you should have the following information:

- The costs of the initiative (up front and ongoing, including both operating and capital)
- The impacts of the initiative (either negative or positive)
- An estimate of when each impact will start and how long each impact will last for
- An estimate of the part of the policy target cohort impacted per year (or **segment**), as well as how they might be affected.

- An estimate of the success rate (ie, the probability of success for the number of attempts) of each impact occurring for those impacted.

Initiative costs

Costs include all one off setup costs (including any operating and capital expenditure), evaluation costs and ongoing costs (operating expenditure) incurred through the lifetime of the initiative. This is a Whole of Life Costs approach.

You only need to include the total operating and capital expenditure in the CBAX initiative costs, however these should be included for the entire length that funding would be made available, not just the Budget year and outyears, up to 25 or 50 years. For example, if the funding is a Multi-Year Appropriation for a fixed term of five years, the costs should be input for those five years. If the funding would be incorporated into baselines after outyears, these costs should also be included in the inputs.

The initiative costs should be supported by and sourced from detailed financial calculations outside the CBAX model. This should cover the details of the fixed costs that do not change with the scale of the initiative, and the variable costs and the drivers of the variable costs. For example, doubling the number of people that are covered by the intervention may only increase the initiative costs by half, and improve the initiative's RoI and value for money. Care should be taken to ensure that impacts and costs are entered for the same initiative scale.

All costs and values are in real terms (ie, in today's dollars). Costs are in the base year prices and measured in 2018 dollars, eg, you do not adjust for inflation. If your costings are not in real terms, use the adjusters in row 6 (hidden) in the Cost Input tab to adjust to real terms. The CBAX applies discount rates automatically and you do not need to discount the costs, or the impacts, that you input.

The fiscal or wellbeing losses arising due to the initiative, outside the direct initiative costs, are treated as dis-benefits or negative impacts in the CBAX model, not as the costs of the initiative.

Impacts, positive and negative

The CBAX model focuses on estimating a monetary value of impacts i.e., monetising impacts. Some of the impacts you have identified may be given a monetary value (monetised) using values in the CBAX Impacts Database. You can add values relevant for your initiative as appropriate to the database.

Currently, there are over 180 monetised impacts in the CBAX Impacts Database. These range from things like the cost of a GP visit, to the cost of the Jobseeker Support benefit.

If you can give an impact a monetary value, you can easily add it into the Impacts Database if it is not listed already.

You might find it helpful to initially summarise impacts in a table as set out below. You can think about the impacts within government — often changes in governmental costs against changes in governmental revenues (fiscal impacts) and society more broadly (wellbeing from use and non-use). Be as comprehensive as possible. Consider both gains/positive impacts and losses/negative impacts. Consider impacts across sectors and across time.

Illustrative examples	Government (often fiscal)	Societal (wellbeing, non-government)
Gains / Positive impacts	<ul style="list-style-type: none"> • Reduced costs • Resilience • Response capability 	<ul style="list-style-type: none"> • Increased health / Lives saved • Increased income • Cleaner water / Protected birds • Safer communities
Losses / Negative impacts	<ul style="list-style-type: none"> • Increased costs • Inefficiencies • Risks 	<ul style="list-style-type: none"> • Pollution • Compliance or user costs • Time delays

The costs and benefits to government tend to be the easiest impacts to quantify because they are often already measured in monetary terms. Costs and impacts of government provided or funded services (whether positive or negative) should generally be prepared on a marginal rather than average basis.

Many of these impacts are included in the CBAX values database for easy use. If a value is not currently included, it is easy to add values to the database for specific CBAX analysis.

It may not be possible to monetise some impacts. When this is the case, consider using a proxy value or make a reasonable assumption for quantifying the impact. You can do this by thinking about the incidence, the size and the likelihood of the impact occurring. Impacts that cannot be monetised should be listed in the Impact Summary Template, including the direction of the impact (positive or negative) and the magnitude (large, medium or small). Use the monetised values within the initiative as reference point for the magnitude of unmonetised impacts, to provide consistency within the initiative.

The cost of deadweight loss of tax funding is often taken into account in CBA by multiplying costs by a factor of 1.2. For simplicity, consistency and comparability, organisations are currently advised not to include the cost of deadweight loss in CBAX. However, there may be cases where it is best to factor it in to provide comparability.

Timing

There are three dimensions to understanding timing. An impact will apply to a cohort:

- in a particular year
- with a certain length, and
- it will then recur as a new cohort is impacted in future years.

Impact time lag – this identifies how long after the intervention has begun the impact will come into effect for each cohort. For example the benefits from formal education come into effect after the fact. In the illustrative example below the time lag is one year.

Impact time length – the impact can last from one to several years per cohort. For example, an impact from an intervention increases income. For the 25 year olds in 2020, does this increase to their income last one year, two, or until the end of their working life? At what point does the achievement of the impact have to do with other factors, such as their own skills or experience? In the illustrative example below the time length is three years. Based on experience as a rule of thumb, a reasonable time period for length of impact is 2-5 years. There will be exceptions to this. In some cases the impacts can change over the time period, for example impacts may taper.

Cohort time period – this identifies the cohort years which will cause impacts. For example, the programme only lasts five years from 2020 and the impacts are not expected to continue without it. So 25 year olds in 2025 miss out. The cohorts only run from 2020 to 2024. Consider ramp up and churn when setting cohort sizes. If it will take some time for the programme to reach its projected long-term capacity through a ramp up period, this should be considered when setting the cohort sizes. In the example ramping up from 20,000 to 40,000 in 2021. If the programme is a service that people can participate in, leave, and then return to, then the degree of churn should be considered when setting the cohort sizes.

Cohort		Timing of impact \$million								
Period	Size	2020	2021	2022	2023	2024	2025	2026	2027	2028
2020	20,000	Lag	100	100	100					
2021	40,000		Lag	200	200	200				
2022	40,000			Lag	200	200	200			
2023	40,000				Lag	200	200	200		
2024	40,000					Lag	200	200	200	
2025	0							0		
Total			100	300	500	600	600	400	200	0

Segment of policy target cohort impacted

A specific part (or **segment**) of the policy target cohort may have specific impacts. Identify what percentage of the policy target cohort that an impact relates to. Different populations may have different segments. For example, an impact may relate to only a segment of 25 year olds. Assuming that the employed make up 80% of 25 year olds, you record 80% as the ‘segment’.

Example: Thinking about the segments of a cohort

Consider a proposal to fund a programme to prevent family violence in New Zealand. Suppose that the programme includes a range of interventions, such as a social media campaign that will apply to the whole 40,000 strong cohort, as well as more intensive and costly interventions (such as family therapy), that will apply to a much smaller sub-group of the cohort.

In this case, it would make sense to carefully segment the impacts as they relate to the cohort. The social media campaign might apply to the full 100% of the cohort, whereas the family therapy might only apply to the 10%. This may affect the way in which the impacts are modelled, since the specific intervention might result in a different impact.

If the costs of a programme differ between segments, then the impacts may also differ.

Probability / success rate

When identifying the possible impacts of the initiative, think about the likelihood of it occurring for the cohort segment. This can be thought of as the 'success rate'. Using the example from the previous page, 25 year olds are the group which could receive an increase income, but not all are guaranteed to. The proportion of those that do determines the **success rate** of that impact.

For more guidance on this step see pages 13-16 of the Treasury's Guide to Social Cost Benefit Analysis.

Evidence rating

All proposals for spending should be supported by evidence. You will also need to give your evidence a rating of low, medium or high. This should also be presented in the intervention logic for the proposal.

Establishing this rating is a judgement call on your behalf. Here is a list of things to consider:

- Have there has been any previous evaluations undertaken on the proposal elsewhere?
- What information is there on how successful previous similar proposals have been in realising benefits?
- How applicable is the evidence to the local New Zealand context? For example, for proposals that are imported from overseas, what evidence or information exists to suggest that it can be successfully delivered in New Zealand? How confident are you that the evidence might apply in the same way in New Zealand?
- Evidence on effectiveness will be limited for pilots. You should look at other ways of showing confidence in the initiative, such as performing sensitivity analysis, or through the views of independent experts and stakeholders. There should also be a commitment to collect evidence of impact of the pilot in the future (as should be the case for non-pilot initiatives), as such evidence will help to support any potential extension of the piloted initiative in the future.
- Where assumptions have been made about the evidence, these should be clearly documented.

There are some helpful resources for guiding your thinking:

- The Social Investment Agency's guide *How to produce a social investment evidence brief* (available here: <https://www.sia.govt.nz/tools-and-guides/how-to-guides/>)
- Superu's has also produced a practical tool for rating evidence, called *An evidence rating scale for New Zealand* (available here: <http://www.superu.govt.nz/resources/evidence-rating-scale>).

2.3 Analysis in CBAX – CBA steps 4 - 5

Step 4: Quantify the costs and benefits

This step involves putting the analysis completed in steps 1-3 into the CBAX model itself. CBAX is designed specifically to help with completing steps 4 and 5 of a CBA. A list of different impacts with values attached to them is built into CBAX, in the impact inputs worksheet. This provides consistency between interventions listing the same impacts. Users can also input their own impacts that they have identified through the policy development process and CBA steps 1 – 3. See the discussion on impact above.

Completing this step is conditional upon having worked through the previous three steps of the cost benefit analysis, as well as general policy analysis (that is, considering the problem definition, and options for addressing the problem or opportunity). This will involve research and iteration. See section 2.2 for advice on how to tackle the earlier steps of policy and cost benefit analysis.

Some benefits may not be easily quantified. More research might help to quantify these benefits, but there are some that do not naturally lend themselves to this step. There are many options for how to address situations such as these, including reverse analysis (see section 4), or ensuring that the unmonetised benefits are included elsewhere in the advice.

It may also be worthwhile checking through the list of quantified wellbeing values that are available through Treasury's licence arrangements with the Australian Social Value Bank. These are listed in Appendix 1.

For more guidance on completing step 4 see pages 16-33 of the Treasury's *Guide to Social Cost Benefit Analysis*, and the worked example in section 3.

Step 5: Discount to a common period, compare with costs and benefits

CBAX automatically completes this step, once all of the information has been input into the model. The Outputs Summary sheet of the model presents a range of different calculations and graphs. The outputs that may be of most interest:

- Lifetime net present value (NPV) of the initiative.
- Lifetime net present value (NPV) of individual impacts.
- Return on investment to society and to the government. The Return on Investment Societal Total is the same as the benefit cost ratio, unless there are negative impacts. If there are negative impacts, then the benefit cost ratio can be manually calculated as set out in the *Budget Initiative Template*.
- CBAX has two Outputs Summary sheets: 'Outputs Summary' and 'Outputs Summary Alt'. Both sheets have identical outputs. The difference between the two is the discount rate used in the calculations for the purpose of completing sensitivity analysis. The 'Outputs Summary' sheet uses a 6% real discount rate and the 'Outputs Summary Alt' uses a 3% real discount rate.

Pages 33-38 of the Treasury's *Guide to Social Cost Benefit Analysis* explain the reasoning behind discounting and why it is important.

2.4 Outputs from CBAX – CBA steps 6 - 7

Step 6: Is the result clear enough?

If not, consider whether it is worth investing in more research and analysis, and repeat the above steps

The CBAX results might not be clear enough. To overcome this you can run different scenarios to test the sensitivity to assumptions and consider investing in obtaining additional information. You will need to make a decision as to whether it is worth investing in more research to produce better information to improve the quality of the CBA.

Be mindful of unmonetised impacts. For example, a proposal may have a RoI of 0.5, but also include a large unmonetised impacts that would in all likelihood increase the RoI above 1 if monetised. In such cases, the interpretation of the CBAX results hinges on the unmonetised impacts. Sensitivity analysis of what the assumptions would have to be for the unmonetised impacts in order for the initiative to break-even can be helpful.

It is important to weigh up the benefit of investing in improved information and more research. CBAX should be approached in a fit for purpose way, having regard to the suitability of the tool to the proposal, and the value that the CBAX analysis might bring to the decision of whether to fund the proposal or not. The value of obtaining additional information should outweigh the cost.

Page 39 of the Treasury's Guide to Social Cost Benefit Analysis discusses this trade off and how to think about investing in obtaining additional information.

Sensitivity analysis may be warranted

Depending on the proposal, it may be worthwhile to work through some sensitivity analysis.

Sensitivity analysis involves working through some alternative scenarios. This could be as simple as considering the impact of different discount rates. The CBAX model produces two output sheets, one with the standard discount rate, and one with the alternative lower discount rate.

Sensitivity analysis could also take the form of working through alternative assumptions for a given intervention. Consider those assumptions which have the greatest influence on the CBAX outputs. For example, you could develop a base case, and from there develop an optimistic case, and a conservative case. This means that you will then be able to express the RoI as a range. Preparing this analysis can help to support the overall case for change. Examples of sensitivity analysis can be found in among the CBAXs that have been proactively released on the Treasury website as part of the Budget proactive information releases.

Sensitivity analysis should be approached in a fit for purpose way. That is to say, it may be more appropriate for larger or more intensive interventions, than for smaller or less-discretionary proposals. You can prioritise efforts to focus on impacts and assumptions that have significant influence on the overall result and where there might be most uncertainty.

CBAX has an automatic built in sensitivity analysis of 6% and 3% discount rate. You find the results in the alternative output. It is easy to change the assumptions in CBAX to do sensitivity analysis, for example changing the segment, success rate or length of impacts.

This can also be useful early in the policy process, to help focus evidence effort where it matters most.

Step 7: Write report – complete the Initiative Templates

This step involves completing the Initiative Template and including the results of the CBAX. The report should:

- Contain a problem definition the initiative is addressing
- Describe the initiative
- Summarise any assumptions made
- Contain any scenario/options analysis
- List the non-quantified and monetised impacts
- Provide summary measures for example net present value (NPV), benefit cost ratio and return on investment (RoI).

The *Budget Initiative Summary Template and Impact Summary Template* capture this information for budget purposes (see the [Treasury CBAX website](#)). Departments should refer to the budget templates available on CFISnet, including special templates and requirements.

Impact summary

The CBAX output includes 50 year headline numbers. This information can be copied directly into the Impact Summary Template.

Return on Investment Summary using the CBAX model (if applicable)	Discount Rate		Evidence Certainty ¹
	6% real (default)	3% real (sensitivity)	
Initiative costs, ie, Government investment \$million	A	A	Low
Government impacts \$million	B	B	Low
Wider societal impacts \$million	C	C	Low
Total societal impacts \$million	A + B + C	A + B + C	Low
Net Present Value (NPV)			
Unmonetised impacts	Estimated magnitude: high/medium/low +/-	Estimated magnitude: high/medium/low +/-	Low
Benefit Cost Ratio (BCR)	(Positive B + C) / (A + negative B + C)	(Positive B + C) / (A + negative B + C)	Low
Return on Investment (RoI) – Societal Total	(B + C) / A	(B + C) / A	Low
Return on Investment (RoI) – Government	B / A	B / A	Low

¹ Rate your level of confidence in the assumptions and evidence as high (green) if based on significant research and evaluations that is applicable, medium (amber) if based on reasonable evidence and data, or low (red) if there is little relevant evidence. Colour the rating box for each impact.

Where your analysis fits into the Budget Initiative and Impact Summary Templates

In step 1, you outlined the problem definition, defined the policy options and the counterfactual (showing what happens if the intervention does not go ahead) for specific options. This will help you fill out the 2.1 **problem definition or opportunity** including the alternative options. Agencies are expected to identify options rather than just the initiative and do nothing, consistent with the approach taken in the regulatory impact statement process.

In steps 2 and 3, you identified the people who gain and lose, and the costs and benefits. Use this information to fill in **section 3: value for money and impacts** in the Budget Initiative Template, describing the costs and benefits that you identified, who they affect, and how. You can talk about the information in CBAX that you drew from in order to monetise these impacts.

In steps 4 and 5, you quantified and monetised the results and discounted them to a common period. You can input the NPV of each impact into the **impact summary template**. We encourage the use of ranges. You can copy CBAX output headline numbers directly into the Impact Summary Template.

In the **impact summary template**, discuss the assumptions that you used in CBAX to generate these results (for instance, the success rate and why you think this is a reasonable assumption). Treasury does not expect to see a CBAX for all options considered, but for each option under active consideration. CBAX can help agencies to prioritise key options for active consideration, and to prioritise resources for policy and evidence efforts accordingly.

It can be helpful for report readers if the initiative costs and impacts are also presented on a per-intervention unit basis. For example, if the intervention unit is families, the report might talk about intervening with 1,500 families over three years, at an expected cost of \$ per family per annum, and with expected impacts per family per annum of: x, y, z.

CBAX/CBA Guide Steps	Budget Initiative Templates
1. Define Policy Alternatives and Counterfactual	Section 2.1 Problem definition or opportunity
2. Identify the people who gain and lose	Section 3. Value for money and impacts
3. Identify the costs and benefits	Impact summary template, including Intervention logic map
4. Quantify the costs and benefits	Section 3. Value for money and impacts
5. Discount to a common period, compare with costs and benefits	Impact summary table, including CBAX output

3 Worked Example – Lurgi Vaccination

This is a straight forward example to give new users an idea of how to go through CBAX if everything is tidy and organised. In practice, identifying impacts and generating these inputs is more complex, requiring evidence and iteration.

The section after the example sets out common questions and ways to deal with them. If you cannot see how to make CBAX work for your intervention, please contact the Treasury for support.

Fictional example: lurgi is rampant for kids aged seven to nine. This is detrimental to health and wellbeing. A possible solution is to fund a recently developed vaccine. We will first go through steps 1-3 to generate inputs for CBAX. Then we will go through where to enter this information into CBAX.

3.1 Inputs for CBAX – CBA steps 1 - 3

Step 1 – Define policy and counterfactual

For simplicity's sake, the counterfactual is 'no change to current practice'. Note that this may differ in many situations. In this case we will assume that the health impacts of lurgi will persist.

Step 2 – Identify the people who gain and those who lose

In this example, the main group that stands to gain are the lurgi afflicted kids. The vaccine would be administered to six year olds, a year before they potentially become vulnerable to lurgi at the age of seven. This means that the cohort is made up of all of the six year olds in New Zealand in a particular year.

We will assume there are 60,000 six year olds each year and that there are still 60,000 of them by the time they are all nine years old. Therefore, there is a **yearly cohort of 60,000 people**.

	2018	2019	2020	2021	Outyears
Six year olds	60,000	60,000	60,000	60,000	60,000

There may be other people who are impacted on, for example the parents of the six year olds. However, the impacts for other people can be linked backed to the six year olds. The cohort is the group that drives the impacts. In this example, it is the group of six year olds, who would be eligible for the vaccine that drives the impacts. The impacts for the six year olds can be considered the primary impacts, and the impacts for the parents considered the secondary or flow-on impacts.

When identifying the people who are impacted, think about the people who may experience loses or negative impacts as well as those who gain. In this example, it is assumed that the negative impacts of immunisation are negligible as there are no adverse reactions.

Step 3 – Identify the benefits and costs, allocate to time periods

Here we generate all the inputs for the CBAX model. You will find CBAX much easier to use if you have done the thinking up front. Refining a CBAX by going between steps is inevitable, adding more impacts, removing others. For simplicity, we treat CBA steps 1 - 3 as generating the inputs for CBAX.

Intervention Logic Map (ILM)

We recommend you set out the impacts in an intervention logic map (ILM), or any other simple and logical way of setting out the way in which the intervention results in a specific set of impacts. There is a template ILM in the Impact Summary Template. Below is an example ILM for the lurgi proposals.

Impacts

There are likely to be many impacts resulting from this intervention, both for the government and for society more widely. For the sake of simplicity in this example we will focus on the two main impacts for the health system, reduced inpatient hospital visits and reduced GP visits, and one wellbeing benefit, improved quality of life.

1. Inpatient hospital visits reduce. The **pre-intervention level is 0.3** hospital visits per child per annum, and we will assume that the **post-intervention level is 0.27** after the vaccine. Around 10% of inpatient hospital visits are due to lurgi, and we will assume that if we fund the vaccine, these hospital visits will cease.
2. GP visits reduce. The **pre-intervention level is 6** GP visits per child per annum and we will assume that the **post-intervention level is 5.7** after the vaccine. Around 5% of GP visits are due to lurgi, and we will assume that if we fund the vaccine, these GP visits will cease.
3. Quality of life improves with greater health, and we can measure this in quality adjusted life years (QALYs). A way to understand the QALY gain is that, without lurgi a child is in perfect health (ie their quality of life is 1.0 and each year of life is 1.0 QALYs). Mild cases of the illness have a reduction in average utility of 0.03 for the period of the illness, ie if a child is otherwise in perfect health and they have the illness for one week, they lose QALYs = $(0.03 * 1/52)$. We assume that **pre-intervention level is 0 QALY gain** per child per annum as without the vaccine we will not prevent the QALY loss. We assume that the **post-intervention level is 0.03 QALY gain**, as the QALY gain is 0.03 when preventing a child getting sick from lurgi.

The values of these three impacts are built into the CBAX model in the impacts database worksheet.

However, it is important to know the extent of the reduction resulting from this intervention. This is the pre and post intervention level listed above. In practice, arriving at a number for these assumptions requires evidence.

Now that we have identified these impacts, for each we need to establish timing details, the segment affected, and the success rate. These details could be different for each impact.

Timing

- Time lag – the vaccine is administered at age six, but lurgi only starts to affect seven year olds, so the impact begins after a year. **Lag for all three impacts is one year.**

- Length – firstly, remember that lurgi afflicts 7-9 year olds. Once they turn 10 years old they are unaffected. This means there is a maximum length of impact of 3 years covering children aged 7, 8 or nine years.
 - Inpatient hospital visits reduce: only seven year olds get lurgi bad enough to be sent to hospital. Once they are eight lurgi can be fixed from a trip to the doctor. Therefore, the **length for this hospital visit impact is one year.**
 - GP visits reduce: GP visits will reduce for kids 7-9 year olds. We will also assume that the reduction is constant across the three years. The **length of this GP visit impact is three years.**
 - Health and quality of life improves: children with lurgi experience a 0.03 QALY reduction for two weeks, which is avoided by taking the vaccine. The **length of Quality Adjusted Life Years (QALY) gain is 0.04 years**, ie 2 weeks / 52 weeks.
- Time period – Based on our evidence base, we will assume that without this vaccine lurgi related health problems will return. This proposal is to have the vaccination programme continue indefinitely. We assume that the vaccine stays effective and that there is no tapering in the vaccine effectiveness over time. **The time period is the maximum 50 years.**

Segment of policy target cohort

There are 60,000 six year olds each year but not all will take the vaccine. Some parents will choose not to. Some children might not be able to get it for health or other reasons. We will assume that of all six year olds **a segment of 80%** receive the vaccine.

Probability

The vaccine is highly effective but will not work for all those who receive it. We will assume 1% of those who get the vaccine will still have the same chance of getting lurgi and need for the doctor or hospital. **The success rate is 99%.**

Evidence rating

You will need to rate the evidence quality as either low, medium or high. In this example, we will assume that the evidence quality for the impact relating to hospital admissions is low, and the evidence quality for the impacts relating to GP visits and QALY gain is medium.

Initiative costs

There is a dedicated worksheet for initiative cost inputs including operating and capital expenditure incurred for each year. The vaccine can be administered at the same time as others, so there are no additional administering operating costs. The vaccine costs \$100 per child. Since we assumed 80% of the group of six year olds would actually get the vaccine, **this cost is \$4.8 million per year** ($\$100 * 0.8 * 60,000$).

Intervention

Vaccine to prevent lurgi in 7-9 year olds.

Vaccinate six year olds, 60,000 per year.

Costs \$100 per vaccination per child, \$4.8 million per year

\$78 million NPV

Outputs

80% of six year olds get vaccinated

20% not vaccinated

Outcomes

Fewer hospital visits / reduced health costs

7 year olds only

Time lag 1 year

Length of impact 1 year

99% successful

Low evidence

Fewer GP visits / reduced health costs

7-9 years only

Time lag 1 year

Length of impact 3 years

99% successful

Medium evidence

More QALY gains / more health

7-9 years only

Time lag 1 year

Length of impact 2 weeks

99% successful

Medium evidence

Impacts Value relative to counterfactual

Fewer hospital visits / reduced health costs
Visits reduced by 10%

Pre-intervention

0.30 visits per year

Post-intervention

0.27 visits per year

\$120 million NPV

Fewer GP visits / reduced health costs
Visits reduced by 5%

Pre-intervention

6 visits per year

Post-intervention

5.7 visits per year

\$57 million NPV

More QALY gains / more health

Pre-intervention

0 QALY gains per year

Post-intervention

0.03 QALYs gains for two weeks per year

\$52 million NPV

Input number. CBAX screenshots show where each input is entered

CBAX outputs Total NPV \$151 million Societal RoI / BCR 2.9

3.2 Analysis in CBAX – CBA steps 4 - 5

Step 4 – Quantifying the benefits and costs within ranges

Here we enter all the information gathered in steps 1 to 3 into the CBAX model.

In the model, the boxes that are coloured orange indicate those boxes that you need to input numbers or information, or check. The boxes that are not coloured can be left.

Action point 1 (Primary Inputs tab)

Inputs: information about the proposal (including the CFISnet number, the title and description of the proposal, the unit of analysis, and the description of the policy target cohort).

Click on the Primary Inputs tab.

Primary Inputs (Year Ending June 30th)

CFISnet reference number		6012	Only enter data in cells with this colour. Other cells will automatically populate.			Policy target cohort entered?		Yes
Initiative details								1
Title	Lurgi Vaccine							
Description	Vaccine for children affected by lurgi							
Policy target cohort		Number of individuals per year to receive service beginning in first year of programme			2018	2019	2020	
What is the unit of analysis (e.g. individuals, families etc)?		Description of the policy target cohort:						
Individuals		Six year olds receiving vaccine to prevent lurgi in 7 - 9 year olds						
		60000	60000	60000				

We have entered in the information about the proposal, and have got the CFISnet number of the proposal from our finance team. We have a cohort made up of 60,000 six year olds per year. The time period is fifty years (the max for CBAX), so we enter in this number in each yearly cell until 2067, which is the final year that CBAX represents.

The first financial year will be 2018. We assume no delay in implementing this proposal.

Action point 2 (Cost Inputs tab)

Inputs: the annual costs to the government of the programme. Now you need to click on the next worksheet, titled Cost Inputs.

Cost Inputs in 2018(\$)

This is the cost of your initiative i.e. the funding being sought. Therefore do not include negative impacts in this sheet.		Year Ending June 30th						Error Check		OK
Costs in 2018 (\$)		2018	2019	2020	2021	2022	2023			
Operating expenditure excluding depreciation and capital charge 2018 (\$)		4,800,000	4,800,000	4,800,000	4,800,000	4,800,000	4,800,000			
Capital expenditure 2018 (\$)										
Unit		\$2018	\$2018	\$2018	\$2018	\$2018	\$2018			

All costs entered in this sheet must be in 2018 (\$).

Nominal dollars can be divided by the appropriate adjustment factor in row 6 (hidden) prior to entry to get 2018 (\$)

We have no capital expenditure. We have calculated the operating costs as \$4,800,000. The time period is fifty years (the max for the CBAX model), as we are proposing that this programme of vaccination be kept ongoing. So we enter the number in each cell until 2067.

These costs are the real costs, based on prices in the base year, in this case, 2018.

Action point 3 (Impacts Database tab)

Click on the next tab along, which is the Impacts Database tab.

This tab contains a collection of publically available quantified impacts. Each impact has a link with source information. You can add in your own quantified impacts, if you have impacts that are not in the database. See section 4 for more information on how to do this.

There are no inputs for you to make in the model in this particular tab, as the three impacts we are modelling are already contained in the database.

Row Number	Outcome area	Description	Value adjusted to 2018	Value	Unit	Government/Non-Government	Sector	Year of data	Source (1)
95	Health	Inpatient hospital visit	-5,597	-4,769	Per visit	Government	Health	2015	Pharmac, 2015 Cost Resource Manual
107	Health	GP visit (20 minutes) - Publicly funded	-83	-86	Per visit	Government	Health	2015	Pharmac, 2015 Cost Resource Manual
142	Health	Quality-adjusted life year (QALY) gained	49,722	45,456	Per year	Non-Government	Private Impact	2012	Pharmac, 2012

The impacts we identified in our research were inpatient hospital visits, GP visits and QALY gains. These are rows 95, 107 and 142 respectively.

Impact Inputs tab overview

All remaining inputs are entered into the Impact Inputs tab. Below is an overview of the whole tab, where you can see inputs 3-9 and where to enter them on one page. We will work through each of these inputs bit by bit.

Row Number	Impact	Outcome Area	Sector	Adjusted Value	Unit	Type	Evidence Quality	Time lag before impact occurrence (years)	Length of impact (years)	End year	Segment of policy target cohort per year (percentage)	Success rate (Percentage)	Impact type	Units per person per annum	
Impact 1	95	Inpatient hospital visit	Health	Health	(5,526.87)	Per visit	Government	Low	1.0	1.0	2.0	80%	99%	Pre intervention level	0.30
OK		INCLUDED					Government							Post intervention level	0.27
							Government							Marginal impact	(0.03)
Impact 2	107	GP visit (20 minutes) - Publicly funded	Health	Health	(93.05)	Per visit	Government	Medium	1.0	3.0	4.0	80%	99%	Pre intervention level	6.00
OK		INCLUDED					Government							Post intervention level	5.70
							Government							Marginal impact	(0.30)
Impact 3	142	Quality-adjusted life year (QALY) gained	Health	Private Impact	59,722.12	Per year	Non-Government	Medium	1.0	0.04	1.0	80%	99%	Pre intervention level	-
OK		INCLUDED					Non-Government							Post intervention level	0.03
							Non-Government							Marginal impact	0.03
Impact 4	-	-	-	-	-	-	-	Low			-	100%	100%	Pre intervention level	
OK		EXCLUDED					-							Post intervention level	

Action point 4 (Impact Inputs tab)

The Impact Inputs tab is where all remaining inputs need to go. First, we need to enter in the row numbers of the impacts we are modelling: 95, 107 and 142. Enter these numbers into the orange boxes for Impacts 1, 2 and 3 in column B.

	A	B	C	D
1	Impact Inputs			
2				
3				
	Row Number	Impact		Outcome Area
4		3		
5				
6	Impact 1	95	Inpatient hospital visit	Health
7	OK		INCLUDED	
8				
9	Impact 2	107	GP visit (20 minutes) - Publicly funded	Health
10	OK		INCLUDED	
11				
12	Impact 3	142	Quality-adjusted life year (QALY) gained	Health
13	OK		INCLUDED	
14				

Once you have done this, you will see several columns auto-fill: the outcome area, the value, the unit and the type.

If it were adults' GP visits, a different impact (row 106) could be used, to show that the cost saving is to individuals, since adults pay for their own GP visits. This would show up as a Non-Government impact, rather than a Government impact. This distinction can be useful when analysing the results.

You might notice that your spreadsheet looks different to ours above, with the boxes in column C showing as red and with 'EXCLUDED'. This is a simple check to show whether or not all of the inputs have been added into the model. If they haven't, it will show as 'EXCLUDED', which means that they are not flowing through to the Output Summary sheet.

Action point 5 (Impact Inputs tab continued)

The next set of inputs we need to enter is the evidence quality, the time lag, and the length of impact.

Evidence Quality	Time lag before impact occurrence (years)	Length of impact (years)	End year
4 Low	5 1.0	6 1.0	2.0
Medium	1.0	3.0	4.0
Medium	1.0	0.04	1.0

For Impact 1 (Inpatient hospital visits) we have assumed that the evidence quality is low. For Impacts 2 and 3 (GP visits and QALY gains), we have assumed that it is medium. Click on the orange box in column I and you will see that there is a drop-down box with low, medium and high. Select the appropriate value. In practice, the evidence quality is relevant at the end of the process, when understanding which impacts contribute most to the benefit cost ratio and other indicators. If these impacts have high (low) quality evidence, then this increases (reduces) the confidence and reliability of these results.

We now need to enter the time lag and length of each impact. All three impacts have a time lag of one year. This is because the proposal is to vaccinate six year olds, one year in advance of the time when they would become susceptible to lurgi. Impact 1 (Inpatient hospital visits) has a length of impact of 1 year, Impact 2 (GP visits) has a length of impact of 3 years, and Impact 3 (QALY gains) has a length of impact of 0.04 years. Once you have entered these details in, the CBAX model will then auto-fill a column with the end year for these impacts.

Action point 6 (Impact Inputs tab continued)

The final inputs in this tab are the segment of the policy target cohort, the success rate, and the pre and post intervention levels.

Segment of policy target cohort per year (percentage)	Success rate (Percentage)	Impact type	Units per person per annum
80%	99%	Pre intervention level	0.30
		Post intervention level	0.27
		Marginal impact	(0.03)
80%	99%	Pre intervention level	6.00
		Post intervention level	5.70
		Marginal impact	(0.30)
80%	99%	Pre intervention level	-
		Post intervention level	0.03
		Marginal impact	0.03
100%	100%	Pre intervention level	

For all three impacts, we model the segment of the policy target cohort per year impacted as 80%. This represents the proportion of the cohort who will actually receive the vaccination. The success rate of the vaccine, based on the evidence, is 99%.

For Impact 1, the pre and post intervention levels were 0.3 and 0.27 respectively. For Impact 2, the pre and post intervention levels were 6 and 5.7 respectively. For Impact 3, the pre and post intervention levels were 0 and 0.03 respectively. Once these are entered we have completed almost all of the information that we need to put into CBAX.

CBAX then calculates the marginal impact (that is, pre intervention level minus post intervention level). This is the difference that the intervention causes (the marginal impact).

			Year Ending June	2018	2019	2020	2021
			<i>Start of year counter</i>	-	1	2	3
Impact type	Units per person per annum	Annual value (\$) Per cohort member	<i>End of year counter</i>	1	2	3	4
Pre intervention level	0.30	(1,313)		-	(1,313)	-	-
Post intervention level	0.27	(1,182)		-	(1,182)	-	-
Marginal impact	(0.03)	131		-	131	-	-
Pre intervention level	6.00	(442)		-	(442)	(442)	(442)
Post intervention level	5.70	(420)		-	(420)	(420)	(420)
Marginal impact	(0.30)	22		-	22	22	22
Pre intervention level	-	-		-	-	-	-
Post intervention level	0.03	1,419		-	57	-	-
Marginal impact	0.03	1,419		-	57	-	-
Pre intervention level		-		-	-	-	-

The screenshot above shows the other automatic calculations within the 'Impact Inputs' tab. For the first year's policy target cohort, the annual value per impact is shown.

The stream of benefits will apply to each cohort year of our policy target cohort entered in the 'Primary Inputs' tab. Note the lag of one year until 2018, before there is any value to the first group of six year olds. This is because of the time lag of 1 year. The value for Impact 1 and 3 only appear in 2018, as they only have a duration of one year or less, while the value for Impacts 2 appears for three years.

Step 5 – Discount to a common period, compare benefits and costs

Action point 7 – Outputs Summary tab

Click on the 'Outputs Summary' tab, where you will see that the model has calculated several things. Particular things of interest are the Rols, the NPVs, and the various charts. You input information about the type of analysis, unmonetised impacts, VFM and strategic alignment scores, explanatory information and the evidence quality for the headline numbers. Copy headline numbers into the Impact Summary Template.

Outputs Summary

Proposal details

Analysis type	Standard CBA
Initiative title	Lurgi Vaccine
Initiative details	Vaccine for children affected by Lurgi
Start year	2018
Period for analysis	50 Years
Un-monetised impacts	Medium (+)

Net benefit summary

Category	Unit: 2018 (£m)				
	5-Year NPV \$m	10-Year NPV \$m	50-Year NPV \$m	2018	2021
Total marginal impact	48	97	229	-	13
Total cost of initiative	(21)	(36)	(78)	(5)	(5)
Net economic benefits	27	61	151	(5)	8

Cost summary

Cost category	Unit: 2018 (£m)				
	5-Year NPV \$m	10-Year NPV \$m	50-Year NPV \$m	2018	2021
Fiscal cost of initiative	-	-	-	(78)	(5)
Operating expenses	-	-	-	(5)	(5)
Capital expenses	-	-	-	(5)	(5)
Total fiscal cost of initiative	-	-	-	(78)	(5)

Impact summary

Evidence Quality	Government	Non-Government	Impact description	Unit: 2018 (£m)				
				5-Year NPV \$m	10-Year NPV \$m	50-Year NPV \$m	2018	2021
Low	Government	-	Inpatient hospital visit	27	52	120	-	8
Medium	Government	-	GP visit (20 minutes) - Publicity funded	10	23	57	-	1
Medium	Non-Government	-	Quality-adjusted life year (QALY) gained	11	22	52	-	3

Summary metrics

Return on Investment, Societal Total (50y)	2.9
Return on Investment with high evidence quality only, Societal Total (50y)	0.0
Return on Investment, Government only (50y)	2.3
Return on Investment with high evidence quality only, Government only (50y)	0.0
Benefit cost ratio, Societal Total (50y)	2.9
Benefit cost ratio with high evidence quality only, Societal Total (50y)	0.0

Agency assessment

Value for money	2 - Medium Returns - Likely
Strategic alignment	2 - Limited Alignment

Word summary/comment field

This is an area to explain key modelling assumptions or anything important individuals looking at the model should know.

Mid cases of the illness have a return to an average utility of 0.03 over a period of the illness, so if a child is otherwise in perfect health and they have the illness for one week, they lose QALYs = (0.03 * 1/52). Severe cases of the illness (perhaps identified as those needing hospitalisation) have an average reduction in utility of 0.35 for the duration of the illness.

Modelling assumes mild cases with QALY gains for two weeks. Returns would increase if severe cases were included.

Secondary benefits to for example parents and siblings are unmonetised. These are expected to be moderate.

Return on Investment summary table (50y) for use in the summary template

Return on Investment Summary (50y) for use in the summary template	Discount rate	
	6% real discount rate	3% real discount rate
Initiative cost - present value i.e. Government investment \$m	(78)	(125)
Government impacts \$m	177	294
Wider societal impacts \$m	52	86
Total societal impacts net present value \$m	151	254
Un-monetised impacts	Medium (+)	Medium (+)
Benefit cost ratio, Societal Total (50y)	2.9	3.0
Return on Investment, Societal Total (50y)	2.9	3.0
Return on Investment, Government only (50y)	2.3	2.3

Charts

Present value of impacts across sectors

Max. GWP impact of intervention

Type of analysis and unmonetised impacts

Explanatory information

VFM and strategic alignment scores

Copy headline numbers

Evidence quality for headline numbers

Output Summary chart interpretation

Return on Investment (RoI)

Summary metrics

Return on Investment, Societal Total (50y)	2.9
Return on Investment with high evidence quality only, Societal Total (50y)	0.0
Return on Investment, Government only (50y)	2.3
Return on Investment with high evidence quality only, Government only (50y)	0.0
Benefit cost ratio, Societal Total (50y)	2.9
Benefit cost ratio with high evidence quality only, Societal Total (50y)	0.0

The return on investment shows the impact on New Zealand per dollar that the government spends on an initiative. In this example, for every dollar that the government spends on the vaccine, New Zealanders receive about \$2.90 worth of benefits.

The outputs summary presents two Rols – a societal total, and a government only.

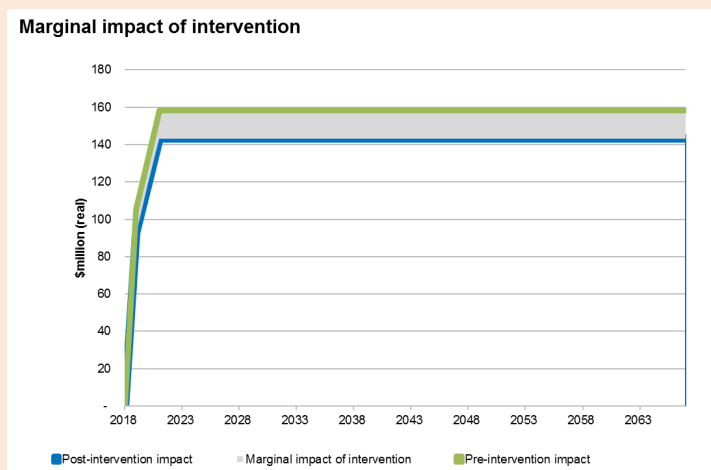
The societal total RoI is the overall RoI, taking into account all the impacts that have been modelled. The government only RoI only uses the government-specific impacts.

VFM and strategic alignment scores

Agency assessment

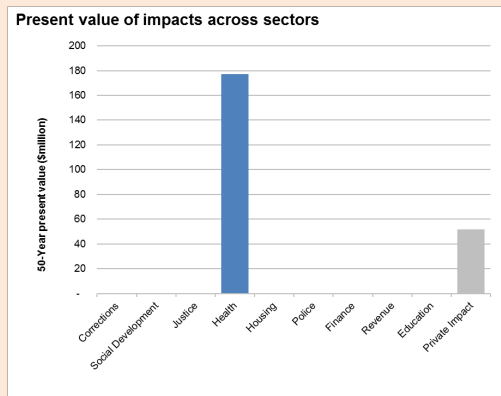
Value for money	2 - Medium Returns - Likely
Strategic alignment	2 - Limited Alignment

Marginal impact of intervention



This chart displays the profile of the pre and post intervention net impact (excluding the cost of the initiative). This grey area displays the size of the marginal impact. In the lurgi example the pre intervention profile is positive, illustrating the net costs to government health services and the health gains are positive, relative to the counterfactual. The post intervention profile is also positive, but smaller. This shows that our health sector costs have gone down.

NPV of economic impact across sectors



This chart displays the 50 year net present value (NPV) of the marginal impact by sector. This means that it shows what the total value is over the 50 year timeframe, but adjusted to present day dollars.

This graph illustrates where the impact falls according to which sector. This can help users identify surprising or significant results at a glance, and areas for further refinement or connection across sectors.

Impact summary chart

Impact summary				5-Year NPV	10-Year NPV	50-Year NPV
Evidence Quality				\$m	\$m	\$m
Impact 1	Low	Government	Inpatient hospital visit	27	52	120
Impact 2	Medium	Government	GP visit (20 minutes) - Publicly funded	10	23	57
Impact 3	Medium	Non-Government	Quality-adjusted life year (QALY) gained	11	22	52

This chart shows the breakdown of the NPVs, according to the particular impact and how they contribute to the overall NPV. It also shows the evidence rating for each impact.

It is very useful for getting a quick sense of which impact is driving the bulk of the NPV (and therefore the overall RoI). Here we can see that it is the hospital visits that has the highest NPV (\$120 million over 50 years compared with around \$50 million for other impacts). We can also see from the chart that the evidence quality for this impact is rated as low, which might mean that we need to approach this finding with some caution. It could also be worth revisiting some of the assumptions that underlie this NPV.

3.3 Outputs from CBAX – CBA steps 6-7

Steps 6 and 7 – Finalise and report the results

You now have the information that you need to review the results. It is common that you might need to do iterations of the CBAX modelling before finalising it. You may find that the results are different to what you might have expected. For example, you might get a negative impact value when you expected a positive net present value.

Policy analysis is often an iterative process. As you get deeper into work, you might do more research, talk to more stakeholders or subject matter experts, or discover other evidence. You could consider doing sensitivity analysis. Any of these elements might make you adjust your assumptions or revise things like the problem definition or the intervention itself.

It is easy to adjust the assumptions you have input into the CBAX model. It is usually just a matter of changing some of the numbers that you have used. As always, you should make sure that your analysis is supported by evidence, and that assumptions are clearly documented.

Once you have finalised the CBAX analysis, you should incorporate your findings into your advice. You can incorporate the monetised net present values for impacts and the overall results into the Budget Initiative Template. Please see Step 7 in the previous section of this guidance for more information.

4 Tips for Common Questions

This section contains common questions encountered by CBAX users, and possible solutions. CBAX has flexibility in its application and functionality that can help you address questions. You can refer to the tips as needed. Some of the explanations relate to the worked example, so please read through it for context.

We are very interested in the experiences and challenges of people who are using the CBAX model. We encourage you to raise issues and any solutions with Treasury. This helps us to make ongoing improvements to the CBAX model and the guidance, and to share your tips and solutions with other users.

Support is available

Use this document as your first point of call for guidance on how to use CBAX.

If you have questions that are not covered by the tips below, you can seek Treasury support. The Treasury can provide support on specific issues and review draft CBAX models. Please contact your Vote Team or CBAX@treasury.govt.nz. A range of support is available, as set out in the table below.

Type of support	Description	When
Treasury Vote Analyst engagement	Vote Analysts can engage with policy, research and finance teams and discuss approaches to work through issues in applying CBAX.	Agencies can engage with their Treasury Vote Analyst at any time. We encourage agencies to engage early and raise potential challenges.
Treasury CBAX helpline	General enquiries about the information contained in this guidance can be directed to CBAX@treasury.govt.nz .	At any time. We can provide feedback on draft models, or advice on how to approach CBAX modelling for specific proposals.
CBAX Community of Practice for all users with extensive or limited experience	Treasury runs workshops for CBAX users to learn and share experiences about CBA steps, the inputs to CBAX, the analysis and the outputs. Contact CBAX@treasury.govt.nz .	Treasury runs these workshops year round, with more during the July-December period to support agencies and advisors in their budget preparation.
Tailored CBAX workshop	Treasury can provide tailored CBAX workshops for teams or on CBA topics. We run a hands-on 'CBAX 101 Introductory Session' that is tailored for new users of CBAX, with no prior knowledge required.	Workshops can be tailored on an ad hoc basis depending on the specific needs.

Key messages

Based on experience, we have a set of CBAX key messages that we often give.

- **We are all learning as we go.** CBAX has been deliberately approached in the spirit of trying things, learning and refining as we go. At any given point, things may not be perfect. We are always open to learning from our experiences.
- **It is about lifting the bar.** Learning as we go is about lifting our expectations. We all have to start somewhere. The vision is to improve the quality of advice over time.
- **Think broadly about the impacts, but be conservative in the extent to which they apply.** We encourage analysts to think broadly about the impact of their proposals. Who might be affected? In what way? Think outside the immediate sector, and consider primary and flow on impacts. Consider long term as well as short term impacts. Consider fiscal and wider wellbeing impacts, government and non-government impacts. Be conservative and do not over-claim impacts. Consider: how confident are you that there is a causal link between the intervention and this impact? At what point do other factors help with the ongoing achievement of the impact?
- **Prepare your best estimate, with sensitivity and ranges.** The best estimate when quantifying impacts is in line with best practices in fields such as accounting and liability valuation. In preparing the best estimate err on conservative rather than over-optimistic assumptions. This makes it easier to have confidence in the results. For assumptions that are particularly critical for the overall result, it is good practice to provide sensitivity analysis with your best and conservative estimate to inform decisions. The Treasury encourages the use of ranges around the best estimate.
- **What's the counterfactual?** Often agencies are uncomfortable with developing cost benefit advice. They typically have a lot of information about the impact of their proposals, but they are often less comfortable when it comes to quantifying these impacts. In this situation it is important to consider *what is the counterfactual?* Where there is an absence of information on the counterfactual, it is best practice to advise decision-makers up front rather than overpromise on the proposal. There is an opportunity cost with funding something, as it means that another proposal, which may have been more worthwhile, will go unfunded.
- **What does the evidence tell us?** When considering the model and how to fill it in, many of the inputs will need to be gleaned from the evidence. Evidence should be your first port of call for developing funding proposals.
- **Transparency is key.** Monetising impacts requires a level of precision. It might be logical to infer that a job mentoring scheme for young people might result in some of those young people being employed. However, in order to establish that New Zealand is *truly* better off for investing in this particular intervention, we need to be able to specify how many young people will be employed, for how long, and so on. Depending on the evidence, part of this may involve making assumptions. Although it can be uncomfortable to make assumptions, it at least provides transparency, and a base from which to evaluate and learn. Transparent assumptions, which can be challenged and honed over time, are generally better than nothing.
- **Fit to the proposal.** The answer to many questions we get asked is dependent on the nature of the proposal, the counterfactual and what the evidence tells us. Often there is not a prescriptive answer or 'one size fits all' approach. Instead, the answer to problems will have much to do with the facts and specifics of an initiative.

	Question	Tips
Use of CBAX tool and results	Using CBAX in decision-making	<ul style="list-style-type: none"> • Initiatives are not evaluated on CBAX results alone. • CBAX results together with unmonetised impacts, evidence base and assumptions inform value for money (VFM) advice. • VFM is considered along-side the wider case eg, strategic alignment.
	People involved in completing a CBAX	<ul style="list-style-type: none"> • Key people: initiative lead (policy/budget) and excel experience. • Involve different perspectives and use specialist capabilities: subject matter experts, policy, finance, actuaries, service delivery and evaluation. • Involve other agencies with shared outcomes or policy target group.
	Prioritising CBAX efforts	<ul style="list-style-type: none"> • Prioritise efforts on those impacts with the greatest influence on the RoI. • Gathering evidence is often the most time-consuming part, but crucial.
	Reverse break even analysis	<ul style="list-style-type: none"> • Reverse analysis enables you to see what you would have to assume to for example break even.
Fundamental elements	Intervention is not about people	<ul style="list-style-type: none"> • The policy target group does <i>not</i> have to be people. It can be for example businesses, areas, society/New Zealand, houses or rivers.
	Determining cohort unit	<ul style="list-style-type: none"> • Try different units to see what works the best. • Keep the analysis as <i>simple</i> as possible and as <i>flexible</i> as possible.
	No appropriate impact value in CBAX database	<ul style="list-style-type: none"> • It is easy to add values to the database for a specific intervention. Analysis then flows like any other value. • Can add values to explore “what if” or “what would it take”.
	Pre and post intervention levels	<ul style="list-style-type: none"> • Specify pre and post intervention levels in one of three ways: binary, frequency or proportional. • It relates to the unit of the impact. Check that it makes sense.
	Cost pressure	<ul style="list-style-type: none"> • Counterfactual is key for appropriate CBAX analysis, or exemption.
Information / evidence	Poor information base	<ul style="list-style-type: none"> • Use judgement and available information for reasonable assumptions. • Undertake sensitivity analysis for varying assumptions. • Provide ranges and interpret your results in light of the evidence base.
	Assumptions	<ul style="list-style-type: none"> • Make on best information available, and make transparent.
	Intervention evaluation	<ul style="list-style-type: none"> • CBAX supports an improved evidence base for decision-making, and provides a basis for an evaluation plan.
	Australian Social Value Bank (ASVB)	<ul style="list-style-type: none"> • Contact Treasury re purchasing ASVB sub-licence, if interested in using the Australian Social Value Bank wellbeing impacts.
Multiple impact entries	Multiple entries of the same impact	<ul style="list-style-type: none"> • You can include the same impact multiple times to address variation in impacts, for example across time and segments of the target population. • Ensure <i>not</i> to double count impacts.
	Affected people differ over time	<ul style="list-style-type: none"> • Use multiple impact entries for each time period and vary assumptions.
	Impacts vary over time	<ul style="list-style-type: none"> • Use multiple impact entries for each time period and vary assumptions about success rates or pre and post intervention levels.
	Segments affected differently	<ul style="list-style-type: none"> • Use multiple impact entries for each segment and vary assumptions.
Adjusted	Non-flat impact profile	<ul style="list-style-type: none"> • You can input an impact profile for pre- and post- intervention that varies across time. This may be results from separate modelling. • Consult Treasury and do not re-use the model (changes formulae).
	Labour market impacts	<ul style="list-style-type: none"> • Adjust labour market impacts such as income, tax/ACC and income benefits for displacement effects and opportunity cost.
	QALYs	<ul style="list-style-type: none"> • Have sound evidence base for QALY assumptions.

4.1 Tips – Use of CBAX Tool and Results

How is cost benefit information used in Budget decision-making?

Tips

- Initiatives are not evaluated on CBAX results alone.
- CBAX results together with unmonetised impacts, evidence base and assumptions inform value for money (VFM) advice.
- VFM is considered along-side wider case and factors eg, strategic alignment with Government priorities, fiscal constraints and implementation risks.

CBA informs value for money advice when considering different options for investment. The initiatives are not ranked and prioritised exclusively on the Return on Investment (RoI) figures. Many factors are considered in the decision-making process, including but not limited to unmonetised impacts, strategic alignment with Government priorities, fiscal constraints, the comparative value of competing proposals and the risks involved.

The RoIs are considered in the context of the assumptions and the evidence base, as well as unmonetised impacts. For example, an initiative with a lower RoI and a solid evidence base may be considered better value for money than a high RoI initiative with optimistic assumptions and limited evidence base.

In the budget context, the CBAX analysis is used primarily by the Treasury vote team in developing value for money advice. As the capability and confidence in the analysis improves over time, ministers are expected to gain greater visibility and use of the analysis.

Who should be involved in completing a CBAX?

Tips

- Key people: initiative lead (policy/budget) and excel experience.
- Involve different perspectives and use specialist capabilities eg, subject matter experts, policy, finance, actuaries, service delivery and evaluation.
- Think about who is best placed to cost an initiative, who is best to identify the counterfactual, etc.
- Involve other agencies with shared outcomes or target group.
- Make contact with them early on – you might be working on a similar proposal that would benefit from a cross-agency approach.

Policy analysts, subject matter and sector experts, evaluation and research teams, finance and actuarial teams should all work together in completing CBAX. Including a wide range of expertise early on is recommended, as drawing different perspectives together can help to identify potential impacts which might be missed if CBAX were done in isolation. It can also help to identify alternative options previously unconsidered.

Draw on specialist teams within your agency. Research and analysis teams are likely to prove helpful in the evidence gathering stage, and those with statistical, costing and/or modelling experience are likely to be helpful in navigating the CBAX tool.

Consider where different areas of expertise sit across government. Are there identified impacts which the CBAX database doesn't include a value for but which an agency might hold? Are other agencies working with the same target group? Are other agencies working towards the same outcome? Would the proposal benefit from a cross-agency approach? Making contact early with external agencies is advised.

Also consider whether there are parties outside of government which could help, for example, universities or research institutes which may have subject matter knowledge to support your evidence base.

Communicate with the relevant Treasury vote team, especially if you're unsure about the process, or even if you just want to test assumptions. You can contact the CBAX team on CBAX@treasury.govt.nz to answer questions, provide advice on how to approach CBAX modelling for a given proposal, and review draft CBAXs. We also offer training.

Which parts of the CBAX analysis should be prioritised?

Tips
<ul style="list-style-type: none">• Prioritise efforts on those impacts with the greatest influence on the RoI.• Gathering evidence is often the most time-consuming part of the process, but crucial.

We appreciate that the CBAX process can be resource intensive, and prioritisation decisions may need to be made in which parts of the CBAX to focus the most on. Generally the gathering evidence is the most time-consuming part of the process, but the most crucial, as it underpins the assumptions you're inputting into the CBAX model. Honing how assumptions are applied within the model is generally easier to do later in the process than it is finding the supporting evidence.

While it is advised to initially identify as broad a range of impacts as possible, some impacts may have a negligible influence on the outputs produced by the model. Test how impact assumptions affect the RoI early on, and prioritise efforts on those impacts with the greatest influence on the RoI.

Consider whether time spent is proportionate to the effect it has on the CBAX results and make the analysis fit for purpose to inform decision-making.

Reverse analysis – what would it take to break even?

Tips
<ul style="list-style-type: none">• Reverse analysis enables you to see what you would have to assume to (for example) break even.• This can be a good option for completing a simple CBAX in situations where the impacts are known, but hard to monetise.

While CBAX is a tool for calculating the impact NPVs and overall return of an intervention, the model can be used to vary assumptions to see what would have to be assumed for it to break even. This process is called reverse analysis. It is a simple way of testing some assumptions, in order to provide a helpful (although limited) analysis.

Reverse analysis is most useful if you have a view of the costs, and a sense of what the impacts are, but no idea about the monetised value of one or more impacts. You can add the cost information and a single or more impact (these should be the bigger impacts listed in the Budget Initiative Template) and work iteratively, changing the impact assumptions until you have a return on investment of one.

This will give you an idea of the assumptions you would need to make for the intervention to break even. It is often easier to make professional judgements about how reasonable those specific assumptions are. Having specific transparent assumptions enables evaluation plans to assess whether those assumptions are achieved. We can test an example with the following details. It is an intervention to boost learning outcomes for children in Northland.

Initiative costs

- Capital: \$500,000 in the first year and \$200,000 in the second year.
- Operating: \$100,000 each year, and it will last 50 years.

Action point 1 (Primary Inputs tab)

Inputs: the yearly policy target cohort and the first financial year the intervention begins.

Primary Inputs (Year Ending June 30th)		<u>Policy target cohort entered?</u> Yes		
1				
2				
3	CFISnet reference number	6,013	Only enter data in cells with this colour. Other cells will automatically populate.	
4	Initiative details			
5	Title	Lifting Northland Education		
6	Description	Improve teaching methods for Northland schools		
11	Policy target cohort		2018	2019
12	Number of individuals per year to receive service beginning in first year of programme		1	1
13	What is the unit of analysis (e.g. individuals, families etc)?	Description of the policy target cohort:		
14	Region	Northland Region school kids		

We will test our assumptions on a policy target cohort of 1. This allows us to make assumptions based on the overall value the impact would have to be to break even (note: this is different to working it out on a per person basis). This is only reasonable if there are no variable costs. The time period is fifty years (the max for CBAX). The first financial year will be 2018, as we will assume no delay in implementing the programme.

Action point 2 (Cost Inputs tab)

Inputs: the annual costs to the government of the programme.

Cost Inputs in 2018(\$)		<u>Error Check</u> OK			
<i>This is the cost of your initiative i.e. the funding being sought. Therefore do not include negative impacts in this sheet.</i>		Year Ending June 30th			
Costs in 2018 (\$)		2018	2019	2020	2021
Operating expenditure excluding depreciation and capital charge		100,000	100,000	100,000	100,000
Capital expenditure 2018 (\$)		500,000	200,000		
Unit		\$2018	\$2018	\$2018	\$2018

We input the information that we have on costs. There are capital costs of \$500,000 in 2018 and \$200,000 in 2019. The operating costs are \$100,000 per year ongoing (that is, each year for 50 years).

Action point 3 (Impacts Database tab)

Inputs: we have to create a new impact. This follows the process for adding an impact value to the Impacts Database explained in this guide.

Impacts Database								
Row Number	Outcome area	Description	Value adjusted to 2018	Value	Unit	Government/Non-Government	Sector	Year of data
186	Education	Kids learn better	20,000	20,000	Per year	Non-Government	Education	2018
187								
188								
189								
190								
191								

This is where we later vary the value of the impact to see how high it would have to be to break even.

Action point 4 (Impact Inputs tab)

Inputs: all the usual inputs required for an impact, firstly the row number

Impact Inputs					
Row Number	Impact	Outcome Area	Sector	Adjusted Value	
Impact 1 OK	186 Kids learn better	Education	Education	20,000.00	INCLUDED
Impact 2 OK	-	-	-	-	EXCLUDED
Impact 3	-	-	-	-	

We will only enter one impact in this example to test the assumptions we have to make in order to break even.

Action point 5 (Impact Inputs tab)

Inputs: evidence quality, time lag, time length, segment of policy target cohort, pre and post intervention levels.

Evidence Quality	Time lag before impact occurrence (years)	Length of impact (years)	End year	Segment of target population per year (percentage)	Success rate (Percentage)	Impact type	Units per person per annum
Low	1.0	2.0	3.0	100%	100%	Pre intervention level	-
						Post intervention level	1.00
						Marginal impact	1.00

We have begun with an assumption of length of impact of two years, a time lag of one year, and 100% for both the segment and the success rate.

The pre intervention level is zero and the post intervention level is one, giving a marginal impact of one. This is the binary version of pre/post intervention levels. We are effectively saying ‘pre the intervention, this impact was not achieved. Post the intervention, the impact was achieved’.

We can now make changes to see how the NPV varies, but to keep things simple, we will leave the pre and post intervention levels as they currently are, with the marginal impact of 1. This way we can focus on changing the value of the impact in the Impact Database tab, in order to keep our assumptions simple and clear.

Action point 6 (Outputs Summary tab)

Summary metrics			
Return on Investment, Societal Total (50y)	0.3	Net economic benefit per cohort member (50y)	\$ 33,995
Return on Investment with high evidence quality only, Societal Total (50y)	0.0	Net economic benefit per cohort member high evidence quality only (50y)	\$ -
Return on Investment, Government only (50y)	0.0	Initiative NPV costs per cohort member (50y)	\$ 45,834
Return on Investment with high evidence quality only, Government only (50y)	0.0		

We see that our return on investment (RoI) is only 0.3, and that the NPV for benefits is negative. The RoI of 0.3 tells us that a total benefit of \$20,000 per year to all of Northland from this initiative is not enough to break even.

We can now repeat the process and change the value of the impact to see what it would have to be for the RoI to reach 1 (which is the point where the initiative breaks even). We could also change the assumption relating to the length of time that the impact will continue to deliver benefits.

Action point 7 (Impacts Database tab)

Inputs: value

Impacts Database								
Row Number	Outcome area	Description	Value adjusted to 2018	Value	Unit	Government/Non-Government	Sector	Year of data
186	Education	Kids learn better	80,000	80,000	Per year	Non-Government	Education	2018
187								
188								
189								

Going back to the Impacts Database tab, we change the value of the impact to \$80,000. Remember, we are spending \$100,000 per year, and there was an up-front capital cost, but the impact lasts for two years.

Action point 8 (Outputs Summary tab)

Outputs Summary

Proposal details	
Analysis type	Reverse analysis

Select 'reverse analysis' as input for this tab. You can provide information on how reasonable the assumptions are.

Summary metrics			
Return on Investment, Societal Total (50y)	1.0	Net economic benefit per cohort member (50y)	\$ 1,521
Return on Investment with high evidence quality only, Societal Total (50y)	0.0	Net economic benefit per cohort member high evidence quality only (50y)	\$ -
Return on Investment, Government only (50y)	0.0	Initiative NPV costs per cohort member (50y)	\$ 45,834
Return on Investment with high evidence quality only, Government only (50y)	0.0		

The value increase of the impact to \$80,000 results in the RoI being 1, and therefore breaking even. This tells us that the learning boost for Northland needs to be valued at \$80,000 per year, for the intervention to break even.

This is a highly simplified way of doing reverse analysis. It is useful to know what the value has to be to Northland for the intervention to break even. A judgement can then be made on whether it seems reasonable, or too high or too low. A judgement about how reasonable this assumption would be, could include analysis on a per child basis. The value could be alternatively calculated for a child per year. You could then compare this to other educational values to make a judgement about how reasonable the assumed value would be.

4.2 Tips – Fundamental Elements

What if the intervention or initiative is not about people?

Tips

- Include an appropriate unit for the intervention target cohort.
- The unit does not have to be people. It can be, for example, firms, areas, animals, schools, society or New Zealand as a whole, houses, rivers.

CBAX intuitively works for interventions with people, for example in the social sector. However, the CBAX model works with any unit that changes the impacts for New Zealanders.

While CBAX is interested in the *impacts for* people (that is, New Zealanders), the impact analysis covers *intervention changes to* people or any other appropriate unit. The unit (or CBAX cohort) does not have to be people. It can be anything that makes sense for the intervention, such as firms, areas, animals, society/New Zealand, houses or rivers. The unit can be identified at the appropriate level, for example: individual, family, business, community, city or country.

How is the intervention target unit determined?

Tips

- Try different units to see what works best.
- Our advice - keep the analysis as simple as possible and as flexible as possible.

User experiences indicate that defining the intervention target cohorts takes lots of analysis, research and discussion. Try different units to see what works the best. The unit is entered into the 'Primary Inputs' tab as the policy target cohorts. All impacts are applied to this unit. Impact assumptions and calculations must relate back to the cohorts.

Keep the analysis as *simple* as possible and as *flexible* as possible. Choose a unit that makes it easy to understand what is going on in the model, and easy to vary the assumptions. As a starting point, think about:

- Who or what is this about? Who or what are you investing in or intervening with?
- What is the intervention/investment logic? See the start of the intervention logic.
- What are the (possible) impacts? What unit can you relate these impacts to?
- What changes the variable costs? This can also be a driver of changes to impacts.
- What are the primary and secondary / flow-on impacts?

Start with considering what the intervention is about and the intervention logic. Initially we focus on the main aim of the intervention, which in the lurgi example is to prevent lurgi for children. Then we will consider how easy it is to update the analysis for changes. For example it may be that particular schools are the focus of the intervention.

It could work to use something other than people as the intervention unit, eg, schools. This means that each impact value is expressed in per school terms. The analysis can work with a cohort of six year olds or schools. The intervention context and options will determine what makes the most sense. Consider an intervention unit that gives you flexibility to add other impacts. Check whether it makes sense to tell the story for each impact along the lines: the intervention affects x number of six year olds or schools and has y and z impacts.

What if there is no appropriate value in the database?

Tips

- It is easy to add values to the database for a specific intervention. Analysis then flows like any other value.
- One or more values may not be available in the CBAX database. This is to be expected.
- The evidence base for a new value may vary, and judgement is needed to decide whether to add a value and what value to use.
- New values should be based on solid evidence where possible
- Can add values to explore 'what if' or 'what would it take to...'
- Over time, values can be incorporated into the standard CBAX database.

If there is an appropriate value in the Impacts Database, you can use that. However, the value you seek may not be in the database. You can easily add a value into the database for your analysis. CBAX works with or without using current database values (largely social sector). Over time, we expect that the CBAX database will evolve and become more comprehensive.

This section covers how to enter a new impact value into CBAX, if you want to list an impact and cannot find anything appropriate in the 'Impacts Database' tab. You can bypass the Impacts Database and enter an impact directly. This is most useful when you have an impact which has varying values across the duration of that impact. This information is likely to have come from separate analysis outside of the modelling you have done in CBAX.

If you have a monetised impact that you want to include in a CBAX, but which is not present in the 'Impact Database' tab, all you have to do is add it to the list. The action point below demonstrates how.

This CBAX functionality can also be used when you have a very poor evidence base, and you want to test or do reverse analysis to see what a value would need to be to break even. That can provide insights for the policy development and give a sense of magnitude and how reasonable that value would be.

Action point 1 (Impact Database tab)

Inputs: outcome area, description, value, unit, government/non-government, sector, year of data (note: the options in the drop-down box may not reflect the impact you're adding. The option you select does not impact the RoI calculation, therefore select the closest option).

1	Impacts Database								
2	Row Number	Outcome area	Description	Value adjusted to 2018	Value	Unit	Government/Non-Government	Sector	Year of data
186	186	Education	Fictional Impact	1,310	1,000	Per week	Government	Revenue	2012
187	187								
188	188								
189	189								
190	190								
191	191								

In this example, we have entered information into each of the orange tabs for an impact relating to Education. Once this is here, we treat it the same as any other impact. We take the row number '186' and enter that into the Impact Inputs tab to continue our analysis.

Note the column reading 'value adjusted to 2018'. The \$1,000 we entered in the 'value' column is current for a particular year; in this case, 2012. The 'value adjusted to 2018' column automatically adjusts this to \$1,310 to bring impact values on a common year basis. This is the value that will be used in CBAX calculations.

How are pre and post intervention levels set out?

Tips	
<ul style="list-style-type: none"> Specify pre and post intervention levels in one of three ways: binary, frequency, or proportional. It relates to the unit of the impact. Check that it makes sense. 	

There are three ways in which you can specify the pre and post intervention levels. The way you specify the level links back to the type of unit for the value impacts that you have chosen.

Use when	
Binary	Something happens or does not happen Unit type: per year, incident, event 0 (pre-intervention) and 1 (post-intervention) OR 1 (pre-intervention) and 0 (post-intervention)
Frequency	Something happens less or more often Unit type: per day, hour, event, visit, incident For example 6 (pre-intervention) and 5.7 (post-intervention) as in the worked example
Proportional	The pre- or post-intervention level is a reference point Unit type: per year For example 0.8 (pre-intervention Job Seeker benefit is 80% of new income) and 1 (post-intervention new income level)

What if the proposal relates to a cost pressure?

Tips	
<ul style="list-style-type: none"> A clear counterfactual is a crucial piece of analysis for a cost pressure proposal, and will tell us a lot about whether a CBAX is appropriate. If a CBAX is required, consider ways in which you might do this (such as a reverse analysis). In some instances, an exemption to the CBAX requirements might be warranted. 	

Cost pressure initiatives cover a very wide range of proposals that the government might fund. In our experience, CBAX works well for some cost pressure initiatives, but provides less insight for others. It depends on the initiative and the information at hand.

A well-considered and reasonable counterfactual is crucial for developing a CBAX for a cost pressure proposal. Many cost pressure proposals will have a complicated counterfactual, reflecting that the alternative includes a range of actions.

If a CBAX is required for the proposal, consider how you might complete this requirement in a way that is appropriate for the level of information that you have, and the insight that the analysis might give to a decision of whether to fund something or not. For example, for some cost pressure proposals, reverse analysis (that is, establishing what level of impact is needed in order for the proposal to break even) might be sufficient.

If, once you have considered these options, it still appears that a CBAX would be difficult to complete and not shed much light on the decision to fund or not fund, then you could consider seeking an exemption from the CBAX requirements. For more information on exemptions, please refer to the Budget Guidance and contact your vote team.

4.3 Tips – Information and Evidence

What if the information is poor or uncertain?

Tips

- Use professional judgement and available information to best estimate assumptions that are reasonable and err on conservative.
- Undertake sensitivity analysis for varying assumptions.
- Provide ranges of potential NPVs. These ranges are likely to be wider where there is greater uncertainty.
- Interpret your results in light of the evidence base.

Even if you have poor information on assumptions and impacts, you can still gain useful insights from CBAX. It is not uncommon that there is a weak evidence base for assumptions relating to one or more impacts in your analysis. If the impact is:

- *unlikely* to have a material impact on the results, then you can leave the impact out of the CBAX analysis, and cover it as an unmonetised impact in your advice
- *likely* to have a material effect on the overall results then you are best to include the impact in the analysis, and do sensitivity analysis using your best professional judgement about reasonable assumptions.

You can present overall advice in light of your evidence base, and do sensitivity analysis. For example, set out the societal return on investment for (a) high evidence base impacts and (b) all impacts, respectively. You can explain the key assumptions and judgements in the budget initiative templates and the Outputs Summary text box, which is an area to explain key modelling assumptions or anything important in understanding the results.

How do you make assumptions?

Tips

- As in the section above – assemble the best information you can to make judgements based on your experience.
- Make sure that you are explicit about your assumptions, and that they are clearly documented in your advice.
- Break big assumptions down into smaller components, and then focus on evidencing and quantifying these.
- Assess your assumptions against your evaluation plan, eg, are the key assumptions evaluated?

Sometimes the evidence for an intervention is weak. This might especially be true in instances where the intervention is a pilot programme, or an innovative solution that has not yet been fully tested.

In situations like these, CBAX modelling can still be useful. It might mean, however, that you need to make assumptions around the level of impact that the intervention might achieve.

Although it can be uncomfortable to make assumptions in situations with little evidence, it might still be appropriate for a number of reasons:

- Consider: what is the counterfactual? If no attempt is made to quantify the level of impacts, can we be sure that New Zealand is truly better off for having invested in the proposal?

- What about other options for addressing the funding? If there are other options with better evidence that can demonstrate a reasonable return on investment, then these might be more appropriate than the un-tested proposal. However, there might be other reasons for choosing a more innovative approach.
- Making some assumptions at least provides a platform for future evaluations.

Here are some practical tips for making assumptions:

- Always start with the evidence. More research might shed more light on the issues. See page 39 of the *Guide to Social Cost Benefit Analysis* for guidance on whether it is worth investing in more research.
- Professional judgements can sometimes be quite useful. Consider: who are the subject matter experts in a given field? Could these experts assist with making assumptions?
- When making assumptions, it is crucial that they are documented. Make sure that they are set out in the outputs summary sheet and in the impact summary template.
- Assumptions can be easier to support when there is a clear plan for evaluation. Although they might be wrong, if they will be evaluated longer-term, then we will have learned something. See the following question for more information on evaluation.

How does intervention evaluation fit in?

Tips

- CBAX supports an improved evidence base for decision-making, and provides a basis for an evaluation plan.

Intervention evaluation includes ex-ante evaluation to inform decisions and ex-post evaluation feedback loops. CBAX supports improved evidence base for decision-making.

Ex-ante evaluation informs the CBAX assumptions, including intervention logic, intervention effectiveness and “what works”. CBAX requires a rating of the quality of evidence for each impact. The ratings do *not* change the calculations. The evidence base forms part of the overall judgements and interpretation of the results.

Ex-post evaluation gives confidence that the assumed impacts are achieved, and enables feedback loops and adjustments in light of experienced impacts. Evaluation plans are to be set out in the Budget Initiative Template. Over time, the ability to demonstrate delivered impacts will increase confidence in future analysis and advice, for example as part of an investor confidence rating.

For resources see:

- Superu 2016 [A guide to finding and appraising evidence for what works](#) and [Standards of evidence for understanding what works: International experiences and prospects for Aotearoa New Zealand](#). See also their Evidence Rating Scale.
- Justice sector evidence briefs – such as [Evidence brief: Alcohol and drug treatment](#).
- The Social Investment Agency guide on [How to produce a social investment evidence brief](#).

- [Integrated Data Infrastructure](#) (IDI) a large research database containing microdata about New Zealand people and households. Researchers use the IDI to answer complex questions to improve outcomes for New Zealanders.
- The UK [what works centre's modified Maryland scale](#) provides a good summary of different impact methodologies and the degree of evidence they provide.
- [Google scholar search](#). Google Scholar provides a simple way to broadly search for scholarly literature. You can search across disciplines and sources.

The CBAX impacts and assumptions can inform an *evaluation plan*, for example, whether the assumed success rates are achieved. Focus ex-post evaluation on significant and uncertain impacts, or on areas where new knowledge can generalise to inform other programmes, for example by evaluating a theory of change.

A strong ex-post evaluation plan provides greater confidence that we will later know how well the intervention is working. An initiative may include funding for evaluation. Early considerations around built in data collection, staggered roll-out, the possibility of randomisation of treatment, and the structure of review and report back, increases the likelihood of robust evidence.

At a minimum, data collection should include legal name, date of birth, and residential address for both intervention participants and those in the comparison groups who were unsuccessful in gaining entry to the intervention (if applicable). Previously this has allowed about 95% of people to be linked to the IDI. Via the IDI, researchers can access a wide range of existing data. This supports service mapping (working out which services are provided to what types of clients at what times) and measurement of a range of existing outcomes already collected by government. If relevant outcomes are currently not in the IDI, (and cannot be put into the IDI) then collection of these data should also be considered.

How can agencies access the Australian Social Value Bank values?

Tips

- Consider using Australian Social Value Bank (ASVB) wellbeing values. See Appendix 1.
- The ASVB values are developed by international experts using robust econometric analysis, and adjusted for New Zealand purposes.
- Contact the Treasury regarding purchasing an ASVB sub-licence.
- ASVB values can be used in CBAX modelling in accordance with the licence agreement.

Values using wellbeing data to estimate the value of impacts are starting to be developed. Developing wellbeing values is a new field internationally. The ASVB values have been developed by international experts using Australian wellbeing survey data. The values involved robust econometric modelling and testing of the values. The values are comparable with similar UK values, and Treasury is confident that these are applicable for New Zealand purposes. The monetary value for the New Zealand licence has been based on New Zealand income levels.

In 2017, Treasury purchased a licence to use about 60 social wellbeing values compiled by the Australian Social Value Bank. The agreement gives Treasury the use of about 60 non-fiscal wellbeing impact values, with the ability to sub-licence to the New Zealand government sector. The values include monetised impacts for wellbeing outcomes like 'housing is no longer overcrowded' and 'increased hope for the future' (see Appendix 1). The values are particularly relevant for housing and social sector initiatives.

Over time, agencies in New Zealand can develop values using a consistent methodology with New Zealand survey data sets. This would be particularly relevant for New Zealand specific wellbeing estimates for example for Maori.

When using the ASVB values, these should be treated as comprehensive and only need fiscal impacts for the Crown modelled as additional impacts.

If you or your agency is interested in using these values for your CBAX modelling, please get in touch with the CBAX team at Treasury about setting up a sub-licence. The ASVB calculator is not part of the New Zealand sub-licence, as values are used in the CBAX tool.

The ASVB user guidance and methodology is available from the ASVB [here](#). The ASVB guidance includes further information on the outcome measures, the underlying survey questions and methodology. An introduction to the methodology is available in Daniel Fujiwara's Treasury guest lecture on social impact values. See <http://www.treasury.govt.nz/publications/media-speeches/questlectures/fujiwara-aug16>

4.4 Tips – Multiple Entries of Impacts

Can there be multiple entries of the same impact?

Tips

- You can include the same impact multiple times to address variations in impact, for example, across time and segments of the policy target cohorts.
- Be careful not to double count impacts.

A common solution to a number of challenges is to include the same impact several times with varying assumptions and impact profiles. It is possible to do this using the CBAX model.

Warning: Check that there is no double counting, if using the same impact several times.

CBAX calculates the NPVs for each impact entry separately. Impacts would be double counted if for example the same segment and period was covered in both impact entries. Ensure that there is no overlap and that for example the combined segments total less than 100%. Users can manually add up NPVs relating to the same impact to summarise results.

This flexibility also enables users to calculate NPVs for several scenarios of an impact in one CBAX model. In that case, the user can use the NPVs for each individual impact entry, but *not* the overall results, for example return on investment, as these would include double counted impacts. This flexibility can be useful for quick “what if” sensitivity analysis and development of ranges.

What if the number of people affected differs over time?

Tips

- Use multiple impact entries for each time period and vary the assumptions.

The cohort might change over time. This means that the actual number of people impacted is changing over time. Using the lurgi example, the starting point was that all 7- 9 year olds were affected equally by lurgi. Instead, if only half of all nine year olds are ever susceptible to lurgi then we would enter a new impact line reflecting this, representing the nine year olds as a different segment. To input this requires:

- Changing the first impact
 - **duration to two years** (this is until the initial cohort turn nine and at this point the new impact will take over).
- Adding another line listing the same impact, for example hospital visits, again with the following details
 - **Time lag becomes three years** (until the six year olds receiving the vaccine turn nine and first impact entry ends)
 - **Segment affected reduces to 40%**. In reality 80% of nine year olds receive the vaccine, but only half of them would have been affected by lurgi, so 40% captures this segment
 - **Length of impact is one year** (until the children turn ten and would no longer be affected by lurgi).

Action Point 1 – Impacts Inputs tab

Inputs: impact number, time lag, segment and length of impact.

Impact Inputs										
Row Number	Impact	Evidence Quality	Time lag before impact occurrence (years)	Length of impact (years)	End year	Segment of target population per year (percentage)	Success rate (Percentage)	Impact type	Units per person per annum	Annual value (\$) Per cohort member
Impact 1	93 Inpatient hospital visit	Low	1.0	2.0	3.0	80%	99%	Pre intervention level	0.30	(1,309)
OK	INCLUDED							Post intervention level	0.27	(1,178)
								Marginal impact	(0.03)	131
Impact 2	93 Inpatient hospital visit	Low	3.0	1.0	4.0	40%	99%	Pre intervention level	6.00	(13,094)
OK	INCLUDED							Post intervention level	5.70	(12,439)
								Marginal impact	(0.30)	655
Impact 3	105 GP visit (20 minutes) - Publicly funded	Medium	1.0	3.0	4.0	80%	99%	Pre intervention level	6.00	(413)
OK	INCLUDED							Post intervention level	5.70	(393)
								Marginal impact	(0.30)	21

Add in impact 93 again, but this time lag becomes three years, segment becomes 40% and length of impact becomes one year.

In this way, we have varied the impact analysis to demonstrate the way in which the number of people affected by one impact (inpatient hospital visits) will vary over time.

What if the impact incidence varies over time?

Tips

- Use multiple impact entries for each time period and vary the assumptions.

An impact might be stronger or more likely to occur in one year over another for the same cohort. For example, the reduction in inpatient hospital visits might be of a greater order of magnitude, or more likely for seven, eight, or nine year olds. To account for this, you can make a separate impact entry.

Considering different success rates, we have said the success rate of the vaccine is 99%, although it might actually be 97% for seven year olds, and rise to 99% for eight and nine year olds (since, if they've lasted till age eight then the chance of getting affected by lurgi reduces).

To input this requires:

- Changing the first impact
 - **Duration to only one year** (because the new impact will take over once they are eight)
 - **Success rate** of 97%.
- Adding another line listing the impact again with the following details
 - **Time lag becomes two years** (now two years since receiving the vaccine at age six)
 - **Success rate is 99%**
 - **Length of impact is two years** (only two years till the children turns ten and is no longer affected by lurgi).

Action point 1 (Impact Inputs tab)

Inputs: impact number, time lag, segment and length of impact.

Row Number	Impact	Evidence Quality	Time lag before impact occurrence (years)	Length of impact (years)	End year	Segment of target population per year (percentage)	Success rate (Percentage)	Impact type	Units per person per annum	
Impact 1	93	Inpatient hospital visit	Low	1.0	1.0	2.0	80%	97%	Pre intervention level	0.30
OK		INCLUDED							Post intervention level	0.27
									Marginal impact	(0.03)
Impact 2	93	Inpatient hospital visit	Low	2.0	2.0	4.0	80%	99%	Pre intervention level	6.00
OK		INCLUDED							Post intervention level	5.70
									Marginal impact	(0.30)
Impact 3	105	GP visit (20 minutes) - Publicly funded	Medium	1.0	3.0	4.0	80%	99%	Pre intervention level	6.00
OK		INCLUDED							Post intervention level	5.70
									Marginal impact	(0.30)

Add in impact 93 again, but this time make the time lag two years, the length of impact two years, and the success rate 99%.

Vary the first iteration of impact 93 by changing the success rate to 97%.

In this way, we have modelled the impact according to the different way in which it affects the cohort at different points in time.

What if the segments are affected differently?

Tips

- Use multiple impact entries for each time period and vary the assumptions.

One impact might affect different segments of the cohort to different extents. In our lurgi example there are two segments:

- 80% who receive the vaccine. We have said that 80% of six year olds each year are likely to receive the vaccine and then considered the resulting reduction in health visits for this cohort when they are 7, 8 and 9 years old.
- 20% who do not receive the vaccine. It may be that those who do not receive the vaccine will be less likely to visit the GP or hospital since there will be less of the virus across society generally. To capture this impact we will add another GP and hospital visit impact.

The segment will be 20%. This is the remaining number of six year olds. We then add the success rate and post-intervention level for this cohort. We can assume that this segment will be sicker and use more services than for children receiving the vaccine. Note that the lag and duration will be the same for this impact entry and the original impact entry, since they cover two different segments concurrently, the six year olds of the same year who either do or do not get the vaccine.

4.5 Tips – Adjusted Impacts

How can a non-flat impact profile be included?

Tips

- You can input an impact profile for pre and post intervention that varies across time. This may be a result of separate modelling.

The default approach is for the value of an impact to be the same each year that the impact lasts. The Impacts Database makes it simple to use this approach. However, you can bypass the Impacts Database, if the profile of values for an impact varies across time and you have this information available from other analysis.

For this example, we will input a time profile which has a pre-intervention level of zero and a post-intervention level value of \$1000 for the first year, and the value increases \$200 each year for five years.

Warning: Using this functionality involves changing formulae in Excel and may break model functionality outlined in the user guide. Do not re-use a CBAX workbook which has a manually entered time profile.

Action point 1 (Impact Inputs tab)

First, we input the details of the impact which CBAX would normally auto-populate after entering the row number from the Impacts Database. These are: name, outcome area, sector, unit and type.

Row Number	Impact	Outcome Area	Sector	Adjusted Value	Unit	Type	Evidence Quality
Impact 1 OK	- Fictional example EXCLUDED	Health	Health	-	Per thing	Government	Low
Impact 2 OK	- EXCLUDED	-	-	-	-	-	Low
Impact 3 OK	- EXCLUDED	-	-	-	-	-	Medium

In this example, we have the name as 'Fictional example', it is in the outcome area of 'Health', the 'Health' sector, the unit is 'Per thing', and it is a 'Government' impact.

Action point 2 (Impact Inputs tab)

Normally, you would enter the information for an impact into the various orange cells below. In this case, you only have to update the evidence quality. You do not touch any of these other cells. You add the values for the impact directly, as shown in Action point 3.

Impact Inputs										
Row Number	Impact	Evidence Quality	Time lag before impact occurrence (years)	Length of impact (years)	End year	Segment of target population per year (percentage)	Success rate (Percentage)	Impact type	Units per person per annum	
Impact 1 OK	- Fictional example EXCLUDED	Low				100%	100%	Pre intervention level		
								Post intervention level		
								Marginal impact	-	
Impact 2 OK	- EXCLUDED	Low				100%	100%	Pre intervention level		
								Post intervention level		
								Marginal impact	-	
Impact 3 OK	- EXCLUDED	Low				100%	100%	Pre intervention level		
								Post intervention level		
								Marginal impact	-	
Impact 4		Low				100%	100%	Pre intervention level		

Action point 3 (Impact Inputs tab)

For the next set of inputs, we add the pre and post intervention values for the impact across future years.

Row Number	Impact	Impact type	Units per person per annum	Annual value (\$) Per cohort member	Year Ending June	2018	2019	2020	2021	2022	2023
					Start of year counter	-	1	2	3	4	5
					End of year counter	1	2	3	4	5	6
Impact 1	-	Fictional example									
OK		INCLUDED									
		Pre intervention level		-	-	-	-	-	-	-	-
		Post intervention level		-	1,000	1,200	1,400	1,600	1,800	2,000	-
		Marginal impact		-	1,000	1,200	1,400	1,600	1,800	2,000	-
Impact 2	-										
OK		EXCLUDED									
		Pre intervention level		-	-	-	-	-	-	-	-
		Post intervention level		-	-	-	-	-	-	-	-
		Marginal impact		-	-	-	-	-	-	-	-

In our example, this is a pre intervention level of zero, and a post intervention value of 1,000 for the first year in 2018, increasing by 200 each year for five years. We input this information directly. As you overwrite the formulae in the CBAX model, it is good practice to shade the affected cells a different colour and insert a comment to warn other users of the spreadsheet that this has been done. The duration of the impact is six years, so in 2024 we do not input anything.

CBAX calculates the marginal impact automatically and fills this in below.

Action point 4 (Outputs Summary tab)

Impact summary			Unit: 2018 (\$m)							
Evidence Quality			5-Year NPV \$m	10-Year NPV \$m	50-Year NPV \$m	2018	2019	2020	2021	2022
Impact 1	Low	Fictional example	61	126	126	4	9	14	21	28
Impact 2	-	-	-	-	-	-	-	-	-	-

The Outputs Summary records the impact like any other. Remember, what you input for the values will apply to each year of the policy target cohort entered into the 'Primary Inputs' tab.

What are the appropriate labour market impacts?

Tips

- Labour market impacts such as income, tax/ACC and income benefits such as Jobseeker Support need to be adjusted for displacement effects and opportunity cost (see below).
- Consider how large the displacement effect and opportunity cost of labour impact is, and therefore how large the value adjustment should be.
- Impacts 35 to 76 in the impacts database has 25% adjusted values for a conservative scenario.

Where an intervention has some impact on the labour market, people moving in and out of jobs, consider the following points. The effects will be different for different interventions, so reflect in your analysis that these effects have been considered and taken appropriately into account.

Displacement effect and opportunity cost

CBAX impacts 35 to 76 are adjusted and include 25% of the increase in income or tax for a conservative scenario. This incorporates two adjustments accounting for displacement effect and the opportunity cost of labour. Each adjustment is 50% (50% multiplied by 50% gives 25%).

Displacement effect

The displacement effect accounts for the fact that if an intervention moves an individual from unemployment into employment, the individual may take a job someone else would have otherwise filled.

In other words, in the absence of the intervention, someone else would have taken the vacant job and the unemployment rate would be no higher or lower. Because in CBA we only want to measure the marginal impact, for example tax revenue, the benefit generated from a worker who merely displaces another worker should not be included.

There are examples of where the displacement effect is zero. For example if an initiative trains up individuals to fill a specialist position that would not otherwise be filled the displacement effect will be zero. Another example is if an intervention creates jobs that would not have otherwise been created and fills the positions with unemployed workers the displacement effect will be zero.

Opportunity cost

Opportunity cost accounts for the fact that a person going into a job does not necessarily see their welfare increase by their increase in income. While unemployed, a person can utilise their time and gain satisfaction from this.

Consider whether or not relevant impact values should be revised downward to account for opportunity cost.

Pages 17-18 of the Treasury's *Guide to Social Cost Benefit Analysis* explain the reasoning behind opportunity cost.

Tax and labour income

You need to list two, or sometimes more such as Job Seeker Benefit, impacts to include the benefit of people moving into a job:

1. Wage income impact (impacts 35 to 55). This is the after-tax income capturing the benefit to the individual, the non-government impact.
2. Tax impact (impacts 56 to 75). This is the tax component the wage income, capturing government impact.

We split out government and non-government impacts because this can be useful in the analysis.

Pre and post intervention levels of income and tax

Ensure that pre-intervention levels are appropriate. For example, before moving to a minimum wage job, someone may be receiving the Jobseeker Support benefit. You must therefore list this as the pre-intervention level in the 'wage income impact'. The same applies if someone is moving from a low paid job to a higher paid one, you list these after-tax incomes in the pre and post intervention cells.

The other side to this is the impact for the government. If people are moving from Jobseeker Support the government saves this amount, and so an impact should be listed to factor this in. The government still receives tax income from the Jobseeker Support benefit which needs to be accounted for. If people are moving into a higher paid job (rather than from the Jobseeker Support to the minimum wage) the pre-intervention level in the 'tax impact' should reflect what the government received beforehand.

How to use Quality Adjusted Life Years impacts (QALYs)

Tips

- These impacts can drive a significant proportion of the NPV, therefore it is important to have good evidence and best estimate assumptions in support of the analysis.

The Quality Adjusted Life Year Saved (QALY) is a measure of health benefits. It combines an intervention's impact on quality of life with its impact on life expectancy. One QALY is set to be the value of a year of life in perfect health. A person in perfect health with a life expectancy of 25 years has 25 QALYs, as does a person with low health status (valued at half of perfect health) with a life expectancy of 50 years.

For the purposes of CBAX, we seek to identify the additional QALYs associated with an intervention. For example, a person with a life expectancy of 25 years, who receives a treatment expected to improve the value of their health status by 10%, gains a total of $0.1 * 25 = 2.5$ QALYs (before discounting) over their lifetime. PHARMAC guidance² provides useful information about using QALYs, including suggestions for where to obtain evidence about the QALYs associated with different health states and/or interventions.

² See PHARMAC 2015 Prescription for Pharmacoeconomic Analysis, pp. 36 – 40, <https://www.pharmac.govt.nz/medicines/how-medicines-are-funded/economic-analysis/> Accessed 21 August 2017

Appendix 1: Australian Social Value Bank

OUTCOMES

Health

- Improved overall health
- No longer obese
- Increased levels of walking
- Feels in control of life
- Accessed free meal programs
- Relief from depression/anxiety
- Increased hope for the future
- Reduced parental stress
- Improved diet
- Relief from Type 2 Diabetes
- Free from Sleeping problems
- Improved self esteem/ confidence
- Accessed Family Violence services
- Accessed Gambling Support services
- Participates in frequent moderate exercise
- Accessed support for people who were sexually assaulted as an adult
- Increased sense of trust in other people
- Relief from Post Traumatic Stress Disorder (PTSD)

Education

- Qualification Obtained - Certificate levels III and IV
- Completed Year 12
- Improved numeracy
- Adequate computer skills
- Improved english language skills for non-native speakers
- Commenced education - Certificate level I or II
- Commenced education - Certificate level III or IV

Home

- Housing Quality - Reduced impact of noise
- Able to make ends meet
- Housing is no longer overcrowded
- Homelessness to temporary accommodation
- Homelessness to secure accommodation
- Homelessness to Social Housing
- Temporary accommodation to Social Housing
- Temporary accommodation to secure accommodation
- Improved condition of Social Housing property

Social and Community

- Increased involvement in decision making
- Improved condition of neighbourhood homes and gardens
- Reduced litter problem
- Meets friends regularly
- Joined a social group
- Volunteers
- Talks to neighbours regularly
- Adequate contact with a non-resident child
- Good neighbourhood (a) Neighbours do things together
(b) Neighbours help each other

Drugs and Alcohol

- Freedom from alcohol problems
- Ceased using Cannabis
- Ceased injecting illegal street drugs
- Treated for drug and alcohol problems in last year
- Ceased smoking (a) Social Smoker
(b) Full time Smoker

Crime

- Reduced problems with anti-social behaviour
- Reduced problems with teenagers hanging around
- Reduced problems with vandalism/graffiti
- Increased sense of personal safety
- Prevented reoffending

Employment

- People with injuries, illness or disability moving into employment
- Obtained casual employment - equivalent full-time hours
- Obtained casual employment - equivalent part-time hours
- Obtained full-time employment
- Obtained part-time employment
- Became self-employed
- Improved job readiness

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Appendix 2: How to navigate the CBAX Spreadsheet

The CBAX spreadsheet model contains a number of worksheets to help with CBA analysis. This section explains the purpose of each worksheets and how the worksheets are related.

Introduction

- **Purpose:** This is an introduction and overview for the CBAX model. The model is available under a creative commons licence.
- Provides inputs to these worksheets: None.
- Uses outputs from these worksheets: None.

Guide to Model

- **Purpose:** Explains how various sheets in the model interact.
- Provides inputs to these worksheets: None.
- Uses outputs from these worksheets: None.

Primary Inputs

- **Purpose:** In this sheet you will input data on the policy target cohort across years. The sheet also contains some automatic assumptions about discount rates.
- **Provides inputs to these worksheets:** The policy target cohort information you input is used as a basis for calculating impacts in the Impact Inputs sheet. The default time period is 50 years, but the user can choose to shorten this time period. The discount rates calculated in this tab are used in the Outputs Summary worksheets.
- **Uses outputs from these worksheets:** None. The user should calculate the appropriate policy target cohort based on evidence modelling prior to completing this.

Cost Inputs

- **Purpose:** In this sheet you will input summary operating and capital costs of the initiative or intervention.
- **Provides inputs to these worksheets:** The cost inputs you enter in this sheet will be used to calculate the CBAX return on investment in the Output Summary worksheets.
- **Uses outputs from these worksheets:** None. The user should calculate costs and enter them into this sheet.

Impacts Database

- **Purpose:** In this sheet you do not input any data. This sheet contains a number of publicly available values. The values are primarily sourced from agencies outside the Treasury, with the source listed in column J. The values were all produced outside the model itself, and those values from past years are adjusted forward so they are all on a common year basis.

- **Provides inputs to these worksheets:** The values in this sheet are used to calculate impact values in the Impact Inputs worksheet. You should use this sheet as a reference to look up and select relevant impact values and then “plug-in” the relevant impact value row number into the Impact Inputs sheet. The values in this database make it easy to estimate impacts. The user can also add new values to the database, and use those new values as inputs to the impact inputs sheet.
- **Uses outputs from these worksheets:** This sheet uses the start year specified in Primary Inputs to adjust the values forward to a common year basis (using GDP data calculations). For consistency all values are adjusted using GDP adjusters.

Impact Inputs

- **Purpose:** In this sheet for each impact you will enter the impact value row number that affects a cohort of individuals (a subset of the policy target cohort), and also any assumptions about the impact on that cohort. The user specifies the assumptions about the counterfactual (pre-intervention level) and the intervention (post-intervention level) for each impact, and the model calculates the marginal impact. Assumptions also include the start and length of the impacts, as well as the percentage of the policy target cohort impacted and the probability of success. You should be explicit and transparent where there is variation in the evidence bases used for assumptions. Further clarification on evidence and assumptions can be explained in the accompanying Impact Summary Template.
- **Provides inputs to these worksheets:** Used in the Outputs Summary worksheets.
- **Uses outputs from these worksheets:** This sheet uses the Primary Inputs sheet, and impact value row numbers from the Impacts Database as input by the user.

Outputs Summary

- **Purpose:** In this sheet you input contextual information such as the type of analysis. This sheet displays the summary output of the calculations, based on the impacts and assumptions selected by the user. The 6% real default discount rate is used.
- **Provides inputs to these worksheets:** None. The outputs from this sheet, such as the net present values for impacts, can be used for the Impact Summary Template. Note that the Return on Investment Societal Total is the same as the Benefit Cost Ratio (BCR), unless there are negative impacts.
- **Uses outputs from these worksheets:** This sheet makes use of the Primary, Costs and Impact Inputs sheets, as well as some hidden sheets that calculate totals.

Output Summary Alt

- **Purpose:** In this sheet you input contextual information such as the type of analysis. This sheet is the same as the Outputs Summary sheet, except that it displays summary outputs using the 3% real discount rate to provide the user with sensitivity analysis.
- **Provides inputs to these worksheets:** same as for the Outputs Summary sheet.
- **Uses outputs from these worksheets:** same as for the Outputs Summary sheet.

Hidden Worksheets

- **Purpose:** To make the model simple and easily accessible for a wide range of users, the CBAX tool performs calculations automatically. The formulas and macros for these calculations are contained on a number of hidden worksheets. If users want to see these worksheets, for example GDP and CPI adjusters, unhide the worksheets.
- **Provides inputs to these worksheets:** Used in the Primary, Costs and Impact Inputs worksheets as well as the Outputs Summary worksheets.
- **Uses outputs from these worksheets:** None.

Appendix 3: Glossary and Acronyms

This appendix provides a glossary of terms and acronyms used in this document.

Adjusted value: The adjusted value uses the start year specified in Primary Inputs sheet to adjust the values in the Impacts Database forward to a common year basis using the nominal GDP data in the GDP inflator hidden worksheet. For consistency all values in the Impacts Database have been adjusted forward using GDP adjusters, even though some values could potentially be adjusted using CPI adjusters.

BCR: See benefit cost ratio.

Benefit cost ratio (BCR): The BCR is the ratio of total discounted benefits to the total discounted costs. A proposal with a BCR greater than 1.0 has a positive impact, because the benefits exceed the costs.

Cohort: A group that experiences an intervention in a particular year. A cohort is made up of members from the policy intervention target group / target population.

CBA: See cost benefit analysis.

CBAX: CBAX is the Treasury's cost benefit spreadsheet model. The tool helps users monetise impacts for cost benefit analysis. The CBAX results are considered as part of the CBA and wider case for the policy intervention. Together with unmonetised impacts, evidence base and confidence in assumptions, CBAX results inform value for money advice.

CFISnet: Crown's Financial and Information System, which is used by the Crown for financial reporting and budget purposes.

Cost benefit analysis (CBA): A systematic approach to evaluating different options to improve decision making. CBA evaluates different options against a single welfare criterion: 'societal net benefit'.

Counterfactual: The counterfactual is the situation that would exist in the absence of an intervention (ie, what would happen if the intervention is not implemented). In many cases this will be different from 'do-nothing'.

Dis-benefit: This is an impact which has a negative effect, and is a wellbeing loss. An intervention might on the whole be positive for society, but certain groups can be negatively impacted. This is different from costs incurred in setting up and operating an intervention.

Discount rate: The discount rate is used to discount impacts, costs and benefits that occur in the future. The discounted value is known as the present value.

IDI: The [Integrated Data Infrastructure](#) is a large research database containing microdata about people and households. Data is from a range of government agencies, Statistics NZ surveys including the 2013 Census, and non-government organisations.

ILM: Intervention (or Investment) Logic Map. An intervention or investment logic map is a single page depiction of the logic that underpins an investment.

Initiative: An initiative is a funding or investment proposal for decision makers to consider.

Intervention: An intervention targets a specific group of people and is designed to have a marginal impact. An initiative may be centred on an intervention, or a combination of interventions within or across sectors.

Marginal impact: Marginal impact refers to the specific change in an impact. Rather than focusing on the overall impact CBA focuses on the marginal change in an impact from an intervention, relative to the counterfactual.

Net present value (NPV): The NPV is the sum of the discounted benefits, less the sum of the discounted costs (relative to the counterfactual). This gives a dollar value representing the marginal impact on the collective living standards of all New Zealanders of the initiative, in today's dollar terms.

Nominal value: A nominal value is a value that is expressed in its nominal price level (ie, the price level at the time). A nominal value has not been adjusted for inflation.

NPV: See net present value.

Policy target cohort: The policy target cohort is the group that an intervention targets. The target group may be individuals or other units. The unit can be identified at the appropriate level of aggregation, for example: individual, family, business, community, city or country.

Probability: The likelihood of the benefit or cost materialising. The likelihood of a benefit or cost materialising can be thought of as the 'success rate' or effectiveness of an intervention.

Proxy: A proxy is an indirect measure that serves in place of an unobservable measure. A good proxy must have a close correlation with the measure of interest.

Real value: A real value is a value that has been adjusted from a nominal value to remove the effects of inflation.

Return on investment (RoI): Calculate the return on investment by dividing the discounted net change in wider societal impact, including benefits to government, by the discounted cost of the initiative. This can be interpreted as the impact on New Zealanders per dollar the government spends on the initiative.

RoI: See return on investment.

Segment: A segment is a part of the cohort for the policy intervention target group or target population. The cohort segments total 100%.

Sensitivity analysis: Sensitivity analysis is a technique used to determine how independent variables such as assumptions and values of impacts will affect the overall results. Sensitivity analysis is important as it can reveal how important different assumptions are to the overall result. Carrying out sensitivity analysis helps determine how robust the results are.

Success rate: See probability.

Target group: See policy target cohort.

Whole of life costs (WoLC): The present value of total cash costs of the investment over its life. This excludes dis-benefits, because they are not a cash cost. WoLC also excludes depreciation. Only include the initial cost of procuring the asset. Capital charge is excluded.